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**Department of Defense
Fiscal Year (FY) 2011 President's Budget**

February 2010



Air Force

Justification Book Volume 1

Research, Development, Test & Evaluation, Air Force - 3600

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Air Force • President's Budget FY 2011 • RDT&E Program

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Department of the Air Force
 FY 2011 President's Budget
 Exhibit R-1 FY 2011 Base and Overseas Contingency Operations (OCO) Request
 Summary
 (Dollars in Thousands)

20 Jan 2010

Summary Recap of Budget Activities	FY 2009 (Base & OCO)	FY 2010 Base & OCO Enacted	FY 2010 Supplemental Request	FY 2010 Total	FY 2011 Base	FY 2011 OCO	FY 2011 Total Request
Basic Research	446,388	482,776		482,776	500,473		500,473
Applied Research	1,190,223	1,221,221		1,221,221	1,181,420		1,181,420
Advanced Technology Development	717,735	758,667		758,667	509,305		509,305
Advanced Component Development & Prototypes	2,242,097	1,841,754		1,841,754	1,503,007	16,000	1,519,007
System Development & Demonstration	3,995,427	3,844,675		3,844,675	3,549,475	30,000	3,579,475
RDT&E Management Support	1,484,616	1,062,440	3,291	1,065,731	1,084,374		1,084,374
Operational Systems Development	16,615,291	18,770,188		18,954,548	18,919,248	220,241	19,139,489
Total Research, Development, Test & Eval, AF	26,691,777	27,981,721	187,651	28,169,372	27,247,302	266,241	27,513,543
 Summary Recap of FYDP Programs							
Strategic Forces	85,534	731,044		731,044	500,974		500,974
General Purpose Forces	2,315,375	2,467,564		2,467,564	2,542,733	4,443	2,547,176
Intelligence and Communications	2,372,609	2,804,119		2,804,119	2,972,917	6,100	2,979,017
Mobility Forces	563,770	524,219		524,219	544,547	10,325	554,872
Research and Development	9,312,534	8,936,341	3,291	8,939,632	7,938,100	46,000	7,984,100
Central Supply and Maintenance	277,356	312,881		312,881	260,237		260,237
Training Medical and Other	7,443	7,360		7,360	2,336		2,336
Administration and Associated Activities	65,903	106,410		106,410	74,913		74,913
Support of Other Nations	3,789	3,748		3,748	3,764		3,764
Classified Programs	11,687,464	12,088,035	184,360	12,272,395	12,406,781	199,373	12,606,154
Total Research, Development, Test & Eval, AF	26,691,777	27,981,721	187,651	28,169,372	27,247,302	266,241	27,513,543

Exhibit R-1G: FY 2011 President's Budget (Published), as of January 20, 2010 at 14:07:17

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Department of the Air Force
 FY 2011 President's Budget
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 (Dollars in Thousands)

Appropriation: 3600F Research, Development, Test & Eval, AF

Date: 20 Jan 2010

Line No	Program Element Number	Item	Act	FY 2009 (Base & OCO)	FY 2010 Base & OCO Enacted	FY 2010 Supplemental Request	FY 2010 Total	FY 2011 Base	FY 2011 OCO	FY 2011 Total Request	Se
1	0601102F	Defense Research Sciences	01	299,830	328,471		328,471	350,978		350,978	U
2	0601103F	University Research Initiatives	01	133,526	141,524		141,524	136,297		136,297	U
3	0601108F	High Energy Laser Research Initiatives	01	13,032	12,781		12,781	13,198		13,198	U
		Basic Research		446,388	482,776		482,776	500,473		500,473	
4	0602102F	Materials	02	185,583	179,202		179,202	137,273		137,273	U
5	0602201F	Aerospace Vehicle Technologies	02	119,544	138,563		138,563	144,699		144,699	U
6	0602202F	Human Effectiveness Applied Research	02	93,954	93,527		93,527	87,452		87,452	U
7	0602203F	Aerospace Propulsion	02	244,890	221,503		221,503	207,049		207,049	U
8	0602204F	Aerospace Sensors	02	130,902	136,012		136,012	157,497		157,497	U
9	0602601F	Space Technology	02	136,072	119,125		119,125	111,857		111,857	U
10	0602602F	Conventional Munitions	02	56,596	58,044		58,044	61,330		61,330	U
11	0602605F	Directed Energy Technology	02	60,233	105,231		105,231	103,596		103,596	U
12	0602702F	Command Control and Communications	02	114,510							U
13	0602788F	Dominant Information Sciences and Methods	02		116,785		116,785	117,283		117,283	U
14	0602890F	High Energy Laser Research	02	47,939	53,229		53,229	53,384		53,384	U
		Applied Research		1,190,223	1,221,221		1,221,221	1,181,420		1,181,420	
15	0603112F	Advanced Materials for Weapon Systems	03	62,070	67,856		67,856	33,414		33,414	U

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16	0603199F	Sustainment Science and Technology (S&T)	03		2,943		2,943	2,935		2,935	U
17	0603203F	Advanced Aerospace Sensors	03	69,902	52,786		52,786	44,677		44,677	U
18	0603211F	Aerospace Technology Dev/ Demo	03	41,748	88,226		88,226	53,588		53,588	U
19	0603216F	Aerospace Propulsion and Power Technology	03	175,292	192,241		192,241	136,135		136,135	U
20	0603231F	Crew Systems and Personnel Protection Technology	03	35,742							U
21	0603270F	Electronic Combat Technology	03	29,364	32,056		32,056	16,992		16,992	U
22	0603401F	Advanced Spacecraft Technology	03	97,834	98,708		98,708	83,705		83,705	U
23	0603444F	Maui Space Surveillance System (MSSS)	03	36,093	36,661		36,661	5,899		5,899	U
24	0603456F	Human Effectiveness Advanced Technology Development	03		27,390		27,390	24,814		24,814	U
25	0603601F	Conventional Weapons Technology	03	16,771	14,296		14,296	15,755		15,755	U
26	0603605F	Advanced Weapons Technology	03	61,420	44,794		44,794	17,461		17,461	U
27	0603680F	Manufacturing Technology Program	03	54,614	50,502		50,502	39,701		39,701	U
28	0603788F	Battlespace Knowledge Development and Demonstration	03		46,414		46,414	32,382		32,382	U
29	0603789F	C3I Advanced Development	03	32,986							U

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30	0603924F	High Energy Laser Advanced Technology Program	03	3,899	3,794		3,794	1,847		1,847	U
		Advanced Technology Development		717,735	758,667		758,667	509,305		509,305	
31	0603260F	Intelligence Advanced Development	04	6,570	5,809		5,809	5,019		5,019	U
32	0603287F	Physical Security Equipment	04	1,659	3,615		3,615	3,576		3,576	U
33	0603423F	Global Positioning System III - Operational Control Segment	04	289,702							U
34	0603430F	Advanced EHF MILSATCOM (SPACE)	04	460,351	461,380		461,380	351,817		351,817	U
35	0603432F	Polar MILSATCOM (SPACE)	04	221,065	252,071		252,071	164,232		164,232	U
36	0603438F	Space Control Technology	04	86,110	100,951		100,951	45,012	16,000	61,012	U
37	0603742F	Combat Identification Technology	04	28,708	28,799		28,799	26,172		26,172	U
38	0603790F	NATO Research and Development	04	4,241	4,351		4,351	4,372		4,372	U
39	0603791F	International Space Cooperative R&D	04	603	632		632	635		635	U
40	0603830F	Space Protection Program (SPP)	04					8,349		8,349	U
41	0603845F	Transformational SATCOM (TSAT)	04	428,618							U
42	0603850F	Integrated Broadcast Service	04	21,020	20,646		20,646	20,580		20,580	U
43	0603851F	Intercontinental Ballistic Missile	04	58,937	68,097		68,097	66,745		66,745	U

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44	0603854F	Wideband Global SATCOM RDT&E (Space)	04	29,520	70,650		70,650	36,123		36,123	U
45	0603859F	Pollution Prevention	04	13,565	10,396		10,396	2,534		2,534	U
46	0603860F	Joint Precision Approach and Landing Systems	04	7,153	22,953		22,953	13,952		13,952	U
47	0604015F	Next Generation Bomber	04					198,957		198,957	U
48	0604283F	Battle Mgmt Com & Ctrl Sensor Development	04		22,612		22,612				U
49	0604327F	Hard and Deeply Buried Target Defeat System (HDBTDS) Program	04	28,310	20,891		20,891	22,389		22,389	U
50	0604330F	Joint Dual Role Air Dominance Missile	04		6,882		6,882	9,799		9,799	U
51	0604337F	Requirements Analysis and Maturation	04		35,533		35,533	34,339		34,339	U
52	0604436F	Next-Generation MILSATCOM Technology Development	04		50,000		50,000				U
53	0604635F	Ground Attack Weapons Fuze Development	04		18,778		18,778	32,513		32,513	U
54	0604796F	Alternative Fuels	04	30,283	73,020		73,020	24,064		24,064	U
55	0604830F	Automated Air-to-Air Refueling	04	9,610	43,158		43,158	85		85	U
56	0604857F	Operationally Responsive Space	04	228,540	124,308		124,308	93,978		93,978	U
57	0604858F	Tech Transition Program	04		9,611		9,611	12,260		12,260	U

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58	0305178F	National Polar-Orbiting Operational Environmental Satellite System (NPOESS)	04	287,532	386,611		386,611	325,505		325,505	U
		Advanced Component Development & Prot		2,242,097	1,841,754		1,841,754	1,503,007	16,000	1,519,007	
59	0603840F	Global Broadcast Service (GBS)	05	17,475	31,072		31,072	18,171		18,171	U
60	0604222F	Nuclear Weapons Support	05	19,845	41,860		41,860	60,545		60,545	U
61	0604226F	B-1B	05	158,081							U
62	0604233F	Specialized Undergraduate Flight Training	05	11,801	10,862		10,862	8,066		8,066	U
63	0604240F	B-2 Advanced Technology Bomber	05	384,190							U
64	0604270F	Electronic Warfare Development	05	66,321	80,275		80,275	89,966		89,966	U
65	0604280F	Joint Tactical Radio	05					631		631	U
66	0604281F	Tactical Data Networks Enterprise	05		87,444		87,444	102,941	30,000	132,941	U
67	0604287F	Physical Security Equipment	05	51	50		50	50		50	U
68	0604329F	Small Diameter Bomb (SDB)	05	122,568	155,415		155,415	153,505		153,505	U
69	0604421F	Counterspace Systems	05	64,318	63,838		63,838	40,276		40,276	U
70	0604425F	Space Situation Awareness Systems	05	211,266	238,377		238,377	426,525		426,525	U
71	0604429F	Airborne Electronic Attack	05	42,173	11,107		11,107	25,937		25,937	U

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72	0604441F	Space Based Infrared System (SBIRS) High EMD	05	542,404	521,156		521,156	530,047		530,047	U
73	0604443F	Third Generation Infrared Surveillance (3GIRS)	05	953	73,369		73,369				U
74	0604602F	Armament/Ordnance Development	05	12,088	18,671		18,671	6,693		6,693	U
75	0604604F	Submunitions	05	1,719	1,784		1,784	1,622		1,622	U
76	0604617F	Agile Combat Support	05	4,518	11,261		11,261	37,987		37,987	U
77	0604706F	Life Support Systems	05	14,907	14,331		14,331	10,650		10,650	U
78	0604735F	Combat Training Ranges	05	12,241	22,718		22,718	36,905		36,905	U
79	0604740F	Integrated Command & Control Applications (IC2A)	05	9,700	6,910		6,910	10		10	U
80	0604750F	Intelligence Equipment	05	2,282	1,495		1,495	1,364		1,364	U
81	0604800F	Joint Strike Fighter (JSF)	05	1,743,569	2,072,897		2,072,897	883,773		883,773	U
82	0604851F	Intercontinental Ballistic Missile	05		60,010		60,010	71,843		71,843	U
83	0604853F	Evolved Expendable Launch Vehicle Program (SPACE)	05	43,628	46,545		46,545	30,245		30,245	U
84	0605011F	RDT&E for Aging Aircraft	05	5,808							U
85	0605221F	Next Generation Aerial Refueling Aircraft	05	22,629	15,000		15,000	863,875		863,875	U
86	0605229F	CSAR HH-60 Recapitalization	05					12,584		12,584	U
87	0605277F	CSAR-X RDT&E	05	15,000	14,975		14,975				U

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88	0605278F	HC/MC-130 Recap RDT&E	05	11,336	20,582		20,582	15,536		15,536	U
89	0605452F	Joint SIAP Executive Program Office	05		14,877		14,877				U
90	0207434F	Link-16 Support and Sustainment	05	278,961	65,619		65,619				U
91	0207451F	Single Integrated Air Picture (SIAP)	05	49,564	13,399		13,399	1,832		1,832	U
92	0207701F	Full Combat Mission Training	05	77,362	79,807		79,807	57,393		57,393	U
93	0305176F	Combat Survivor Evader Locator	05	12,500							U
94	0401138F	Joint Cargo Aircraft (JCA)	05	16,271	9,353		9,353	26,407		26,407	U
95	0401318F	CV-22	05	17,992	19,640		19,640	18,270		18,270	U
96	0401845F	Airborne Senior Leader C3 (SLC3S)	05	1,906	19,976		19,976	15,826		15,826	U
	System Development & Demonstration			3,995,427	3,844,675		3,844,675	3,549,475	30,000	3,579,475	
97	0604256F	Threat Simulator Development	06	33,951	23,331		23,331	21,245		21,245	U
98	0604759F	Major T&E Investment	06	67,898	67,797		67,797	61,587		61,587	U
99	0605101F	RAND Project Air Force	06	37,674	29,101		29,101	26,752		26,752	U
100	0605502F	Small Business Innovation Research	06	375,035							U
101	0605712F	Initial Operational Test & Evaluation	06	29,085	25,833		25,833	20,665		20,665	U
102	0605807F	Test and Evaluation Support	06	756,327	746,465	3,291	749,756	759,868		759,868	U

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103	0605860F	Rocket Systems Launch Program (SPACE)	06	16,853	14,637		14,637	23,551		23,551	U
104	0605864F	Space Test Program (STP)	06	44,707	46,721		46,721	47,623		47,623	U
105	0605976F	Facilities Restoration and Modernization - Test and Evaluation Support	06	47,339	54,809		54,809	46,327		46,327	U
106	0605978F	Facilities Sustainment - Test and Evaluation Support	06	29,618	29,683		29,683	27,579		27,579	U
107	0606323F	Multi-Service Systems Engineering Initiative	06					18,901		18,901	U
108	0702806F	Acquisition and Management Support	06	41,053	18,865		18,865	24,968		24,968	U
109	0804731F	General Skill Training	06	1,215	1,450		1,450	1,544		1,544	U
110	0909999F	Financing for Cancelled Account Adjustments	06	72							U
111	1001004F	International Activities	06	3,789	3,748		3,748	3,764		3,764	U
		RDT&E Management Support		1,484,616	1,062,440	3,291	1,065,731	1,084,374		1,084,374	
112	0603423F	Global Positioning System III - Operational Control Segment	07		292,000		292,000				U
113	0604263F	Common Vertical Lift Support Platform	07	3,858	4,000		4,000				U
114	0605018F	Air Force Integrated Military Human Resources System (AF-IMHRS)	07					43,300		43,300	U
115	0605024F	Anti-Tamper Technology Executive Agency	07	20,407	47,276		47,276	42,255		42,255	U
117	0101113F	B-52 Squadrons	07	39,835	102,330		102,330	146,096		146,096	U

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118	0101122F	Air-Launched Cruise Missile (ALCM)	07	384	3,652		3,652	3,631		3,631	U
119	0101126F	B-1B Squadrons	07		143,360		143,360	33,234		33,234	U
120	0101127F	B-2 Squadrons	07		407,189		407,189	260,466		260,466	U
121	0101313F	Strat War Planning System - USSTRATCOM	07	17,013	33,746		33,746	28,441		28,441	U
122	0101314F	Night Fist - USSTRATCOM	07	5,136	5,328		5,328	5,359		5,359	U
124	0102325F	Atmospheric Early Warning System	07		9,832		9,832				U
125	0102326F	Region/Sector Operation Control Center Modernization Program	07	23,151	25,589		25,589	23,732		23,732	U
126	0102823F	Strategic Aerospace Intelligence System Activities	07	15	18		18	15		15	U
127	0203761F	Warfighter Rapid Acquisition Process (WRAP) Rapid Transition Fund	07	29,928	11,968		11,968	10,580		10,580	U
128	0205219F	MQ-9 UAV	07	57,205	93,145		93,145	125,427		125,427	U
129	0207040F	Multi-Platform Electronic Warfare Equipment	07		14,747		14,747	15,574		15,574	U
130	0207131F	A-10 Squadrons	07	3,989	12,197		12,197	5,661		5,661	U
131	0207133F	F-16 Squadrons	07	123,733	142,620		142,620	129,103		129,103	U
132	0207134F	F-15E Squadrons	07	203,816	319,967		319,967	222,677		222,677	U
133	0207136F	Manned Destructive Suppression	07	5,413	9,748		9,748	12,937		12,937	U

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134	0207138F	F-22A Squadrons	07	579,710	569,345		569,345	576,330		576,330	U
135	0207142F	F-35 Squadrons	07					217,561		217,561	U
136	0207161F	Tactical AIM Missiles	07	5,585	5,915		5,915	6,040		6,040	U
137	0207163F	Advanced Medium Range Air-to-Air Missile (AMRAAM)	07	43,633	49,971		49,971	62,922		62,922	U
138	0207170F	Joint Helmet Mounted Cueing System (JHMCS)	07	3,095	2,529		2,529	2,407		2,407	U
139	0207224F	Combat Rescue and Recovery	07					944		944	U
140	0207227F	Combat Rescue - Pararescue	07		2,950		2,950	2,921		2,921	U
141	0207247F	AF TENCAP	07	11,547	11,643		11,643	11,648		11,648	U
142	0207249F	Precision Attack Systems Procurement	07		2,950		2,950	3,017		3,017	U
143	0207253F	Compass Call	07	4,526	13,019		13,019	20,652		20,652	U
144	0207268F	Aircraft Engine Component Improvement Program	07	146,359	139,689		139,689	147,396		147,396	U
145	0207277F	ISR Innovations	07		11,261		11,261				U
146	0207325F	Joint Air-to-Surface Standoff Missile (JASSM)	07	32,131	29,494		29,494	20,000		20,000	U
147	0207410F	Air & Space Operations Center (AOC)	07	95,908	101,587		101,587	93,102		93,102	U
148	0207412F	Control and Reporting Center (CRC)	07	18,688	52,177		52,177	58,313		58,313	U
149	0207417F	Airborne Warning and Control System (AWACS)	07	122,425	175,514		175,514	239,755		239,755	U

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150	0207418F	Tactical Airborne Control Systems	07	1,486							U
151	0207423F	Advanced Communications Systems	07	28,210	73,009		73,009	67,532		67,532	U
153	0207431F	Combat Air Intelligence System Activities	07		1,475		1,475	3,310		3,310	U
154	0207438F	Theater Battle Management (TBM) C4I	07	18,845	19,033		19,033	15,170		15,170	U
155	0207445F	Fighter Tactical Data Link	07	55,069	66,872		66,872	85,492		85,492	U
156	0207446F	Bomber Tactical Data Link	07	21,603							U
157	0207448F	C2ISR Tactical Data Link	07	1,671	1,659		1,659	1,584		1,584	U
158	0207449F	Command and Control (C2) Constellation	07	30,832	30,293		30,293	24,229		24,229	U
159	0207581F	Joint Surveillance/Target Attack Radar System (JSTARS)	07	97,625	185,616		185,616	168,917		168,917	U
160	0207590F	Seek Eagle	07	21,355	22,071		22,071	19,263		19,263	U
161	0207601F	USAF Modeling and Simulation	07	28,062	27,161		27,161	21,638		21,638	U
162	0207605F	Wargaming and Simulation Centers	07	3,752	7,018		7,018	6,020		6,020	U
163	0207697F	Distributed Training and Exercises	07	6,918	6,740		6,740	2,863		2,863	U
164	0208006F	Mission Planning Systems	07	94,589	81,577		81,577	79,112	4,443	83,555	U
165	0208021F	Information Warfare Support	07	11,780	13,779		13,779	2,294		2,294	U
166	0208059F	Cyber Command Activities	07					1,117		1,117	U

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173	0301400F	Space Superiority Intelligence	07					10,006		10,006	U
174	0302015F	E-4B National Airborne Operations Center (NAOC)	07	158	26,107		26,107	12,532		12,532	U
175	0303131F	Minimum Essential Emergency Communications Network (MEECN)	07	81,095	72,360		72,360	78,784		78,784	U
176	0303140F	Information Systems Security Program	07	162,815	165,401		165,401	140,017		140,017	U
177	0303141F	Global Combat Support System	07	8,613	3,319		3,319	3,393		3,393	U
178	0303150F	Global Command and Control System	07	3,124	6,279		6,279	3,055		3,055	U
179	0303158F	Joint Command and Control Program (JC2)	07	3,140				2,157		2,157	U
180	0303601F	MILSATCOM Terminals	07	277,501	253,818		253,818	186,582		186,582	U
182	0304260F	Airborne SIGINT Enterprise	07	170,714	166,989		166,989	149,268		149,268	U
185	0305099F	Global Air Traffic Management (GATM)	07	10,584	5,654		5,654	5,708		5,708	U
186	0305103F	Cyber Security Initiative	07	2,020	2,065		2,065	2,030		2,030	U
187	0305105F	DoD Cyber Crime Center	07					279		279	U
188	0305110F	Satellite Control Network (SPACE)	07	54,547	20,825		20,825	21,667		21,667	U
189	0305111F	Weather Service	07	45,918	33,291		33,291	32,373		32,373	U
190	0305114F	Air Traffic Control, Approach, and Landing System (ATCAL5)	07	8,796	11,313		11,313	33,268		33,268	U

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191	0305116F	Aerial Targets	07	10,970	54,807		54,807	63,573		63,573	U
194	0305128F	Security and Investigative Activities	07	1,962	742		742	469		469	U
196	0305146F	Defense Joint Counterintelligence Activities	07	39	39		39	40		40	U
198	0305164F	NAVSTAR Global Positioning System (User Equipment) (SPACE)	07	121,798	137,163		137,163	165,936		165,936	U
199	0305165F	NAVSTAR Global Positioning System (Space and Control Segments)	07	86,648	51,197		51,197	34,471		34,471	U
201	0305173F	Space and Missile Test and Evaluation Center	07	1,920	3,593		3,593	4,572		4,572	U
202	0305174F	Space Warfare Center	07	2,890	2,961		2,961	2,929		2,929	U
203	0305182F	Spacelift Range System (SPACE)	07	13,322	9,915		9,915	9,933		9,933	U
204	0305193F	Intelligence Support to Information Operations (IO)	07	3,627	2,240		2,240	1,254		1,254	U
205	0305205F	Endurance Unmanned Aerial Vehicles	07		48,736		48,736				U
206	0305206F	Airborne Reconnaissance Systems	07	111,170	145,413		145,413	168,963		168,963	U
207	0305207F	Manned Reconnaissance Systems	07	17,811	14,846		14,846	15,337		15,337	U
208	0305208F	Distributed Common Ground/Surface Systems	07	75,251	82,404		82,404	93,398		93,398	U
209	0305219F	MQ-1 Predator A CAV	07	38,605	35,160		35,160	28,913		28,913	U

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210	0305220F	RQ-4 UAV	07	279,164	317,268		317,268	251,318		251,318	U
211	0305221F	Network-Centric Collaborative Targeting	07	8,783	8,160		8,160	7,267	6,100	13,367	U
212	0305265F	GPS III Space Segment	07	379,046	423,466		423,466	828,171		828,171	U
213	0305614F	JSpOC Mission System	07		136,271		136,271	132,706		132,706	U
214	0305887F	Intelligence Support to Information Warfare	07	5,251	5,220		5,220	5,512		5,512	U
215	0305913F	NUDET Detection System (SPACE)	07	41,102	83,846		83,846	72,199		72,199	U
216	0305924F	National Security Space Office	07	7,512				10,630		10,630	U
217	0305940F	Space Situation Awareness Operations	07	15,579	53,805		53,805	43,838		43,838	U
218	0307141F	Information Operations Technology Integration & Tool Development	07	18,042	29,788		29,788	21,912		21,912	U
219	0308699F	Shared Early Warning (SEW)	07	3,060	3,047		3,047	2,952		2,952	U
220	0401115F	C-130 Airlift Squadron	07	156,010	109,250		109,250	113,107		113,107	U
221	0401119F	C-5 Airlift Squadrons (IF)	07	110,191	85,266		85,266	58,990		58,990	U
222	0401130F	C-17 Aircraft (IF)	07	182,754	161,855		161,855	177,212		177,212	U
223	0401132F	C-130J Program	07	25,190	30,019		30,019	26,770		26,770	U
224	0401134F	Large Aircraft IR Countermeasures (LAIRCM)	07	22,490	26,784		26,784	17,227		17,227	U
225	0401218F	KC-135s	07	11,917	10,220		10,220	20,453		20,453	U
226	0401219F	KC-10s	07	3,800	35,586		35,586	56,669		56,669	U

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227	0401314F	Operational Support Airlift	07		4,916		4,916	4,988		4,988	U
228	0401315F	C-STOL Aircraft	07					1,283		1,283	U
229	0401839F	Air Mobility Tactical Data Link	07	7,700							U
230	0408011F	Special Tactics / Combat Control	07	7,549	11,354		11,354	7,345	10,325	17,670	U
231	0702207F	Depot Maintenance (Non-IF)	07	1,489	1,508		1,508	1,514		1,514	U
232	0702976F	Facilities Restoration & Modernization - Logistics	07	44,778	8,000		8,000				U
233	0708012F	Logistics Support Activities	07	23,042							U
234	0708610F	Logistics Information Technology (LOGIT)	07	144,861	246,250		246,250	227,614		227,614	U
235	0708611F	Support Systems Development	07	22,133	38,258		38,258	6,141		6,141	U
236	0804743F	Other Flight Training	07	2,000	805		805	667		667	U
237	0804757F	Joint National Training Center	07	3,115	3,220		3,220	9		9	U
238	0804772F	Training Developments	07		1,769		1,769				U
239	0808716F	Other Personnel Activities	07	1,113	116		116	116		116	U
240	0901202F	Joint Personnel Recovery Agency	07	5,590	11,376		11,376	6,107		6,107	U
241	0901212F	Service-Wide Support (Not Otherwise Accounted For)	07	3,648							U

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242	0901218F	Civilian Compensation Program	07	14,647	8,174		8,174	7,811		7,811	U
243	0901220F	Personnel Administration	07	18,947	30,969		30,969	11,179		11,179	U
244	0901538F	Financial Management Information Systems Development	07	22,999	55,891		55,891	49,816		49,816	U
9999	9999999999	Classified Programs		11,687,464	12,088,035	184,360	12,272,395	12,406,781	199,373	12,606,154	U
		Operational Systems Development		16,615,291	18,770,188		18,954,548	18,919,248	220,241	19,139,489	
Total Research, Development, Test & Eval, AF				26,691,777	27,981,721	187,651	28,169,372	27,247,302	266,241	27,513,543	

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18	03	0603211F	Aerospace Technology Dev/Demo.....	Volume 1 - 509
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REGION/ SECTOR OPERATIONS CONTROL CENTER	0102326F	125	07.....Volume 3 - 129	
Requirements Analysis and Maturation	0604337F	51	04.....Volume 2 - 309	
Rocket Systems Launch Program (RSLP)	0605860F	103	06.....Volume 2 - 1083	
Satellite Control Network	0305110F	188	07.....Volume 3 - 925	
Security And Investigative Activities	0305128F	194	07.....Volume 3 - 975	
Seek Eagle	0207590F	160	07.....Volume 3 - 615	
SERVICE-WIDE SUPPORT	0901212F	241	07.....Volume 3 - 1557	
Shared Early Warning System	0308699F	219	07.....Volume 3 - 1281	
Single Integrated Air Picture (SIAP)	0207451F	91	05.....Volume 2 - 943	
SLC3S-A (Senior Leader C3S)	0401845F	96	05.....Volume 2 - 1021	
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Space Based Infrared Systems (SBIRS) High EMD	0604441F	72	05.....Volume 2 - 673	
Space Control Technology	0603438F	36	04.....Volume 2 - 71	
Spacelift Range System	0305182F	203	07.....Volume 3 - 1029	
Space Protection Program	0603830F	40	04.....Volume 2 - 165	
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SPACE SUPERIORITY INTELLIGENCE	0301400F	173	07.....Volume 3 - 717	

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Space Test Program	0605864F	104	06.....Volume 2 - 1091	
SPACE WARFARE CENTER	0305174F	202	07.....Volume 3 - 1021	
Specialized Undergraduate Pilot Training	0604233F	62	05.....Volume 2 - 473	
SPECIAL TACTICS/COMBAT CONTROL	0408011F	230	07.....Volume 3 - 1439	
STRAT AEROSPACE INTEL SYS ACTIVITIES	0102823F	126	07.....Volume 3 - 139	
STRAT WAR PLANNING SYS - USSTRATCOM	0101313F	121	07.....Volume 3 - 91	
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Support Systems Development	0708611F	235	07.....Volume 3 - 1485	
Sustainment Science and Technology (S&T)	0603199F	16	03.....Volume 1 - 473	
TAC AIRBORNE CONTROL SYSTEM	0207418F	150	07.....Volume 3 - 485	
Tactical AIM Missiles	0207161F	136	07.....Volume 3 - 269	
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Theater Battle Management (TBM) C4I	0207438F	154	07.....Volume 3 - 527	
Third Generation Infrared Surveillance (3GIRS)	0604443F	73	05.....Volume 2 - 689	
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Warfighter Rapid Acquisition Program	0203761F	127	07.....Volume 3 - 147	
Wargaming and Simulation Centers	0207605F	162	07.....Volume 3 - 653	
WEATHER SERVICE	0305111F	189	07.....Volume 3 - 935	
Wideband MILSATCOM (Space)	0603854F	44	04.....Volume 2 - 233	
WWMCCS/GLOBAL COMMAND & CONTROL SYSTEM	0303150F	178	07.....Volume 3 - 825	

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PROGRAM ELEMENT COMPARISON SUMMARY

PROGRAM ELEMENT (By BUDGET ACTIVITY)

BUDGET ACTIVITY #1: BASIC RESEARCH (Volume 1)

BUDGET ACTIVITY #2: APPLIED RESEARCH (Volume 1)

0602601F Space Technology

REMARKS

In FY 2011, increases in funding are due the movement of technologies from PE 0603401F, Advanced Spacecraft Technology, to this PE in order to better align the technology readiness levels of these efforts.

BUDGET ACTIVITY #3: ADVANCED TECHNOLOGY DEVELOPMENT (Volume 1)

0603401F Advanced Spacecraft Technology
 0603216F Aerospace Propulsion and Power Technology
 0603112F Advanced Materials for Weapon Systems

In FY 2011, Changes in funding are due to some technology development efforts being moved to PE 0602601F, Space Technology, in order to better align the technology readiness levels of these efforts.
 In FY 2011, The funding in this project 63681B decreases due to planned taper of turbine engine technologies.
 In FY 2011, funds from Project 2100 have been moved to Program Element 0602102F BPAC 4348 to increase emphasis on applied research.

BUDGET ACTIVITY #4: ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPE (Volume 2)

0603438F Space Control Technology
 0604015F Long Range Strike and Industrial Base
 0603830F Space Protection Program

In FY 2011 OCO requested, \$16.000M, replaces and upgrades equipment left with Army and Air Force counterspace units in Operation Iraqi Freedom (OIF). This technology was developed by the Rapid Reaction Squadron in response to numerous warfighter Urgent Operational Needs (UONs) and Joint Urgent Operational Needs (JUONs) for OIF.
 In FY 2011 PE 0604015F is a new start effort.
 In FY 2011, new Program Element 0306830F. All Space Protection Program funding and content were transferred from PE 0630438F, Space Control Technology, and PE 0305940F, Space Situational Awareness, in FY 2011.

BUDGET ACTIVITY #5: SYSTEM DEVELOPMENT AND DEMONSTRATION (SDD) (Volume 2)

0604706F Life Support Systems
 0604281F TACTICAL DATA NETWORKS ENTERPRISE
 0605221F KC-X, Next Generation Aerial Refueling Aircraft

In FY 2011, Project 65412A, Life Support Systems, includes new starts for flash blindness goggles and aircrew flight equipment.
 In FY 2011 funding totals include \$30M requested for Overseas Contingency Operations.
 In FY 2011 PB restructures the KC-X budget to account for the fact-of-life delays for the recompetition and planned summer 2010 contract award.

BUDGET ACTIVITY #6: RDT&E MANAGEMENT SUPPORT (Volume 2)

0606323F Multi-Service Systems Engineering

In FY 2011, this is a new PE. In FY 2010, PE 0605452F Joint Single Integrated Air Picture (SIAP) Program Executive Office efforts come to a close. This new PE (0606323F) includes follow-on efforts under the Joint Integrated Air and Missile Defense (JIAMD) initiative. FY 2011 efforts in this PE include Multi-Service Systems Engineering (MSSE), Joint Track Manager Capability (JTMC) demonstrations, and Joint Operational requirements definition.

BUDGET ACTIVITY #7: OPERATIONAL SYSTEM DEVELOPMENT (Volume 3)

0208021F Information Warfare Support

In FY 2011, Electronic Combat Spt, C3 Protection/Multi-Mission, Technology and Spt efforts transferred to PE 0310400F, Space Superiority Intelligence for proper execution in AFSPC.

PROGRAM ELEMENT COMPARISON SUMMARY

PROGRAM ELEMENT (By BUDGET ACTIVITY)

REMARKS

0208006F	Mission Planning Systems	<p>In FY 2011, Project 673858, Mission Planning Systems, efforts were transferred to PE 0208006F, Mission Planning Systems, Project 675302, Mobility Air Forces Planning Systems (previously titled Precision Aerial Delivery System) and Project 675380, Combat Air Forces Planning Systems, in order to more accurately group and reflect the products being developed within the program.</p> <p>FY 2011 funding totals include \$4.443 for Overseas Contingency Operations (OCO)</p> <p>FY 2011 - Project 675365 is new in FY11 to provide enhanced funds tracking and accountability for Engine CIP support of F-35 propulsion systems. Engine CIP for all other AF aircraft propulsion programs is accomplished within Project 671012.</p> <p>In FY 2011, this effort contains a new start for P3I R7 Study Effort for Next Phase.</p>
0207268F 0207136F	Aircraft Engine Component Improvement Program (CIP) Manned Destructive Suppression	<p>In FY 2011, the F-15 program has a new start: F-15C/D Advanced Display Core Processor (ADCP+)with Vertical Situation Display to replace obsolete 25 MHz Central Computers.</p>
0207134F	F-15E SQUADRONS	<p>In FY 2011 funding totals include \$6.1M for the Overseas Contingency Operations (OCO) Supplemental Request to develop a Network Centric Collaborative Targeting (NCCT) Core Technology Ground Moving Target Indicator (GMTI) / Signals Intelligence (SIGINT) Correlator. A GMTI / SIGINT correlator for the NCCT fusion engine supports OCO real-time and forensic operations, accelerates High-Side (classified) message architecture to network OCO relevant sensor systems, and directly supports tactics, techniques and procedures (TTP) development for rapid operator use.</p>
0305221F	Network Centric Collaborative Targeting	<p>In FY 2011, Project Number 670374, Electronic Combat Spt, C3 Protection/Multi-Mission Technology and Spt, funding and content were transferred from PE 0208021F, Information Warfare Support.</p> <p>In FY 2011, PE0207142F is a new PE for Joint Strike Fighter (JSF). PE0604800F is the primary RDT&E funding for JSF.</p> <p>In FY 2011, Electronic Combat Spt, C3 Protection/Multi-Mission, Technology and Spt efforts transferred to PE 0301400F, Space Superiority Intelligence for proper execution in AFSPC.</p>
0301400F	Mission Planning Systems	<p>In FY 2011 funding totals include \$10.325M requested for Overseas Contingency Operations.</p> <p>In FY 2011, Project 675365 is new providing enhanced funds tracking and accountability for F-35 propulsion systems.</p> <p>In FY 2011, Project Number 67A051, Space Superiority - Advanced Intelligence Systems content and funding were transferred from PE 0208021F, Information Warfare Support, in order to focus specific attention on the Space Superiority Intelligence requirements.</p>
0207142F	Joint Strike Fighter Squadrons	
0208021F	Information Warfare Support	
0408011F	SPECIAL TACTICS/COMBAT CONTROL	
0207268F	Aircraft Engine Component Improvement Program (CIP)	
0301400F	SPACE SUPERIORITY INTELLIGENCE	

The following are Program Elements not providing RDT&E exhibits due to classification:

<u>Program Element</u>	<u>Title</u>
0101314F	NIGHT FIST- USSTRATCOM
0101815F	Advanced Strategic Program
0207424F	Evaluation and Analysis Program
0208161F	Special Evaluation System
0301310F	National Air Intelligence Center
0301314F	COBRA BALL
0301315F	Missile and Space Technical Collection
0301324F	FOREST GREEN
0301386F	GDIP Collection Management
0301555F	Classified Programs
0301556F	Special Program
0304111F	Special Activities
0304311F	Selected Activities
0304348F	Advanced Geospatial Intelligence (AGI)
0305124F	Special Applications Program
0305142F	Applied Technology and Integration
0305159F	Defense Reconnaissance Support Activities
0305172F	Combined Advanced Applications
0605798F	Analysis Support Group
0305127F	Foreign Counterintelligence Activities

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**Department of Defense
Fiscal Year (FY) 2011 President's Budget**

February 2010



Air Force

Justification Book Volume 1

Research, Development, Test & Evaluation, Air Force - 3600

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02	01	0601103F	University Research Initiatives.....	Volume 1 - 73
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Budget Activity 02: Applied Research

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05	02	0602201F	Aerospace Vehicle Technologies.....	Volume 1 - 143
06	02	0602202F	Human Effectiveness Applied Research.....	Volume 1 - 165
07	02	0602203F	Aerospace Propulsion.....	Volume 1 - 205
08	02	0602204F	Aerospace Sensors.....	Volume 1 - 265
09	02	0602601F	Space Technology.....	Volume 1 - 317
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Budget Activity 02: Applied Research

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12	02	0602702F	Command Control and Communications.....	Volume 1 - 379
13	02	0602788F	Dominant Information Technology.....	Volume 1 - 403
14	02	0602890F	High Energy Laser Research.....	Volume 1 - 437

Budget Activity 03: Advanced Technology Development (ATD)

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16	03	0603199F	Sustainment Science and Technology (S&T).....	Volume 1 - 473
17	03	0603203F	Advanced Aerospace Sensors.....	Volume 1 - 479
18	03	0603211F	Aerospace Technology Dev/Demo.....	Volume 1 - 509
19	03	0603216F	Aerospace Propulsion and Power Technology.....	Volume 1 - 521
20	03	0603231F	Crew Systems and Personnel Protection Technology.....	Volume 1 - 563
21	03	0603270F	Electronic Combat Technology.....	Volume 1 - 583
22	03	0603401F	Advanced Spacecraft Technology.....	Volume 1 - 599
23	03	0603444F	MAUI SPACE SURVEILLANCE SYSTEM.....	Volume 1 - 631

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Budget Activity 03: Advanced Technology Development (ATD)

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26	03	0603605F	Advanced Weapons Technology.....	Volume 1 - 671
27	03	0603680F	Manufacturing Technologies.....	Volume 1 - 691
28	03	0603788F	Global Information Dev/Demo.....	Volume 1 - 705
29	03	0603789F	C3I Advanced Development.....	Volume 1 - 733
30	03	0603924F	High Energy Laser Advanced Technology Program.....	Volume 1 - 749

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Human Effectiveness Applied Research	0602202F	06	02.....Volume 1 - 165	
Manufacturing Technologies	0603680F	27	03.....Volume 1 - 691	
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Space Technology	0602601F	09	02.....Volume 1 - 317	
Sustainment Science and Technology (S&T)	0603199F	16	03.....Volume 1 - 473	
University Research Initiatives	0601103F	02	01.....Volume 1 - 73	

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Exhibit R-1

(Listing by Budget Activity, then Program Element Number)

BA# 01: Basic Research

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
01	01	0601102F	Defense Research Sciences	299.830	328.471	350.978	0.000	350.978
02	01	0601103F	University Research Initiatives	133.526	141.524	136.297	0.000	136.297
03	01	0601108F	High Energy Laser Research Initiatives	13.032	12.781	13.198	0.000	13.198
Total: Basic Research				446.388	482.776	500.473	0.000	500.473

BA# 02: Applied Research

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
04	02	0602102F	Materials	185.583	179.202	137.273	0.000	137.273
05	02	0602201F	Aerospace Vehicle Technologies	119.544	138.563	144.699	0.000	144.699
06	02	0602202F	Human Effectiveness Applied Research	93.954	93.527	87.452	0.000	87.452
07	02	0602203F	Aerospace Propulsion	244.890	221.503	207.049	0.000	207.049
08	02	0602204F	Aerospace Sensors	130.902	136.012	157.497	0.000	157.497
09	02	0602601F	Space Technology	136.072	119.125	111.857	0.000	111.857
10	02	0602602F	Conventional Munitions	56.596	58.044	61.330	0.000	61.330
11	02	0602605F	DIRECTED ENERGY TECHNOLOGY	60.233	105.231	103.596	0.000	103.596

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Exhibit R-1

(Listing by Budget Activity, then Program Element Number)

BA# 02: Applied Research

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
12	02	0602702F	Command Control and Communications	114.510	0.000	0.000	0.000	0.000
13	02	0602788F	Dominant Information Technology	0.000	116.785	117.283	0.000	117.283
14	02	0602890F	High Energy Laser Research	47.939	53.229	53.384	0.000	53.384
Total: Applied Research				1,190.223	1,221.221	1,181.420	0.000	1,181.420

BA# 03: Advanced Technology Development (ATD)

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
15	03	0603112F	Advanced Materials for Weapon Systems	62.070	67.856	33.414	0.000	33.414
16	03	0603199F	Sustainment Science and Technology (S&T)	0.000	2.943	2.935	0.000	2.935
17	03	0603203F	Advanced Aerospace Sensors	69.902	52.786	44.677	0.000	44.677
18	03	0603211F	Aerospace Technology Dev/Demo	41.748	88.226	53.588	0.000	53.588
19	03	0603216F	Aerospace Propulsion and Power Technology	175.292	192.241	136.135	0.000	136.135
20	03	0603231F	Crew Systems and Personnel Protection Technology	35.742	0.000	0.000	0.000	0.000
21	03	0603270F	Electronic Combat Technology	29.364	32.056	16.992	0.000	16.992
22	03	0603401F	Advanced Spacecraft Technology	97.834	98.708	83.705	0.000	83.705

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Exhibit R-1

(Listing by Budget Activity, then Program Element Number)

BA# 03: Advanced Technology Development (ATD)

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
23	03	0603444F	MAUI SPACE SURVEILLANCE SYSTEM	36.093	36.661	5.899	0.000	5.899
24	03	0603456F	Human Effectiveness Adv Tech Dev	0.000	27.390	24.814	0.000	24.814
25	03	0603601F	Conventional Weapons Technology	16.771	14.296	15.755	0.000	15.755
26	03	0603605F	Advanced Weapons Technology	61.420	44.794	17.461	0.000	17.461
27	03	0603680F	Manufacturing Technologies	54.614	50.502	39.701	0.000	39.701
28	03	0603788F	Global Information Dev/Demo	0.000	46.414	32.382	0.000	32.382
29	03	0603789F	C3I Advanced Development	32.986	0.000	0.000	0.000	0.000
30	03	0603924F	High Energy Laser Advanced Technology Program	3.899	3.794	1.847	0.000	1.847
Total: Advanced Technology Development (ATD)				717.735	758.667	509.305	0.000	509.305

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	299.830	328.471	350.978	0.000	350.978	339.007	338.984	355.955	373.683	Continuing	Continuing
612301: <i>Physics</i>	46.896	48.370	50.470	0.000	50.470	47.648	47.498	49.872	52.379	Continuing	Continuing
612302: <i>Solid Mechanics and Structures</i>	16.921	19.666	20.683	0.000	20.683	19.663	18.848	19.955	20.903	Continuing	Continuing
612303: <i>Chemistry</i>	36.584	38.957	41.587	0.000	41.587	40.207	38.953	40.459	42.500	Continuing	Continuing
612304: <i>Mathematics and Computing Sciences</i>	28.707	33.208	37.697	0.000	37.697	36.221	37.258	39.215	41.193	Continuing	Continuing
612305: <i>Electronics</i>	36.876	40.401	45.066	0.000	45.066	43.056	42.368	44.526	46.763	Continuing	Continuing
612306: <i>Materials</i>	24.104	29.321	32.040	0.000	32.040	31.134	30.964	32.611	34.225	Continuing	Continuing
612307: <i>Fluid Mechanics</i>	19.346	25.706	26.800	0.000	26.800	26.226	26.394	27.830	29.182	Continuing	Continuing
612308: <i>Propulsion</i>	24.669	32.115	34.022	0.000	34.022	32.772	32.599	34.335	36.057	Continuing	Continuing
612311: <i>Information Sciences</i>	29.698	51.026	53.143	0.000	53.143	52.784	54.630	57.314	60.208	Continuing	Continuing
612312: <i>Biological Sciences</i>	9.831	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
612313: <i>Human Performance</i>	14.319	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
614113: <i>External Research Programs Interface</i>	11.879	9.701	9.470	0.000	9.470	9.296	9.472	9.838	10.273	Continuing	Continuing

Note
Note: In FY 2010, research efforts in Projects 2312 and 2313 moved to Projects 2306, 2307, 2308, and 2311 in this PE to more accurately align them to the Projects they support.

A. Mission Description and Budget Item Justification
This program consists of extramural research activities in academia and industry along with in-house investigations performed in the Air Force Research Laboratory. This program funds fundamental broad-based scientific and engineering research in areas critical to Air Force weapon systems. Projects are coordinated through

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>
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the Defense Reliance process to harmonize efforts, eliminate duplication, and ensure the most effective use of funds across the Department of Defense. All research areas are subject to long-range planning and technical review by both Air Force and tri-Service scientific planning groups. This program is in Budget Activity 1, Basic Research, because it funds scientific study and experimentation.

B. Program Change Summary (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	313.845	321.028	0.000	0.000	0.000
Current President's Budget	299.830	328.471	350.978	0.000	350.978
Total Adjustments	-14.015	7.443	350.978	0.000	350.978
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-1.357			
• Congressional Adds		8.800			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-14.015	0.000	350.978	0.000	350.978

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 612301: *Physics*

Congressional Add: *Center for Microplasma Science and Technology (CMST).*

Congressional Add: *Development of Deployable Biosensors*

Congressional Add Subtotals for Project: 612301

Project: 612307: *Fluid Mechanics*

Congressional Add: *Development and Validation of Advanced Design Technologies for Hypersonic Research (National Hypersonic Research Center).*

Congressional Add Subtotals for Project: 612307

Project: 612308: *Propulsion*

	FY 2009	FY 2010
	1.995	0.000
	0.000	1.593
	1.995	1.593
	1.995	1.593
	1.995	1.593

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2009	FY 2010
Congressional Add: <i>Coal Transformation Laboratory</i>	0.798	0.797
Congressional Add Subtotals for Project: 612308	0.798	0.797
Project: 612311: <i>Information Sciences</i>		
Congressional Add: <i>Process Integrated Mechanism for Human-Computer Collaboration and Coordination</i>	0.000	0.797
Congressional Add: <i>Safeguarding End-User military Software</i>	0.000	3.984
Congressional Add Subtotals for Project: 612311	0.000	4.781
Congressional Add Totals for all Projects	4.788	8.764

Change Summary Explanation

Note: The FY 2010 President's Budget sumittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note: In FY 2010, Congress added \$0.8 million for Process Integrated Mechanism for Human-Computer Collaboration and Coordination, \$4.0 million for Safeguarding End-User Military Software, \$0.8 million for Coal Transformation Laboratory, \$1.6 million for Technologies for Hypersonic Research, and \$1.6 million for Development of Deployable Biosensors.

Note: In FY 2010, efforts moved to Project 2306 from Project 2312 in this PE to more accurately align basic research efforts in Materials.

Note: In FY 2010, efforts moved to Project 2307 from Project 2313 in this PE to more accurately align basic research efforts in Fluid Mechanics.

Note: In FY 2010, efforts moved to Project 2311 from Project 2313 in this PE to more accurately align basic research efforts in Information Sciences.

Note: In FY 2010, efforts moved from Project 2312 to Project 2308 within this PE to more accurately align basic research efforts in Propulsion.

Note: In FY 2010, efforts moved from Project 2313 to Project 2307 within this PE to more accurately align basic research efforts in Fluid Dynamics.

Note: In FY 2010, efforts will move from Project 2313 to Project 2311 within this PE to more accurately align basic research efforts in Information Sciences.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY
3600: *Research, Development, Test & Evaluation, Air Force*
BA 1: *Basic Research*

R-1 ITEM NOMENCLATURE
PE 0601102F: *Defense Research Sciences*

C. Performance Metrics
(U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612301: <i>Physics</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612301: <i>Physics</i>	46.896	48.370	50.470	0.000	50.470	47.648	47.498	49.872	52.379	Continuing	Continuing

A. Mission Description and Budget Item Justification

Physics basic research seeks to enable revolutionary advances in, and expand the fundamental knowledge of supporting laser technologies, sensing and imaging capabilities, communications and navigational systems, fuels and explosives, and directed energy weapons that are critical to the Air Force. The primary areas of research investigated by this project are laser and optical physics; electro-energetics (includes plasma) physics; atomic, molecular, and particle physics; space sensors and imaging physics; space environment physics; electromagnetics; and applied analysis.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Investigate regulated, broad-spectrum, variable-energy lasers, laser arrays, and novel bright incoherent light sources.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Investigated applications of previous research enabling large inexpensive, very bright micro-plasma array ultraviolet sources to large flexible displays, materials curing, and small laser sources. Continued to expand research on high energy, tunable, all solid-state lasers. Studied direct-write micro-systems, including onboard power sources. Applied 3-D laser write techniques in special glasses to inexpensive, flexible subsystems for space.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Extend high energy solid-state laser research into new materials and materials processing procedures to increase the average power and tunability range of ceramic lasers. Study novel optical fiber geometries to achieve single mode operation in large core area, thereby allowing high power operation. Study novel techniques for alleviating deleterious nonlinear optical effects in high power, single mode fiber lasers, and novel means to couple such lasers for very high powers.</p>	10.219	10.778	11.530	0.000	11.530

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010						
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>		R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>		PROJECT 612301: <i>Physics</i>						
B. Accomplishments/Planned Program (\$ in Millions)										
<p>MAJOR THRUST: Advance technologies for space sensors, imaging, identification and tracking methods, and effective space situational awareness.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Investigated fundamental limits affecting ground-based and space-based surveillance of space objects. Developed improved adaptive optics and post-processing techniques for improved image resolution. Studied spectral, polarimetric, and temporal approaches to unresolved space object identification. Continued the study of fundamental processes in the solar-terrestrial system that affects atmospheric density to lead to physics-based methods of satellite orbit prediction and precision tracking.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Investigate new sensing modalities to improve resolution and precision limits of ground-based and space-based surveillance of space objects. Continue study of spectral, polarimetric, and temporal signatures of space objects to identify unresolved space objects. Investigate physics involved in active imaging techniques. Investigate inclusion of fundamental processes of the solar-terrestrial system into physics-based models to predict atmospheric density and increase precision of satellite orbit prediction and precision tracking.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to develop new sensing modalities that reduce limits on optical resolution and precision tracking of space objects. Investigate new methods of uniquely identifying unresolved space objects and incorporate this investigation in the identification of uncorrelated space objects. Continue study of the physics of signatures in the scattering and reflection of light during active imaging. Expand research into fundamental processes and energy sources affecting satellite drag leading to improved understanding of precursors to atmospheric density variations.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612301: <i>Physics</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Center for Microplasma Science and Technology (CMST). <i>FY 2009 Accomplishments:</i> In FY 2009: Created a National Center for the microplasma research field. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.995	0.000
Congressional Add: Development of Deployable Biosensors <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Fundamental research in remotely controlling the operation of both nanofabrication equipment and nanoscale analysis tools while performing nano-related research.	0.000	1.593
Congressional Adds Subtotals	1.995	1.593

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612301: <i>Physics</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602601F: <i>Space Technology.</i>											
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612302: <i>Solid Mechanics and Structures</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612302: <i>Solid Mechanics and Structures</i>	16.921	19.666	20.683	0.000	20.683	19.663	18.848	19.955	20.903	Continuing	Continuing

A. Mission Description and Budget Item Justification

Solid mechanics and structures basic research aims to improve load-bearing performance of air and space structures through the prediction and control of multi-scale phenomena ranging from micro-level deformation and fracture of materials to the structural dynamics of large platforms. The goals are cost-effective development and safe, reliable operation of superior Air Force weapon and defensive systems. Fundamental knowledge of "multi-functional" structures with smart materials, sensors, actuators, and control systems integrated to accomplish damage control, thermal management, vibration reduction, and reconfigurable shapes. Research topics include: the modeling of non-linear static/dynamic behavior of structures; mechanical reliability of micro-devices; design of multi-functional materials; mechanical behavior of nanomaterials; and composite materials for structures.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Explore the integration of advanced nano materials and devices into turbine engines, air vehicles, space systems, and other weapon systems, and develop new mechanics.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued research in the area of multifunctional hybrid composite systems for sensing and neutralization of exogenous threats to load-bearing capability. Conducted research in the areas of diagnostics, prognostics, autonomics, self-healing, thermal management, energy harvesting/storage, electromagnetic energy radiation/transmission, and micro-/nano-mechanics to enable safer and more durable aerospace structures with improved performance characteristics. Further developed the fundamental knowledge required to design and manufacture multi-functional aerospace material systems and devices and to predict their performance and structural integrity. Continued developing and exploiting methods that combine information technology and multi-scale modeling in the design of new material systems.</p>	8.050	9.422	9.930	0.000	9.930

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612302: <i>Solid Mechanics and Structures</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Expanded the novel theoretical and experimental methods in morphing aircraft structures to achieve broader operational capabilities. Utilized novel actuation devices and materials for Air Force aircraft and space structural applications. Expanded the study of the science related to the acceptance into new structures of the novel materials developed under the advanced materials programs, and used the knowledge to develop new aerospace structural concepts. Continued the development of structural health monitoring sensors and techniques towards an integrated vehicle-wide approach. Consolidated an integrated approach to structural systems lifetime prognosis and reliability. Expanded the understanding of mechanical and dynamic behavior of micro-/nano-scale structures to generate novel structural concepts. Investigated nonlinear phenomena associated with the structural deformation and aero-elastic instabilities and limit-cycle vibration to include novel structural concepts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Search for unprecedented new and revolutionary flight structure concepts that will permit broader operational capabilities, a faster reconfigurable ability, and more affordable accelerated fabrication; this search will include morphing aircraft structures. Investigate novel actuation devices and materials for Air Force aircraft and space structural applications. Expand scientific knowledge related to new structures of the novel materials developed under the advanced materials programs. Expand development of structural health monitoring sensors and techniques towards an integrated vehicle health monitoring and operational capability prognosis. Understand a risk-based approach to structural systems lifetime prognosis and reliability. Expand understanding of mechanical and dynamic behavior of flight structures under extreme environments (e.g., intense vibration, nonlinear structural dynamics, unsteady aero-thermo-elastic effects on flight structure, and directed energy) with objective of enhancing operational survivability and mission success.</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612302: <i>Solid Mechanics and Structures</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to seek new and revolutionary flight structure concepts that will permit broader operational capabilities, a faster reconfigurable ability, and more affordable accelerated fabrication. Investigate new structures of novel materials developed under the advanced materials programs and identify a proof-of-concept demonstration. Expand the understanding of structural health monitoring sensors and techniques and test the developed new science under laboratory conditions. Enhance the understanding of dynamic and mechanical behavior of flight structures under extreme environments (intense vibration, nonlinear structural dynamics, unsteady aero-thermo-elastic effects, directed energy effects etc.) to increase operational survivability and mission success.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	16.921	19.666	20.683	0.000	20.683

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612302: <i>Solid Mechanics and Structures</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603211F: <i>Aerospace Structures.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612303: <i>Chemistry</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612303: <i>Chemistry</i>	36.584	38.957	41.587	0.000	41.587	40.207	38.953	40.459	42.500	Continuing	Continuing

A. Mission Description and Budget Item Justification

Chemistry basic research seeks bold innovations in understanding, modeling, and controlling chemical reactions for developing new materials, improving synthesis of existing materials, controlling energy flow and storage, and regulating interactions between materials and their environments. Studies expand fundamental understanding of properties regulating the chemical dynamics and energy transfer processes that foster advances in laser weaponry and allow predictions of the infrared, optical, and radar signatures of reaction products and intermediates that advance reliable target assessment and tracking. Critical research topics include: novel synthesis and characterization of lower cost, higher performance functional and structural materials, electronics, and photonic materials; nano-structures; electromagnetics; and conventional weaponry. Focused investigations include bio-derived mechanisms for lifetime extension of materials and catalysis and the exploration of atomic and molecular surface interactions that limit performance of electronic devices, compact power sources, and lubricant materials. Primary areas of research include molecular reaction dynamics; theoretical chemistry; polymer chemistry; biophysical mechanisms; and surface and interfacial science.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Research and characterize molecular dynamics, reaction mechanics/interactions, and theoretical chemistry to model, predict, control, and exploit atomic and molecular energetics. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued to develop new capabilities to predict molecular and macroscopic properties of chemicals of interest to the Air Force. Explored properties and potential of nano-scale energetic materials. Continued to develop new experimental methods to advance understanding of reactivity and energy flow in molecules for applications to signatures, battle space awareness, propellants, munitions, and laser systems. Continued developing novel applications of catalysis and plasmonic structures for applications to propulsion, energetics, and sensing. Explored new concepts for closed-cycle hybrid chemical lasers.	15.888	16.382	17.485	0.000	17.485

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612303: <i>Chemistry</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Propulsion.</i>											
• PE 0602500F: <i>Multi-Disciplinary</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Space Technology.</i>											
• PE 0602601F: <i>Space</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Technology.</i>											
• PE 0602602F: <i>Conventional</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<i>Munitions.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>			R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612304: <i>Mathematics and Computing Sciences</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612304: <i>Mathematics and Computing Sciences</i>	28.707	33.208	37.697	0.000	37.697	36.221	37.258	39.215	41.193	Continuing	Continuing

A. Mission Description and Budget Item Justification

Mathematics and computing sciences basic research develops novel techniques for mathematical modeling and simulation, algorithm development, complex systems control, and innovative analytical and high performance computing methods for air and space systems. Basic research provides fundamental knowledge enabling improved performance and control of systems and subsystems through accurate models and computational tools, artificial intelligence, and improved programming techniques and theories. The primary areas of research investigated by this project are dynamics and control, optimization and discreet mathematics, and computational mathematics.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Perform dynamics and control research to develop innovative techniques for design and analysis of complex control systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Further developed the design and analysis techniques for cooperative control systems in dynamic, uncertain, adversarial environments with applications to swarms of smart munitions, unattended aerial vehicles (UAVs), and constellations of small satellites. Conducted additional research for teams of micro air vehicles operating at various altitudes in complex environments to execute assigned missions with variable operator intervention. Continued developing control methodologies to improve non-equilibrium behavior of complex, unsteady fluid systems. Advanced image processing and sensor technologies for use in UAV controllers, smart munitions, and non-destructive testing of vehicles. Developed methods for design and analysis of bio-inspired sensing systems, controls, and computational systems. Continued development of algorithms for control of and over dynamic, large-scale networks. Further developed theory and algorithms for specification, design, verification, and validation of distributed embedded systems. Studied novel devices to exploit nonlinear</p>	14.667	16.917	19.161	0.000	19.161

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612304: <i>Mathematics and Computing Sciences</i>

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>dynamic phenomena with a focus on detection, classification, and control systems for use in urban combat environments.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop the design and analysis techniques for cooperative control systems in dynamic, uncertain, adversarial environments with applications to swarms of smart munitions, UAVs, and constellations of small satellites with an emphasis on heterogeneous agents and mixed human-robot interactions. Expand additional research for teams of micro air vehicles operating at various altitudes in complex environments to execute assigned missions with variable operator intervention to include adaptive control and machine learning. Develop control methodologies to improve non-equilibrium behavior of complex, nonlinear systems. Continue to advance image processing and sensor technologies for use in UAV controllers and smart munitions to include target tracking and ownship state estimation. Develop mathematical control theoretic models that capture the robust, nonlinear, hybrid dynamics of microbiological systems. Develop methods for design and analysis of bio-inspired sensing systems, controls, and computational systems. Continue development of algorithms for control of and over dynamic, large-scale networks. Develop theory and algorithms for specification, design, verification, and validation of distributed embedded control systems.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Further develop heterogeneous and mixed human-robot interaction concepts for the design and analysis of cooperative control systems in dynamic, uncertain, adversarial environments with applications to swarms of smart munitions, UAVs, and constellations of small satellites. Develop increased levels of high-confidence adaptive control and machine learning techniques for teams of micro air vehicles operating at various altitudes in complex environments to execute assigned missions with variable operator intervention. Continue development of control methodologies to improve non-equilibrium behavior of complex, nonlinear systems. Advance image processing and sensor</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612304: <i>Mathematics and Computing Sciences</i>

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Continue to develop theoretically rigorous and computationally effective mathematical methods for solving large and complex problems in logistics, system diagnostics/prognostics, air mobility contingencies, engineering design, target tracking, and strategic/tactical planning for battle space information management. Meta heuristic searches are combined with rigorous methods and emphasis is placed on those for which provable bounds are shown. Place emphasis on development of innovative mathematical and numerical algorithms that enhance modeling and simulation capabilities in understanding and forecasting of complex physical phenomena and design and control of systems of interest to the Air Force. The application areas of interest include non-equilibrium plasma, non-steady aerodynamics for various flight regimes, material design, and structural mechanics. Focus on numerical algorithms that include multi-scale and multi-physics approaches with particular emphasis on convergence, error analysis and adaptability. Increase emphasis on development of algorithms for efficient and robust multidisciplinary design and optimization as well as understanding and quantifying the effects of uncertainties in computational models.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to support new theoretically rigorous and computationally effective mathematical methods for solving large, complex problems in logistics, system diagnostics/prognostics, air mobility contingencies, engineering design, target tracking, and strategic/tactical planning (including cooperative control) for battle space information management. Meta heuristic searches are being combined with rigorous search techniques, with emphasis on the mathematical underpinning and the establishment of rigorous error bounds when convergence to non-optimal solutions occurs. Continue developing mathematically rigorous numerical algorithms for enhancing the modeling and simulations of large, complex, multi-scale, and nonlinear systems and phenomena of interest to the Air Force. The application areas in plasma, aerodynamics, structural mechanics, and materials will emphasize the increasing challenges in capturing the unsteady, dynamic, multi-physics, and multi-scale nature of the</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force							DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>			R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>			PROJECT 612304: <i>Mathematics and Computing Sciences</i>					
B. Accomplishments/Planned Program (\$ in Millions)											
							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>problems. Continue to focus on uncertainty quantification and management based on combination of computational science, information theory, statistics, and probability to lead to better understanding and analysis of complex systems. Support development and integration of novel optimization strategies with high-order, time-accurate solutions for superior design of Air Force systems.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>											
Accomplishments/Planned Programs Subtotals							28.707	33.208	37.697	0.000	37.697
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602602F: <i>Conventional Munitions.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702F: <i>Command, Control, and Communications.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603789F: <i>C3I Advanced Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D. Acquisition Strategy											
Not Applicable.											

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612304: <i>Mathematics and Computing Sciences</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612305: <i>Electronics</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612305: <i>Electronics</i>	36.876	40.401	45.066	0.000	45.066	43.056	42.368	44.526	46.763	Continuing	Continuing

A. Mission Description and Budget Item Justification

Electronics basic research generates and exploits fundamental knowledge and understanding of novel solid-state electronic, sensor, and optoelectronic materials and device implementation schemes vital to advance Air Force operational capabilities in surveillance, information and signal processing, communications, command and control, electronic countermeasures, stealth technologies, and directed energy weapons. Solid-state electronics research discovers and develops new materials, advances processing and fabrication sciences, and develops and implements advanced physical modeling and simulation capabilities essential to evaluate novel electronic, sensor, and optoelectronic structures and device concept implementation schemes. Research stresses high-risk, far-term, game-changing capability breakthroughs essential for future leaps in warfighter system performance, functionality, reliability, and survivability while simultaneously reducing component and system power, size, mass, and life cycle costs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Investigate novel detector and electronic materials, device concepts, and circuit architecture and implementation schemes important to future military space platforms.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Investigated novel innovative reconfigurable multifunctional electronic materials, material bandgap and defect-band tuning concepts, phenomenology-based detection mechanisms, novel hetero-material interfacing and interconnect schemes, and novel nano-science and biologically-based detection processes. Investigated 'smart' reconfigurable materials whose properties can be dynamically tailored via self-programming or system software in response to changing behavior or mission needs. Focused on novel 'programmable pathways' to enable tailoring novel hybrid material systems such as metamorphic and heterogeneous systems.</p>	8.790	9.821	10.987	0.000	10.987

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612305: <i>Electronics</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
carbon nanotubes that form the basis for a new generation of sensors and circuit elements. Metamaterials research continues to produce more efficient and smaller, omni-directional antennas. Investigation of superconductors produce several new superconducting materials, and research begins on making larger quantities and better quality specimens of said materials to determine cost effectiveness. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	36.876	40.401	45.066	0.000	45.066

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702F: <i>Command, Control, and Communications.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603789F: <i>C3I Advanced Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612306: <i>Materials</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612306: <i>Materials</i>	24.104	29.321	32.040	0.000	32.040	31.134	30.964	32.611	34.225	Continuing	Continuing

Note

Note: In FY 2010, Natural Materials and Systems efforts from Project 2312 in this PE moved to this Project to more accurately align basic research efforts in Materials.

A. Mission Description and Budget Item Justification

Materials basic research enhances the performance, cost, and reliability of structural materials to eliminate reliability issues related to high-temperature strength, toughness, fatigue, and environmental conditions. This research expands fundamental knowledge of material properties that leads to the development of novel materials for airframe, turbine engine, and spacecraft structures. The goals of this project are to develop improved materials for air and space vehicles that provide increased structural efficiency and reliability, increase the operating temperature of aerospace materials, and further increase thrust-to-weight ratio of engines. A primary research focus is on refractory alloys, intermetallics, polymer composites, metal and ceramic matrix composites, advanced ceramics, and new material processing methods. Basic research is also conducted in natural materials and systems to exploit unique properties and products for use in the development of advanced weapon technologies. Research is conducted to mimic the natural detection systems of organisms at the molecular level for use in developing novel man-made sensors. Research in natural materials focuses on using existing organisms or bioengineered organisms to manufacture new materials, or using the organisms themselves as materials. The primary areas investigated by this project are ceramics, non-metallic hybrid composites, metallic materials, and natural materials and systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Perform non-metallic, ceramic, and hybrid materials research to identify/design new materials and composites with very-high (>1400F) and ultra-high (>2500F) temperature. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued optimizing the design of multi-functional structural ceramics materials to enable structurally enhanced smart systems for application in extreme environments. Expanded the development of new approaches in improving the thermal and mechanical stability of ceramic and metallic composites for aerospace applications. Explored the role of the operational environment on	11.599	11.966	12.872	0.000	12.872

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612306: <i>Materials</i>
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B. Accomplishments/Planned Program (\$ in Millions)	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>Continue research of natural materials' extension into new electronic and photonic systems by utilizing the self-assembly of these materials into unique electronic and optical architectures for Intelligence Surveillance Reconnaissance applications. Will research the manipulation of natural systems in order to develop new synthetic avenues to produce unique material properties and systems. Further explore extremophile research to access synthetic pathways and materials not achievable under standard conditions. Continue work in physical mechanisms in nature to discover and understand the basic underlying natural mechanism that could be used to either harden or repair natural materials-based devices.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	24.104	29.321	32.040	0.000	32.040

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Structures.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612306: <i>Materials</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0708011F: <i>Industrial Preparedness.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612307: <i>Fluid Mechanics</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612307: <i>Fluid Mechanics</i>	19.346	25.706	26.800	0.000	26.800	26.226	26.394	27.830	29.182	Continuing	Continuing

Note

Note: In FY 2010, Natural Flight Control and Navigation efforts from Project 2313 in this PE moved to this Project to more accurately align basic research efforts in Fluid Mechanics.

A. Mission Description and Budget Item Justification

Fluid mechanics basic research advances fundamental knowledge, tools, data, concepts, and methods for improving the efficiency, effectiveness, and reliability of air and space vehicles. The goals are to improve theoretical models for aerodynamic prediction and design, as well as to originate flow control concepts and predictive methods used to expand current flight performance boundaries through enhanced understanding of key fluid flow (primarily high-speed air) phenomena. Vehicle control principles based upon natural flight sensory and sensorimotor systems applicable to small unattended aerial vehicles (UAVs) and ultraslow flight are also examined. Basic research emphasis is on turbulence prediction and control, unsteady and separated flows, subsonic/supersonic/hypersonic flows, and internal fluid dynamics. The primary approach is to perform fundamental experimental investigations and to formulate advanced computational methods for the simulation and study of complex flows, prediction of real gas effects in high-speed flight, and control and prediction of turbulence in flight vehicles and propulsion systems. Primary areas of research investigated by this project are unsteady aerodynamics, supersonic and hypersonic aerodynamics, turbulence, and rotating and internal flows characteristic of turbomachinery flows.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Investigate and characterize complex phenomena in supersonic, hypersonic, boundary layers, and turbulent flows to enable and optimize the design of air and space vehicles systems.	8.205	8.452	9.348	0.000	9.348
<i>FY 2009 Accomplishments:</i> In FY 2009: Extended efforts to characterize and model fundamental phenomena of high-speed boundary laminar-turbulent transition to include interactions between multiple instability modes. Validated high-fidelity, unsteady numerical simulation methodologies for shock-dominated flows and non-equilibrium effects. Extended strategies for control of excessive heat transfer, unsteadiness, and					

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612307: <i>Fluid Mechanics</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	17.351	24.113	26.800	0.000	26.800

	FY 2009	FY 2010
Congressional Add: Development and Validation of Advanced Design Technologies for Hypersonic Research (National Hypersonic Research Center). <i>FY 2009 Accomplishments:</i> In FY 2009: Continued research on experimental and numerical simulation to characterize and develop predictive numerical methods for physical phenomena associated with hypersonics. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.995	1.593
Congressional Adds Subtotals	1.995	1.593

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612307: <i>Fluid Mechanics</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603211F: <i>Aerospace Structures.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612308: <i>Propulsion</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612308: <i>Propulsion</i>	24.669	32.115	34.022	0.000	34.022	32.772	32.599	34.335	36.057	Continuing	Continuing

Note

Note: In FY 2010, Bioenergy and Catalysis efforts from Project 2312 in this PE moved to this Project to more accurately align basic research efforts in Propulsion.

A. Mission Description and Budget Item Justification

Propulsion basic research expounds fundamental knowledge to enable and enhance efficient utilization of energy in airbreathing engines, chemical and non-chemical rockets, and combined cycle propulsion systems for future rapid global reach and on-demand space access. Basic research thrusts include airbreathing propulsion, space power and propulsion, high altitude signature characterization and contamination, propulsion diagnostics, thermal management of space-based power and propulsion, and the synthesis of new chemical propellants. These thrusts can be grouped into reacting flows and non-chemical energetics. Study of reacting flows involves the complex coupling between energy release through chemical reaction and the flow processes that transport chemical reactants, products, and energy. Non-chemical energetics research includes both plasma and beamed-energy propulsion for orbit-raising space missions and ultra-high energy techniques for space-based energy utilization. Primary areas of research investigated by this project are space power, propulsion, combustion, and diagnostics. As a newly emerging research direction within this project, bioenergy and catalysis will investigate the economical production of renewable biofuels for airbreathing engines and will explore biocatalysis for compact power applications.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Research and model space propulsion and power in the areas of chemistry, electronics, miniaturization, and contamination/signature.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued studies of small satellite, microsatellite, and nanosatellite propulsion and investigated plasma dynamics in these thrusters. Investigated high altitude plumes signature and contamination. Continued investigating alternate launch systems using electromagnetic forces. Conducted fundamental component and system level research that leads to introduction of novel multi-use technologies and concepts to achieve multi-functional satellite architectures and development of</p>	10.951	11.576	12.477	0.000	12.477

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010						
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>		R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>		PROJECT 612308: <i>Propulsion</i>						
B. Accomplishments/Planned Program (\$ in Millions)										
<p>of algae whose genes may be used to enhance the production of algal oil. Continue research on biological fuel cells that explore the biophysical and catalytic mechanisms required for efficient electron transfer between electrodes and microbial materials, enabling the future utilization of complex, impure biofuels for compact power needs.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to study biosolar hydrogen to manipulate the photosynthetic flow of electrons to the hydrogen-generating enzyme by eliminating and/or adding genes that code for alternative pathways of electron flow and for the oxygen-sensitive inhibition of the hydrogen-generating enzyme. Continue bio-prospecting research to identify and clone unique algal oil-generating genes that metabolically engineer into one strain, optimizing the control and enhancement of algal oil for use as a future source of jet fuel. Continue to identify and map the interaction of metabolic pathways involved in controlling and channeling electrons from photosynthesis to the oil-producing pathways in microalgae. Continue research on microbial fuel cells by exploring and characterizing newly discovered bacterial nanowires to understand their role in transporting electrons from microbial biofilms to electrodes, and begin to identify microbial genes involved in extracting electrons from the cathode to reduce oxygen and enhance power generation. Also, continue the research on enzymatic fuel cells by utilizing thermophilic enzymes, self-assembly mechanisms, active-site analysis, and bioengineering to create novel, resilient pathways for the complete and efficient oxidation of multiple biofuels to enable enhanced compact power production.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals						23.871	31.318	34.022	0.000	34.022
						FY 2009	FY 2010			
						0.798	0.797			

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612308: <i>Propulsion</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Coal Transformation Laboratory. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted basic research in the area of coal-to-liquids fuels, with focus on addressing the barriers that inhibit rapid commercialization of coal to liquid technologies. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Adds Subtotals	0.798	0.797

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Structures.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612311: <i>Information Sciences</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612311: <i>Information Sciences</i>	29.698	51.026	53.143	0.000	53.143	52.784	54.630	57.314	60.208	Continuing	Continuing

Note

Note: In FY 2010, efforts in building and testing mathematical descriptions of cognitive decision-making moved from Project 2313 in this PE to this Project to more accurately align basic research efforts in Information Services.

A. Mission Description and Budget Item Justification

Information sciences basic research generates fundamental knowledge and understanding to support critical Air Force capabilities in information superiority, precision targeting (or strike), and improved battle space awareness. Areas of research focus are (1) access to disparate data and information, (2) information fusion and distribution, and (3) conversion of information into knowledge to support decision making. The data, fusion engines, and command and control functions reside on interlocking systems connected by networks leading to a system of systems architecture. Areas of research underpinning these team-focused, network-enabled systems are those in networks and communications, software, information management, and human-system interactions. Complementing these overall focus areas, research is occurring in the following areas: information operations network, software, and system architectures; information fusion; information forensics; communications and signals and control of large systems. Information Sciences also derive mathematical models and computational algorithms designed to optimize information intelligently and problem-solving under adverse conditions, including sustained operations, non-cooperative environments, and multi-interactive command and control.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Explore basic mechanisms to realize gains in innovative transformational communications technologies, enabling enhancement to its dominance communications using the space medium. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued to study and refine results of selected solid state partially coherent laser designs together with the propagation of partially coherent laser beams through surrogate turbulent media. Monitored the polarization states to verify the predicted long distance stability.	1.000	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>		R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>		PROJECT 612311: <i>Information Sciences</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Investigate high-order cognitive processes critical for decision-making and problem-solving, with emphasis on the challenges of sustained operations in environments that require efficient operations under risk, uncertainty, high workload, and fatigue. Elucidate brain mechanisms that may inform computational approaches to information analysis, including mathematical representations of coupled neural oscillation, modulation filtering, and compressive sampling. Seek deeper scientific insight into principles of adaptive intelligence. Develop new approaches to optimize problem-solving in dynamic environments, with emphasis on decision strategies for adversarial, multi-dimensional, and multi-cultural conflict. Develop the basic research foundation, using computational and modeling approaches, to understand and anticipate competitive and cooperative interactions among decision-makers in a cross-cultural context.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to investigate high-order cognitive processes, and explore new mathematical frameworks to enable, in a principled way, upward scaling of cognitive information processing approaches from simpler to more complex and realistic decision-making tasks. Develop and test algorithms for applications in reinforcement learning, sequential sampling, kernel-based classification and generalization, Bayesian forecasting, and optimization of attentional resources. Develop new techniques to understand, measure, and control informational masking to enhance speech communication and situational awareness. Investigate the fundamental constraints and limits of computationally-based socio-cultural prediction, including scalability from individual or small groups to larger coalitions.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				29.698	46.245	53.143	0.000	53.143

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Process Integrated Mechanism for Human-Computer Collaboration and Coordination <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Enhance fundamental understanding in a process integrated mechanism, which ties together computers and humans into a single collaborating system by virtue of a single program that rapidly moves among all computers in the system.	0.000	0.797
Congressional Add: Safeguarding End-User military Software <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct fundamental multi-disciplinary research associated with the further safeguarding of military software.	0.000	3.984
Congressional Adds Subtotals	0.000	4.781

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612311: <i>Information Sciences</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602702F: <i>Command, Control, and Communications.</i>											
• PE 0603410F: <i>Space System Environmental Interactions Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603500F: <i>Multi-Disciplinary Advanced Development Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612312: <i>Biological Sciences</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612312: <i>Biological Sciences</i>	9.831	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, efforts were moved from this Project to Projects 2306 and 2308 within this PE to more accurately align basic research efforts in the Materials and Propulsion disciplines, respectively.

A. Mission Description and Budget Item Justification

Biological basic science research provides the fundamental knowledge necessary to understand and enable technologies associated with selected biological responses induced by chemical and physical agents, electromagnetic sensors based on biomimicry, biomolecular materials, biochromatics, and luminescence. The goal is to exploit biological properties to control and manipulate operational environments. Research topics are focused on the interactions of chemicals and physical agents (lasers and microwaves) with human tissues and associated effects to enable safety assessment strategies, hazard-free development and use of future air and space materials and directed energy systems, and innovation of biotechnologies to enhance the physiological performance and protection of Air Force personnel. Research in biomimetic sensors strives to mimic the biological detection systems of organisms at the molecular level in developing novel man-made sensors. Basic research in biocatalysis characterizes and bioengineers cellular enzymes to biosynthesize renewable hydrogen fuel from sunlight and water. Research in biomaterials focuses on the mimicking of natural materials, using organisms as biomaterial factories of new materials, genetically altering existing organisms for new materials capabilities, or taking existing biomaterials/organisms and using them as novel materials like viral gradients or processing them further to make a useful material as in biomineralization. Research in biointerfacial science is focused on new biosensors and bionanotechnology, and specifically addresses the fundamental science at either the biotic-biotic or the biotic-abiotic interface. Research in biophysical mechanisms will look to discover and understand basic biological mechanisms that could be used to either harden or repair bio-based devices or utilize complex, impure biofuels for compact power.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Characterize, understand, predict, control, and engineer biomolecular responses induced in organisms by chemical and physical agents of Air Force significance.	5.570	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>		R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>		PROJECT 612312: <i>Biological Sciences</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Began to integrate individual computational models characterizing multi-component fuel deposition in lung and absorption through skin into animal biokinetic models for predicting whole animal disposition of single fuel components. Collected data from biological systems exposed to nano-materials and began to develop a data base of responses for future predictive modeling studies based on physico-chemical properties of various nanostructures. Collected direct energy dose-response data and began bioinformatics analyses to identify unique biomolecular profiles responding to specific levels of radiant exposure. Continued bio-prospecting, bio-engineering, and directed-evolution approaches to the generation of hydrogen fuel by photosynthetic microbes and began metabolic engineering research to identify and eliminate pathways that drain unnecessary energy equivalents away from the hydrogen-generating apparatus. Utilized state-of-the-art tools and techniques to explore, collect, and analyze data with regard to low-dose chemical and radiation exposure effects, and the molecular pathways and profiles mediating the responses to the exposures.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Explore biomimetics, biomaterials, and biointerfacial sciences to enable development of novel sensors, engineering processes, and mechanisms, and the synthesis of novel materials.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted research on manipulating materials to mimic the desirable properties found in skin for maintenance, self-healing, and repair. Expanded investigating predator avoidance</p>				4.261	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612312: <i>Biological Sciences</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>and new prey detection schemes as future technology areas. Further probed and manipulated biochromophores and biophotoluminescent characteristics in microbial and protein-based biosystems for applications to military sensor systems. Exploited biomaterial and biointerfacial sciences to control cellular systems to synthesize novel materials, evaluate biosensors, and elucidate bionanotechnology applications. Researched surface mediated cellular differentiation as a new sensor modality. Continued investigations in extremophile research to access biosynthetic pathways and materials not achievable with room temperature organisms. Continued work in biophysical mechanisms to discover and understand the basic underlying biological mechanism that could be used to either harden or repair bio-based devices or can utilize complex, impure biofuels for compact power.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	9.831	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612312: <i>Biological Sciences</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602602F: <i>Conventional Munitions.</i>											
• PE 0602702F: <i>Command, Control, and Communication.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612313: <i>Human Performance</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
612313: <i>Human Performance</i>	14.319	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, efforts will move from this Project to Projects 2307 and 2311 within this PE to more accurately align basic research efforts in the Fluid Dynamics and Information Science disciplines, respectively.

A. Mission Description and Budget Item Justification

Human performance basic research seeks the fundamental knowledge needed to understand, measure, and optimize human capabilities critical to Air Force operations. Within this project, the special areas of scientific interest include Sensory Systems, Cognition and Decision, Homeostatic and Circadian Regulation of Human Performance, and Socio-Cultural Modeling. In all areas, experimental efforts are coordinated with mathematical or computational modeling. Air Force sensory research emphasizes human auditory capabilities, including 3D spatial hearing, multi-talker communication, speech intelligibility, and informational masking. Cognitive research emphasizes decision optimization in complex, dynamic tasks, including coordinated decision-making performed by networked, multi-person teams. Also aligned with Air Force cognitive research are efforts to determine how best to promote robust, reliable decision-making through information-processing algorithms for fusion, automation, and intelligent signal processing. Modeling efforts include cultural factors that may affect behavior in adversarial decision-making. The Air Force reliance on sustained human performance during trans-meridian operations and night operations motivates basic research efforts to predict and mitigate cognitive impairments from extended wake and much higher than normal workload periods.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Probe human sensory systems and perceptions critical for warfighter performance (auditory and visual processes, multi-sensory integration, and sensory biomimetics). <i>FY 2009 Accomplishments:</i> In FY 2009: Engaged new research methods to characterize requirements for optimal speech communication, including modulation representation and filtering. Developed data, models, and algorithms to minimize informational masking in speech signals and in spatial audio displays. To inform the design of new hearing protection systems, developed and tested theoretical models	6.021	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>			R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>			PROJECT 612313: <i>Human Performance</i>					
B. Accomplishments/Planned Program (\$ in Millions)											
						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	
<i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.											
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A											
Accomplishments/Planned Programs Subtotals						14.319	0.000	0.000	0.000	0.000	
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702F: <i>Command, Control, and Communication.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D. Acquisition Strategy Not Applicable.											
E. Performance Metrics Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.											

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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
614113: <i>External Research Programs Interface</i>	11.879	9.701	9.470	0.000	9.470	9.296	9.472	9.838	10.273	Continuing	Continuing

A. Mission Description and Budget Item Justification

The primary elements in this project are to facilitate interactions between the international and domestic research communities and Air Force researchers and to support and develop scientists and engineers with an awareness of Air Force basic research priorities. These professional interactions and collaborations stimulate scientific and engineering education beneficial to the Air Force, increase the awareness of Air Force basic research priorities to the research community as a whole, and attract talented scientists and engineers to address Air Force needs. International interactions facilitate future interoperability of coalition systems and foster relationships with future coalition partners. This project also seeks to enhance educational interactions with historically black colleges and universities, Hispanic serving institutions, and other minority institutions.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Foster international science and technology cooperation by supporting the Air Force's international strategy mission. Identify and obtain unique foreign research capabilities.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued to provide centralized cooperation expertise and support international technology liaison missions in order to identify and maintain awareness of foreign science and technology developments. Continued to capitalize on foreign investments by influencing and acquiring world-class scientific research. Continued to seek and maintain access to technical briefs and publications on unique foreign research capabilities. Continued to support international visits of high-level DoD delegations and provide primary interface to coordinate international participation among DoD organizations.</p>	6.443	5.354	5.238	0.000	5.238

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Supported science, mathematics, and engineering research, and educational outreach programs at U.S. colleges and universities, including historically black colleges and universities, Hispanic serving institutions, and other minority institutions. Increased awareness of Air Force research needs throughout civilian scientific community, while simultaneously identifying/recruiting the best scientific talent to participate in critical Air Force research.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue to support science, mathematics, and engineering research, and educational outreach programs at U.S. colleges and universities, including historically black colleges and universities, Hispanic serving institutions, and other minority institutions. Increase awareness of Air Force research needs throughout civilian scientific community, while simultaneously identifying/recruiting the best scientific talent to participate in critical Air Force research.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to support science, mathematics, and engineering research, and educational outreach programs at U.S. colleges and universities, including historically black colleges and universities, Hispanic serving institutions, and other minority institutions. Increase awareness of Air Force research needs throughout civilian scientific community, while simultaneously identifying/recruiting the best scientific talent to participate in critical Air Force research.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	11.879	9.701	9.470	0.000	9.470

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 614113: <i>External Research Programs Interface</i>
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C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0601103D: <i>University Research Initiative.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Avionics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602269F: <i>Hypersonic Technology Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602602F: <i>Conventional Munitions.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702F: <i>Command, Control and Communication.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>			PE 0601103F: <i>University Research Initiatives</i>								
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	133.526	141.524	136.297	0.000	136.297	140.273	145.093	147.415	149.702	Continuing	Continuing
615094: <i>University Research Initiatives</i>	133.526	141.524	136.297	0.000	136.297	140.273	145.093	147.415	149.702	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program supports defense-related basic research in a wide range of scientific and engineering disciplines pertinent to maintaining U.S. military technology superiority; enhances and promotes the education of U.S. scientists and engineers in disciplines critical to maintaining, advancing, and enabling future U.S. defense technologies; and assists universities in establishing superior instrumentation capabilities needed to improve the quality of defense-related research and education. A fundamental component of this program is the recognition that future technologies and technology exploitations require highly coordinated and concerted multi- and interdisciplinary efforts. This program is in Budget Activity 1, Basic Science, because it funds scientific study and experimentation.

B. Program Change Summary (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	137.056	132.249	0.000	0.000	0.000
Current President's Budget	133.526	141.524	136.297	0.000	136.297
Total Adjustments	-3.530	9.275	136.297	0.000	136.297
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.585			
• Congressional Adds		9.860			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-3.530	0.000	136.297	0.000	136.297

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 615094: *University Research Initiatives*

FY 2009	FY 2010
0.798	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Partnership in Innovative Preparation for Educators and Students (PIPES) and the Space Education Consortium (SEC).*

Congressional Add: *High Temperature Hydrogen Energy Production.*

Congressional Add: *Battle Space Reducing Military Decision Cycles.*

Congressional Add: *Secure Network Centric Operations.*

Congressional Add: *Aerodynamic Wind Tunnel Upgrade Initiative.*

Congressional Add: *Cyber Security Laboratory at Louisiana Tech University.*

Congressional Add: *Lean Management System Research Initiative at Air Mobility Wing MacDill AFB.*

Congressional Add: *Rapid Prototyping and Nanotechnology Initiative.*

Congressional Add: *Unmanned Aerial Systems Mission Planning and Operation Center.*

Congressional Add: *Cyber Innovation Center (CIC) Research and Development Seed Fund.*

Congressional Add: *Energy and Sensor Informatics Research and Transition.*

Congressional Add: *Frank R. Seaver Science and Engineering Initiative.*

Congressional Add Subtotals for Project: 615094

Congressional Add Totals for all Projects

	FY 2009	FY 2010
	1.197	0.797
	1.277	0.000
	1.596	1.693
	1.596	0.000
	2.991	1.195
	0.798	0.000
	0.798	0.000
	0.399	2.788
	0.000	0.797
	0.000	0.797
	0.000	1.753
	11.450	9.820
	11.450	9.820

Change Summary Explanation

Note: The FY 2010 President's Budget summittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note: In FY 2010, Congress added \$1.2 million for Cyber Security Research Program/Cyber Security Laboratory, \$2.8 million for Unmanned Aerial Systems Mission Planning and Operation Center, \$0.8 million for Energy and Sensor Informatics Research and Transition, \$1.76 million for Frank R. Seaver Science and Engineering Initiative, \$0.8 million for Cyber Innovation Center (CIC) Research and Development Seed Fund, \$1.7 million for Cybersecurity for Control Networks Research, and \$0.8 million for High Temperature Hydrogen Energy Production Facility.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force

DATE: February 2010

APPROPRIATION/BUDGET ACTIVITY

3600: *Research, Development, Test & Evaluation, Air Force*
BA 1: *Basic Research*

R-1 ITEM NOMENCLATURE

PE 0601103F: *University Research Initiatives*

C. Performance Metrics
(U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>				PROJECT 615094: <i>University Research Initiatives</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
615094: <i>University Research Initiatives</i>	133.526	141.524	136.297	0.000	136.297	140.273	145.093	147.415	149.702	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program supports defense-related basic research in a wide range of scientific and engineering disciplines pertinent to maintaining U.S. military technology superiority; enhances and promotes the education of U.S. scientists and engineers in disciplines critical to maintaining, advancing, and enabling future U.S. defense technologies; and assists universities in establishing superior instrumentation capabilities needed to improve the quality of defense-related research and education. A fundamental component of this program is the recognition that future technologies and technology exploitations require highly coordinated and concerted multi- and interdisciplinary efforts. This program is in Budget Activity 1, Basic Science, because it funds scientific study and experimentation.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Promote fundamental, multi- and interdisciplinary science and engineering research projects.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued funding competitive research awards at U.S. universities to focus on underpinning Air Force-related technologies usually not achievable through typical single investigator awards. Supported and recognized superior academic researchers in the early stages of their career through the Presidential Early Career Award for Scientists and Engineers (PECASE) program. Continued funding of multi-disciplinary programs initially awarded in prior years.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue funding competitive research awards at U.S. universities to focus on underpinning Air Force-related technologies usually not achievable through typical single investigator awards. Support and recognize superior academic researchers in the early stages of their career</p>	70.144	72.793	75.646	0.000	75.646

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>		R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>		PROJECT 615094: <i>University Research Initiatives</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals				122.076	131.704	136.297	0.000	136.297
				FY 2009	FY 2010			
Congressional Add: Partnership in Innovative Preparation for Educators and Students (PIPES) and the Space Education Consortium (SEC). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted multi-disciplinary research associated with information network for educators and students. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				0.798	0.000			
Congressional Add: High Temperature Hydrogen Energy Production. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted research to develop methods for hydrogen production. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				1.197	0.797			
Congressional Add: Battle Space Reducing Military Decision Cycles. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued developing decision-making tool that can result in rapid and effective analyses of battlefield situational elements and recommendations for response.				1.277	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>	PROJECT 615094: <i>University Research Initiatives</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Secure Network Centric Operations. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted research on the security issues in information technology architectures and components. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.596	1.693
Congressional Add: Aerodynamic Wind Tunnel Upgrade Initiative. <i>FY 2009 Accomplishments:</i> In FY 2009: Supported major facility renovation and diagnostic capability acquisition for the University of Arizona Wind Tunnel. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.596	0.000
Congressional Add: Cyber Security Laboratory at Louisiana Tech University. <i>FY 2009 Accomplishments:</i> In FY 2009: Focused on new and theoretically sound profiling techniques for detection and identification of terrorists and cyber attacks.	2.991	1.195

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>	PROJECT 615094: <i>University Research Initiatives</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Lean Management System Research Initiative at Air Mobility Wing MacDill AFB. <i>FY 2009 Accomplishments:</i> In FY 2009: Facilitated civilian education and training program at the base. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.798	0.000
Congressional Add: Rapid Prototyping and Nanotechnology Initiative. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted rapid prototyping and automatic construction of physical objects with 3D printers, stereo lithography machines, or special laser sintering systems. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.798	0.000
Congressional Add: Unmanned Aerial Systems Mission Planning and Operation Center. <i>FY 2009 Accomplishments:</i> In FY 2009: The Unmanned Aerial Systems (UAS) Mission Planning and Operation Center worked with the Great Plains Joint Regional Training Center to train Guard personnel in mission planning and aircraft operation for homeland security and disaster missions using the CQ-10 Snowgoose UAS platform owned by the Guard.	0.399	2.788

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>	PROJECT 615094: <i>University Research Initiatives</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Cyber Innovation Center (CIC) Research and Development Seed Fund. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Utilize seed funds to establish a Research and Development Cyber Information Center.	0.000	0.797
Congressional Add: Energy and Sensor Informatics Research and Transition. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct fundamental research in the energy and sensor informatics discipline to increase knowledge and accelerate transitions to military applications.	0.000	0.797
Congressional Add: Frank R. Seaver Science and Engineering Initiative. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Support the Frank R. Seaver Science and Engineering Complex in conducting basic research in science and engineering disciplines.	0.000	1.753

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>	PROJECT 615094: <i>University Research Initiatives</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Adds Subtotals	11.450	9.820

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>			PE 0601108F: <i>High Energy Laser Research Initiatives</i>								
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	13.032	12.781	13.198	0.000	13.198	14.258	14.094	14.326	14.554	Continuing	Continuing
615097: <i>High Energy Laser Research Initiatives</i>	13.032	12.781	13.198	0.000	13.198	14.258	14.094	14.326	14.554	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds basic research aimed at developing fundamental scientific knowledge to support future Department of Defense (DoD) high energy laser (HEL) systems. The HEL Joint Technology Office (JTO) sends these funds to multi-disciplinary research institutes (MRIs) for projects on laser and beam control technologies. In addition, funding supports educational grants to stimulate interest in HELs. These educational grants are used for educational tools, scholarships, and summer intern employees in military laboratories. Through this program, the DoD invests in research directed toward increasing knowledge and understanding in those fields of science and engineering related to long-term national security needs. This program is in Budget Activity 1, Basic Research, because it funds scientific study and experimentation.

B. Program Change Summary (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	13.389	12.834	0.000	0.000	0.000
Current President's Budget	13.032	12.781	13.198	0.000	13.198
Total Adjustments	-0.357	-0.053	13.198	0.000	13.198
• Congressional General Reductions		-0.053			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.357	0.000	13.198	0.000	13.198

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>
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Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>	PROJECT 615097: <i>High Energy Laser Research Initiatives</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
615097: <i>High Energy Laser Research Initiatives</i>	13.032	12.781	13.198	0.000	13.198	14.258	14.094	14.326	14.554	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds basic research aimed at developing fundamental scientific knowledge to support future Department of Defense (DoD) high energy laser (HEL) systems. The HEL Joint Technology Office (JTO) sends these funds to multi-disciplinary research institutes (MRIs) for projects on laser and beam control technologies. In addition, funding supports educational grants to stimulate interest in HELs. These educational grants are used for educational tools, scholarships, and summer intern employees in military laboratories. Through this program, the DoD invests in research directed toward increasing knowledge and understanding in those fields of science and engineering related to long-term national security needs. This program is in Budget Activity 1, Basic Research, because it funds scientific study and experimentation.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Improve the fundamental understanding of high-power laser sources, to include solid-state, free electron, and gas laser technologies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed efforts to conduct fiber laser research focused on single aperture scaling single-mode fibers, and organization of multiple fibers. Completed fundamental research of optically-pumped atomic and molecular gas lasers. Continued research on awarded topics in diode-pumped alkali, free electron, and solid state laser technologies. Initiated interaction to look at promising technology development overseas.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue research on awarded topics in diode-pumped alkali, free electron, and solid state laser technologies. Initiate a new call for fiber-based solid state laser technologies. Establish</p>	7.887	8.641	8.838	0.000	8.838

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>	PROJECT 615097: <i>High Energy Laser Research Initiatives</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A						
<p>MAJOR THRUST: Maintain and evaluate high-fidelity models for HEL scenario evaluations and the HEL toolkit. Provide for HEL systems level modeling into mission-level wargaming activities.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed a solid state laser model to allow parameterization of components with the laser system. Developed a high-fidelity model for HEL system scenario evaluation.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>		1.850	0.000	0.000	0.000	0.000
<p>MAJOR THRUST: Fund educational grants, through the Directed Energy Professional Society, intended to simulate interest in HEL technologies among students.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Provided scholarships and internships to support college students studying HEL degrees. Provided grants to Service Academies to stimulate HEL studies among military cadets. Provided support to K-12 school programs to stimulate science and math studies, with an emphasis on lasers and optics. Funded publication of journals and continuing education for professionals in the HEL field. Conducted a proposal call for FY 2010 for execution and coordination of the Educational Grant program.</p>		0.750	0.736	0.750	0.000	0.750

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>	PROJECT 615097: <i>High Energy Laser Research Initiatives</i>

B. Accomplishments/Planned Program (\$ in Millions)					
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Provide scholarships and internships to support college students studying HEL degrees. Provide grants to Service Academies to stimulate HEL studies among military cadets. Provide support to K-12 school programs to stimulate science and math studies, with an emphasis on lasers and optics. Fund publication of journals and continuing education for professionals in the HEL field.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Provide scholarships and internships to support to college students studying HEL degrees. Provide grants to Service Academies to stimulate HEL studies among military cadets. Provide support to K-12 school programs to stimulate science and math studies, with an emphasis on lasers and optics. Fund publication of journals and continuing education for professionals in the HEL field.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	13.032	12.781	13.198	0.000	13.198

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602890F: <i>High Energy Laser Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603444F: <i>Maui Space Surveillance System.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>	PROJECT 615097: <i>High Energy Laser Research Initiatives</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0603924F: <i>High Energy Laser Advanced Technology Program.</i>											
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602624A: <i>Weapons and Munitions Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603004A: <i>Weapons and Munitions Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702E: <i>Tactical Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: <i>Ballistic Missile Defense Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C: <i>Ballistic Missile Defense Boost Phase Segment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603651M: <i>Joint Non-Lethal Weapons Technology Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>	PROJECT 615097: <i>High Energy Laser Research Initiatives</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	185.583	179.202	137.273	0.000	137.273	135.649	135.476	134.063	136.891	Continuing	Continuing
6201SP: <i>Space Materials Development</i>	31.727	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	79.314	110.280	84.865	0.000	84.865	81.649	80.713	78.623	80.669	Continuing	Continuing
624348: <i>Materials for Electronics, Optics, and Survivability</i>	34.044	33.744	31.687	0.000	31.687	30.746	30.840	30.967	31.255	Continuing	Continuing
624349: <i>Materials Technology for Sustainment</i>	28.853	22.697	16.893	0.000	16.893	19.320	20.022	20.364	20.715	Continuing	Continuing
624915: <i>Deployed Air Base Technology</i>	11.645	12.481	3.828	0.000	3.828	3.934	3.901	4.109	4.252	Continuing	Continuing

Note
Note: In FY 2010 and out, funds from Project 01SP have been moved to Project 4347, Project 4348, and Project 4349 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification
This program develops advanced materials, processing, and inspection technologies to reduce life cycle costs and improve performance, sustainability, availability, affordability, supportability, reliability, and survivability of current and future Air Force systems and operations. The program has five projects that develop: (1) the materials and processing technology base for spacecraft and launch systems; (2) structural, propulsion, and sub-systems materials and processes technologies; (3) electronic, optical, and survivability materials and processes technologies; (4) sustainment materials, processes technologies, and advanced non-destructive inspection methodologies; and (5) air base operations technologies including deployable base infrastructure, force protection, and fire fighting capabilities. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	188.152	127.957	0.000	0.000	0.000
Current President's Budget	185.583	179.202	137.273	0.000	137.273
Total Adjustments	-2.569	51.245	137.273	0.000	137.273
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.755			
• Congressional Adds		52.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-2.569	0.000	137.273	0.000	137.273

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 624347: *Materials for Structures, Propulsion, and Subsystems*

Congressional Add: *Advanced Carbon Fiber Research and Test Initiative.*

Congressional Add: *Advanced Thermal Control Coatings for Space Applications.*

Congressional Add: *Ceramic Matrix Composite Turbine Blade Demonstration.*

Congressional Add: *Innovative Polymeric Materials for Three-Dimensional (3-D) Microdevice Construction.*

Congressional Add: *Intelligent Manufacturing Initiative.*

Congressional Add: *Nanocomposites for Lightning Protection of Composite Airframe Structures.*

Congressional Add: *Partnership for Emerging Technologies.*

Congressional Add: *Air Force Minority Leaders Program.*

Congressional Add: *Pennsylvania Nanomaterials Commercialization Center.*

Congressional Add: *Carbon Nanomaterials for Advanced Aerospace Applications.*

Congressional Add: *ONAMI Safer Nanomaterials and Nanomanufacturing.*

	<u>FY 2009</u>	<u>FY 2010</u>
	2.393	0.000
	1.596	0.000
	3.989	0.000
	1.596	0.000
	2.393	0.000
	1.197	0.000
	1.596	0.000
	7.978	4.780
	1.995	0.797
	2.393	0.797
	3.989	3.505

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Congressional Add: <i>Consortium for Nanomaterials for Aerospace Commerce and Technology (CONTACT).</i>	2.393	3.187
Congressional Add: <i>Advanced Aerospace Carbon Foam Heat Exchangers.</i>	1.596	3.187
Congressional Add: <i>Institute for Science and Engineering Simulation/Aircraft Fatigue Modeling and Simulation.</i>	3.351	3.585
Congressional Add: <i>Development of Mobile Wind Turbine Systems to Power Forward Bases.</i>	0.798	1.195
Congressional Add: <i>Aerospace Laser Micro Engineering Station.</i>	0.000	0.797
Congressional Add: <i>Hybrid Nanoparticle-based Coolant Technology Development and Manufacturing.</i>	0.000	0.797
Congressional Add: <i>Lightning Protection Composites.</i>	0.000	2.987
Congressional Add: <i>Ultra-High Temperature Materials for Hypersonic Aerospace Vehicles.</i>	0.000	2.390
Congressional Add Subtotals for Project: 624347	39.253	28.004
Project: 624348: <i>Materials for Electronics, Optics, and Survivability</i>		
Congressional Add: <i>Free Electron Laser Capabilities for Aerospace Microfabrication.</i>	1.117	0.000
Congressional Add: <i>Gallium Nitride (GaN) RF Power Technology.</i>	1.596	0.000
Congressional Add: <i>Plasma-Sphere Array for Flexible Electronics.</i>	2.792	0.000
Congressional Add: <i>Diamond Substrate for Cooling of Micro-Electronics.</i>	1.995	0.000
Congressional Add: <i>High Power Broadly Tunable Middle-Infrared Laser Sources.</i>	2.393	0.000
Congressional Add: <i>Light Weight Organic Photovoltaic Technologies.</i>	1.197	0.000
Congressional Add: <i>Liquid Crystal Laser Eye Protection.</i>	1.596	0.000
Congressional Add: <i>Optic Band Control Program.</i>	0.798	0.000
Congressional Add: <i>Large Area, APVT Materials Development for High Power Devices.</i>	0.798	1.593
Congressional Add: <i>Gallium Nitride (GaN) Microelectronics and Materials.</i>	0.000	1.593
Congressional Add: <i>Low-Defect Density Gallium Nitride Materials for High-Performanace Electronics Devices.</i>	0.000	2.788
Congressional Add: <i>Mid-IR Laser Materials.</i>	0.000	0.797

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	
<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>		FY 2009	FY 2010
Congressional Add Subtotals for Project: 624348		14.282	6.771
Project: 624349: <i>Materials Technology for Sustainment</i>			
Congressional Add: <i>Aircraft Fatigue Modeling and Simulation.</i>		2.992	0.000
Congressional Add: <i>Science for Sustainment.</i>		1.596	0.000
Congressional Add: <i>Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair.</i>		2.992	1.992
Congressional Add: <i>Conducting Polymer Stress and Polymer Damage Sensors for Composites.</i>		1.436	2.868
Congressional Add: <i>LGX High Temperature Acoustic Wave Sensors.</i>		1.596	1.593
Congressional Add: <i>Hybrid Materials Integration (HMI).</i>		0.000	1.992
Congressional Add Subtotals for Project: 624349		10.612	8.445
Project: 624915: <i>Deployed Air Base Technology</i>			
Congressional Add: <i>Advanced Military Installations that Integrate Renewable Energy and Advanced Energy Storage Technologies.</i>		3.989	0.000
Congressional Add: <i>Tactical Shelters Next Generation Composite Initiative.</i>		1.596	0.000
Congressional Add: <i>Fire and Blast Resistant Materials for Force Protection.</i>		1.596	3.187
Congressional Add: <i>Energy Efficiency, Recovery, and Generation (ENERGY).</i>		0.000	0.996
Congressional Add: <i>Fine Water Mist Fire Suppression Technology to Replace Halon.</i>		0.000	1.992
Congressional Add: <i>Partnership for Energy and Automation Technologies.</i>		0.000	1.593
Congressional Add: <i>Temperature Resistant Landing Pad Jet Blast Protection.</i>		0.000	0.797
Congressional Add Subtotals for Project: 624915		7.181	8.565
Congressional Add Totals for all Projects		71.328	51.785

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>
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Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

In FY 2010, Congress added \$2.0 million for Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair, \$3.2 million for Advanced Aerospace Carbon Foam Heat Exchangers, \$0.8 million for Aerospace Laser Micro Engineering Station, \$4.8 million for Air Force Minority Leaders Program, \$0.8 million for Carbon Nanomaterials for Advanced Aerospace Applications, \$2.88 million for Conducting Polymer Stress and Polymer Damage Sensors for Composites, \$3.2 million for Consortium for Nanomaterials for Aerospace Commerce and Technology (CONTACT), \$1.2 million for Development of Mobile Wind Turbine Systems to Power Forward Bases, \$1.0 million for Energy Efficiency, Recovery, and Generation (ENERGY), \$2.0 million for Fine Water Mist Fire Suppression Technology to Replace Halon, \$3.2 million for Fire and Blast Resistant Materials for Force Protection, \$1.6 million for Gallium Nitride (GaN) Microelectronics and Materials, \$2.0 million for Hybrid Materials Integration (HMI), \$0.8 million for Hybrid Nanoparticle-based Coolant Technology Development and Manufacturing, \$3.6 million for Institute for Science and Engineering Simulation/Aircraft Fatigue Modeling and Simulation, \$1.6 million for Large Area, APVT Materials Development for High Power Devices, \$3.0 million for Lightning Protection Composites, \$1.6 million for LGX High Temperature Acoustic Wave Sensors, \$2.8 million for Low-Defect Density Gallium Nitride Materials for High-Performance Electronics Devices, \$0.8 million for Mid-IR Laser Materials, \$3.52 million for ONAMI Safer Nanomaterials and Nanomanufacturing, \$1.6 million for Partnership for Energy and Automation Technologies, \$0.8 million for Pennsylvania NanoMaterials Commercialization Center, \$0.8 million for Temperature Resistant Landing Pad Jet Blast Protection, and \$2.4 million for Ultra-High Temperature Materials for Hypersonic Aerospace Vehicles.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 6201SP: <i>Space Materials Development</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6201SP: <i>Space Materials Development</i>	31.727	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4347, Project 4348, and Project 4349 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops the materials and processing technology base for spacecraft and launch systems to improve affordability, maintainability, and performance of current and future Air Force space systems. Families of affordable lightweight materials are being developed, including metals, polymers, ceramics, metallic composites, and nonmetallic composites to provide new capabilities for spacecraft, ballistic missile, and propulsion systems to meet the future space requirements. Rocket propulsion materials development in this project supports the Integrated High Payoff Rocket Propulsion Technology program. Advanced high-temperature protection materials are being developed that are affordable, lightweight, dimensionally stable, thermally conductive, and/or ablation and erosion resistant to meet space and ballistic missile requirements. Materials technologies are also being developed to enable surveillance and terrestrial situational awareness systems and subsystems for space and ballistic missile applications.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop materials and processes to dramatically improve performance, durability, and cost of rocket propulsion systems. FY 2009 Accomplishments: In FY 2009: Downselected the highest payoff materials and processes for high-speed turbopump housings and turbines, ducts, valves, solid rocket casings, insulation, and nozzle throats and develop mechanical property databases for design consideration. Optimized processes to produce full scale test components that can be tested in rocket engine environment. Analyzed material behavior in rocket combustion environment. Focused development plans on pervasive materials requirements to	3.550	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 6201SP: <i>Space Materials Development</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (236): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	79.314	110.280	84.865	0.000	84.865	81.649	80.713	78.623	80.669	Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4347 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops the materials and processing technology base for aircraft, spacecraft, launch systems and missiles to improve affordability, maintainability, and performance of current and future Air Force systems. A family of affordable lightweight materials is being developed, including metals, polymers, ceramics, metallic and nonmetallic composites, and hybrid materials to provide upgraded capabilities for existing aircraft, missile, and propulsion systems to meet the future system requirements. Develops high-temperature turbine engine materials that will enable engine designs to double the turbine engine thrust-to-weight ratio. Advanced high temperature protection materials are being developed that are affordable, lightweight, dimensionally stable, thermally conductive, and/or ablation and erosion resistant to meet aerospace and missile requirements. Alternative or replacement materials are being developed to maintain the performance of aging operational systems. Materials for thermal management including coolants, adaptive thermally conductive materials, coatings, friction and wear-resistant materials, and other pervasive nonstructural materials technologies are being developed for directed energy, propulsion, and subsystems on aircraft, spacecraft, and missiles. Develops nanostructured and biological materials for aircraft structures, munitions, air vehicle subsystems, and personnel. Develops novel materials for electromagnetic interactions with matter for electromagnetic pulse (EMP), high power microwave, and lightning strike protection. Concurrently develops advanced processing methods to enable adaptive processing of aerospace materials.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop ceramic, ceramic matrix composite, & hybrid materials technologies for performance & supportability improvement in propulsion systems & high temperature aerospace structures. <i>FY 2009 Accomplishments:</i> In FY 2009: Validated advanced ceramic composite performance through testing under real and simulated engine service life conditions. Validated the life prediction model to address time dependent	2.166	11.340	13.073	0.000	13.073

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Develop fabrication and characterization for EO/IR metamaterials. Develop fabrication and characterization for emerging metamaterial applications. <i>FY 2011 OCO Plans:</i> In FY2011 OCO:								
MAJOR THRUST: Develop lightweight metallic & intermetallic high temperature materials, life prediction & metals processing technologies to lower costs, increase durability & improve reliability. <i>FY 2009 Accomplishments:</i> In FY 2009: Validated materials-damage predictive approaches for engine health determination and life extension capability. Developed and validate advanced metallic materials for enhanced performance propulsion for air platforms with an emphasis on higher temperature capability. Transitioned computational methods supporting development and processing to reduce costs to accelerate insertion of advanced metals into Air Force systems. <i>FY 2010 Plans:</i> In FY 2010: Continue development and validation of advanced metallic materials and processes for enhanced performance propulsion for air platforms with an emphasis on higher temperature capability. Initiate development of an advanced disk system concept for insertion into advanced propulsion concepts for air platforms. Initiate development of advanced materials and processes for liquid rocket engine applications. Initiate development of advanced computation methods to support modeling of materials for advanced propulsion systems. Demonstrate processing for thin gage metallics and fabrication of honeycomb and sandwich panels. Validate panel analysis methodology. Develop quantitative models linking microstructure with thermal and physical properties of metallic thermal management materials.				10.003	15.611	13.903	0.000	13.903

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate large-scale synthesis and characterization techniques for energetic nanomaterials to provide stable, triggerable, nanoscale energetic materials for enhanced energy release munitions, high efficiency air-breathing propulsion, and access to space. Validate the transport and compartmentalization of nanoparticles being investigated as nanoenergetics to evaluate potential environmental impact. Analyze microstructural characterization tools to provide robust processing-performance correlations of nanoenergetic systems. Develop multi-component, structured nanoparticle catalyses as controlled release agents for enhancing stability and storage as well as providing enhanced ignition. Downselect most promising biological/nanomaterial hybrids for the detection and identification of threat agents.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate nanomaterials that provide stable, triggerable, nanoscale energetic materials for enhanced energy release munitions, high efficiency air-breathing propulsion, and access to space. Develop understanding of rapid propulsion methods for nano bio material devices for aircraft and space structures, actuators, sensors and electronics. Demonstrate the transport and compartmentalization of nanoparticles being investigated as nanoenergetics to evaluate potential environmental impact. Validate microstructural characterization tools to provide robust processing-performance correlations of nanoenergetic systems. Continue to develop multi-component, structured nanoparticle catalyses as controlled release agents for enhancing stability and storage as well as providing enhanced ignition. Demonstrate biological/nanomaterial hybrids for the detection and identification of threat agents.</p> <p><i>FY 2011 OCO Plans:</i> In FY2011 OCO: N/A.</p>						
MAJOR THRUST: Develop high temperature materials, structures, and thermal management concepts to enable future defense capabilities for prompt global strike concepts.		0.000	2.000	2.726	0.000	2.726

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Investigate advanced ceramics, ceramic matrix composites, hybrids, and metallic concepts for hot structure and thermal protection systems.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to investigate advanced ceramics, CMCs, hybrids and metallic concepts for hot structure and thermal protection systems.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				40.061	82.276	84.865	0.000	84.865
				FY 2009	FY 2010			
<p>Congressional Add: Advanced Carbon Fiber Research and Test Initiative.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advanced Carbon Fiber Research and Test Initiative.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				2.393	0.000			
<p>Congressional Add: Advanced Thermal Control Coatings for Space Applications.</p>				1.596	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advanced Thermal Control Coatings for Space Applications.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Ceramic Matrix Composite Turbine Blade Demonstration.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Ceramic Matrix Composite Turbine Blade Demonstration.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	3.989	0.000
<p>Congressional Add: Innovative Polymeric Materials for Three-Dimensional (3-D) Microdevice Construction.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Innovative Polymeric Materials for 3-D Microdevice Construction.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.596	0.000
<p>Congressional Add: Intelligent Manufacturing Initiative.</p>	2.393	0.000

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Intelligent Manufacturing Initiative.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Nanocomposites for Lightning Protection of Composite Airframe Structures.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Nanocomposites for Lightning Protection of Composite Airframe Structures.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.197	0.000
<p>Congressional Add: Partnership for Emerging Technologies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Partnership for Emerging Technologies.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.596	0.000
<p>Congressional Add: Air Force Minority Leaders Program.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Air Force Minority Leaders Program.</p>	7.978	4.780

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Air Force Minority Leaders Program.		
Congressional Add: Pennsylvania Nanomaterials Commercialization Center. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Pennsylvania Nanomaterials Commercialization Center. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Pennsylvania Nanomaterials Commercialization Center.	1.995	0.797
Congressional Add: Carbon Nanomaterials for Advanced Aerospace Applications. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Carbon Nanomaterials for Advanced Aerospace Applications. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Carbon Nanomaterials for Advanced Aerospace Applications.	2.393	0.797
Congressional Add: ONAMI Safer Nanomaterials and Nanomanufacturing. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for ONAMI Safer Nanomaterials and Nanomanufacturing.	3.989	3.505

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for ONAMI Safer Nanomaterials and Nanomanufacturing.		
Congressional Add: Consortium for Nanomaterials for Aerospace Commerce and Technology (CONTACT). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for CONTACT. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for CONTACT.	2.393	3.187
Congressional Add: Advanced Aerospace Carbon Foam Heat Exchangers. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advanced Aerospace Carbon Foam Heat Exchangers. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Aerospace Carbon Foam Heat Exchangers.	1.596	3.187
Congressional Add: Institute for Science and Engineering Simulation/Aircraft Fatigue Modeling and Simulation. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Institute for Science and Engineering Simulation/Aircraft Fatigue Modeling and Simulation.	3.351	3.585

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Institute for Science and Engineering Simulation/Aircraft Fatigue Modeling and Simulation.		
Congressional Add: Development of Mobile Wind Turbine Systems to Power Forward Bases. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Development of Mobile Wind Turbine Systems to Power Forward Bases. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Development of Mobile Wind Turbine Systems to Power Forward Bases.	0.798	1.195
Congressional Add: Aerospace Laser Micro Engineering Station. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Aerospace Laser Micro Engineering Station.	0.000	0.797
Congressional Add: Hybrid Nanoparticle-based Coolant Technology Development and Manufacturing. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	0.797

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Hybrid Nanoparticle-based Coolant Technology Development and Manufacturing.		
Congressional Add: Lightning Protection Composites. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Lightning Protection Composites.	0.000	2.987
Congressional Add: Ultra-High Temperature Materials for Hypersonic Aerospace Vehicles. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Ultra-High Temperature Materials for Hypersonic Aerospace Vehicles.	0.000	2.390
Congressional Adds Subtotals	39.253	28.004

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603112F: <i>Advanced Materials for Weapon Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>			
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603211F: <i>Aerospace Technology Dev/Demo.</i>											
• PE 0603216F: <i>Aerospace Propulsion and Power Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D. Acquisition Strategy Not Applicable.											
E. Performance Metrics Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.											

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624348: <i>Materials for Electronics, Optics, and Survivability</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624348: <i>Materials for Electronics, Optics, and Survivability</i>	34.044	33.744	31.687	0.000	31.687	30.746	30.840	30.967	31.255	Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4348 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops materials technologies for surveillance and situational awareness systems and subsystems for aircraft and missile applications, including sensor, microwave, and infrared detection and countermeasures devices used for targeting, electronic warfare, and active aircraft protection. Materials for protection of aircrews, sensors, and aircraft from laser and high-power microwave directed energy threats are also developed. Electronic and optical materials are being developed to enable surveillance and situational awareness with faster operating speeds, greater tunability, higher power output, improved thermal management (including higher operating temperatures), greater sensitivity, and extended dynamic range. New materials are being developed to counter the most prominent laser threats and to respond to emerging and agile threat wavelengths without impairing mission effectiveness.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop IR detector & hybrid materials, M&P technologies for performance, affordability, & operational capability of surveillance, tracking, targeting, & situational awareness systems.	1.769	8.234	8.665	0.000	8.665
<i>FY 2009 Accomplishments:</i> In FY 2009: Developed materials and transition strategies for innovative IR materials while continuing to exploit newly emerging material concepts. Validated and optimized IR materials systems capable of responses to more than two discrete wavelengths. Developed candidate materials for three-dimensional growth to exploit unique detection properties of complex IR materials. Developed promising materials growth technologies for nano-scale IR detection materials. Demonstrated epitaxial materials device and substrate improvements. Developed design capability, leveraging new					

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624348: <i>Materials for Electronics, Optics, and Survivability</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Pursue materials for enabling improved laser source components operating in the mid-infrared range. Improve very high speed beam steering materials and pursue most promising beam steering configurations. Improve materials to increase high energy laser efficiency and gain.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				19.762	26.973	31.687	0.000	31.687
				FY 2009	FY 2010			
<p>Congressional Add: Free Electron Laser Capabilities for Aerospace Microfabrication.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Free Electron Laser Capabilities for Aerospace Microfabrication.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				1.117	0.000			
<p>Congressional Add: Gallium Nitride (GaN) RF Power Technology.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for GaN RF Power Technology.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				1.596	0.000			

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
Congressional Add: Plasma-Sphere Array for Flexible Electronics. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Plasma-Sphere Array for Flexible Electronics. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	2.792	0.000
Congressional Add: Diamond Substrate for Cooling of Micro-Electronics. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Diamond Substrate for Cooling of Micro-Electronics. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.995	0.000
Congressional Add: High Power Broadly Tunable Middle-Infrared Laser Sources. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for High Power Broadly Tunable Middle-Infrared Laser Sources. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	2.393	0.000
Congressional Add: Light Weight Organic Photovoltaic Technologies.	1.197	0.000

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Light Weight Organic Photovoltaic Technologies.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Liquid Crystal Laser Eye Protection.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Liquid Crystal Laser Eye Protection.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.596	0.000
<p>Congressional Add: Optic Band Control Program.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Optic Band Control Program.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	0.798	0.000
<p>Congressional Add: Large Area, APVT Materials Development for High Power Devices.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Large Area, APVT Materials Development for High Power Devices.</p>	0.798	1.593

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Large Area, APVT Materials Development for High Power Devices.		
Congressional Add: Gallium Nitride (GaN) Microelectronics and Materials. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Gallium Nitride (GaN) Microelectronics and Materials.	0.000	1.593
Congressional Add: Low-Defect Density Gallium Nitride Materials for High-Performanace Electronics Devices. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Low-Defect Density Gallium Nitride Materials for High-Performanace Electronics Devices.	0.000	2.788
Congressional Add: Mid-IR Laser Materials. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	0.797

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Mid-IR Laser Materials.		
Congressional Adds Subtotals	14.282	6.771

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	
• PE 0603112F: <i>Advanced Materials for Weapon Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Technology Dev/Demo.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624349: <i>Materials Technology for Sustainment</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624349: <i>Materials Technology for Sustainment</i>	28.853	22.697	16.893	0.000	16.893	19.320	20.022	20.364	20.715	Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4349 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops materials and materials processing technologies to support operational Air Force mission areas by providing the ability to inspect the quality of delivered systems, transitioning more reliable and maintainable materials, establishing a capability to detect and characterize performance threatening defects, characterizing materials processes and properties necessary for materials transition, and providing quick reaction support and failure analysis to the operational commands and repair centers. Repair techniques and nondestructive inspection/evaluation (NDI/E) methods are developed that are needed for metallic and non-metallic structures, coatings, corrosion control processes, and to support integration of composite structures for aerospace systems. Various NDI/E methods are essential to ensure optimum quality in the design and production of aircraft, propulsion, and missile systems. These NDI/E methods are also essential to monitor and detect the onset of any service-initiated damage and/or deterioration due to aging of operational systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop sensing and life prediction technologies to identify damage and characterize the health of aging structures, propulsion systems, and low-observable materials and structures.	6.716	3.012	5.079	0.000	5.079
<i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated novel NDI/E methods and techniques to detect and track damage in a wide variety of materials and components for aerospace systems. Demonstrated NDI/E technologies for inspection of thick (multi-layer) aging aircraft structures with complex geometries. Developed sensing technology to detect changes in temperature, strain, pressure, and vibration to enable on-demand health status of turbine engines, aircraft structures, wiring systems, and thermal protection systems.					

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624349: <i>Materials Technology for Sustainment</i>

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>Air Force systems. Developed test methods and techniques to understand the effects of materials processes, such as the application of residual stress on the surface of steel and other structural metals, to support studies and point design solutions that will extend the life of specific structural components on Air Force systems. Demonstrated and transitioned technologies for improved maintainability of advanced LO materials and designs, such as conductive outer-mold-line, applique, door edges and seals, and multifunctional systems.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Evaluate advanced materials and processes technologies to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Develop and demonstrate test methods and techniques to understand the effects of in-service environments and materials processes, such as the application of residual stress on the surface of steel and other structural metals, to support studies and point design solutions that will extend the life of specific structural components on Air Force systems. Demonstrate and transition technologies for improved maintainability and life cycle cost of advanced LO materials and designs, such as conductive outer-mold-line, applique, door edges and seals, and multifunctional systems. Develop and demonstrate laboratory test methods to evaluate and characterize candidate space materials for properties and material behavior suitable for use in space applications.</p> <p><i>FY 2011 Base Plans:</i> FY 2011: Evaluate advanced materials and processes technology to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Develop and demonstrate test methods and techniques to understand the effects of in-service environments and materials processes, such as the application of residual stress on the surface of steel and other structural metals, to support studies and point design solutions that will extend the life of specific structural components on Air Force systems. Demonstrate and transition technologies for improved maintainability and life cycle cost of advanced materials and designs, such as conductive outer-mold-line, films, coatings, assess panel treatments and multifunctional systems. Develop and demonstrate laboratory test methods to evaluate and</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624349: <i>Materials Technology for Sustainment</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
characterize candidate space materials for properties and material behavior suitable for use in space applications. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.								
MAJOR THRUST: Develop support capabilities, information, and processes to resolve materials problems and provide electronic and structural failure analysis of components. <i>FY 2009 Accomplishments:</i> In FY 2009: Performed quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provide advanced materials solutions to ensure system availability and safety of flight. Developed advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrated advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Developed advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapons systems. <i>FY 2010 Plans:</i> In FY 2010: Perform quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provide advanced materials solutions to ensure system availability and safety of flight. Develop advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrate advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Develop advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapons systems.				6.485	6.296	6.674	0.000	6.674

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624349: <i>Materials Technology for Sustainment</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Perform quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provide advanced materials solutions to ensure system availability and safety of flight. Develop advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrate advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Develop advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapons systems.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				18.241	14.252	16.893	0.000	16.893
				FY 2009	FY 2010			
Congressional Add: Aircraft Fatigue Modeling and Simulation.				2.992	0.000			
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Aircraft Fatigue Modeling and Simulation.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>								
Congressional Add: Science for Sustainment.				1.596	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624349: <i>Materials Technology for Sustainment</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Science for Sustainment.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair.</p>	2.992	1.992
<p>Congressional Add: Conducting Polymer Stress and Polymer Damage Sensors for Composites.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Conducting Polymer Stress and Polymer Damage Sensors for Composites.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Conducting Polymer Stress and Polymer Damage Sensors for Composites.</p>	1.436	2.868
<p>Congressional Add: LGX High Temperature Acoustic Wave Sensors.</p>	1.596	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force							DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>			PROJECT 624349: <i>Materials Technology for Sustainment</i>					
B. Accomplishments/Planned Program (\$ in Millions)											
						FY 2009	FY 2010				
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for LGX High Temperature Acoustic Wave Sensors.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for LGX High Temperature Acoustic Wave Sensors.</p>											
<p>Congressional Add: Hybrid Materials Integration (HMI).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conducted Congressionally-directed effort for Hybrid Materials Integration (HMI).</p>						0.000	1.992				
Congressional Adds Subtotals						10.612	8.445				
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603112F: <i>Advanced Materials for Weapons Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Technology Dev/Demo.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D. Acquisition Strategy Not Applicable.											

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624349: <i>Materials Technology for Sustainment</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624915: <i>Deployed Air Base Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624915: <i>Deployed Air Base Technology</i>	11.645	12.481	3.828	0.000	3.828	3.934	3.901	4.109	4.252	Continuing	Continuing

Note

Note: FY 2008 funding totals include \$3.7 million in supplemental funding.

A. Mission Description and Budget Item Justification

This project develops new deployable airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs, and to improve protection and survivability of deployed Air Expeditionary Force (AEF) warfighters. Affordable, efficient technologies are developed for base infrastructure, fire fighting, and force protection to improve Expeditionary Combat Support operations.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop deployable infrastructure airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs in support of AEF operations.	2.026	2.160	1.911	0.000	1.911
<i>FY 2009 Accomplishments:</i> In FY 2009: Analyzed and demonstrated renewable power technologies applicable to deployed forces. Demonstrated advanced integrated power technologies. Evaluated and developed mitigation for high temperature effects on operating surfaces. Demonstrated and analyzed nondestructive inspection of airfield surface evaluation technologies.					
<i>FY 2010 Plans:</i> In FY 2010: Develop deployable applications of higher efficiency collection and conversion of solar power for deployed applications. Analyze performance of candidate high temperature aircraft operating surface materials. Develop remote nondestructive inspection of airfield surface evaluation technologies.					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624915: <i>Deployed Air Base Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Developed and demonstrated deployable applications of higher efficiency collection and conversion of solar power for deployed applications. Developed and optimized performance of candidate high temperature operating surface materials. Developed and improved remote and autonomous nondestructive inspection of airfield surface evaluation technologies.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
<p>MAJOR THRUST: Develop affordable technologies to provide force protection and survivability to AEF deployed warfighters and infrastructure.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed and demonstrated methodologies to characterize candidate fire suppression agents and continue to develop supporting fire suppression technologies for crash/rescue. Developed and analyzed combined technologies for fire fighter effectiveness. Validated and demonstrated resilient structural materials and methodologies for improved protection of structures and inhabitants. Developed and demonstrated effectiveness of innovative defeat of improvised explosive device (IED) and high energy threats.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Analyze fire suppression agents using methodologies supporting deployed warfighters and infrastructure. Investigate novel, cost-effective technologies for fire fighter effectiveness and optimize developed technologies. Investigate novel structural materials and technologies to support deployed warfighters and infrastructure, using methodologies developed for protection. Analyze and conduct experiments to verify effectiveness for defeat of IED and high energy threat technologies. Transition mature defeat technologies and investigate emerging threats. Explore functions of microbes and develop effective methodologies to capture biological processes for use in Air Force applications.</p>				2.438	1.756	1.917	0.000	1.917

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624915: <i>Deployed Air Base Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Develop and optimize fire suppression agents using methodologies supporting deployed warfighters and infrastructure. Develop novel cost effective technologies for fire fighter effectiveness in deployed environments. Develop novel structural materials and technologies to support deployed warfighters and infrastructure using methodologies developed for protection from emerging threats. Develop and optimize techniques and materials for defeat of new and evolving IED and high energy threats. Analyze functions of microbes and develop effective methodologies to capture biological processes for use in Air Force applications, such as sensing and development of solid state materials. Evaluate design and performance of microbial-based technologies.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				4.464	3.916	3.828	0.000	3.828
				FY 2009	FY 2010			
<p>Congressional Add: Advanced Military Installations that Integrate Renewable Energy and Advanced Energy Storage Technologies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advanced Military Installations that Integrate Renewable Energy and Advanced Energy Storage Technologies.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				3.989	0.000			
				1.596	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624915: <i>Deployed Air Base Technology</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
Congressional Add: Tactical Shelters Next Generation Composite Initiative. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Tactical Shelters Next Generation Composite Initiative. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Fire and Blast Resistant Materials for Force Protection. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Fire and Blast Resistant Materials for Force Protection. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Fire and Blast Resistant Materials for Force Protection	1.596	3.187
Congressional Add: Energy Efficiency, Recovery, and Generation (ENERGy). <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for ENERGy.	0.000	0.996
Congressional Add: Fine Water Mist Fire Suppression Technology to Replace Halon.	0.000	1.992

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624915: <i>Deployed Air Base Technology</i>	
B. Accomplishments/Planned Program (\$ in Millions)			
		FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.			
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Fine Water Mist Fire Suppression Technology to Replace Halon.			
Congressional Add: Partnership for Energy and Automation Technologies.		0.000	1.593
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.			
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Partnership for Energy and Automation Technologies.			
Congressional Add: Temperature Resistant Landing Pad Jet Blast Protection.		0.000	0.797
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.			
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Temperature Resistant Landing Pad Jet Blast Protection.			
Congressional Adds Subtotals		7.181	8.565

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624915: <i>Deployed Air Base Technology</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603112F: <i>Advanced Materials for Weapon Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	119.544	138.563	144.699	0.000	144.699	149.062	145.609	149.835	152.533	Continuing	Continuing
622401: <i>Structures</i>	36.902	44.307	44.224	0.000	44.224	47.570	55.857	57.457	58.474	Continuing	Continuing
622403: <i>Flight Controls and Pilot-Vehicle Interface</i>	32.169	28.752	39.283	0.000	39.283	39.679	37.755	38.841	39.532	Continuing	Continuing
622404: <i>Aeromechanics and Integration</i>	50.473	65.504	61.192	0.000	61.192	61.813	51.997	53.537	54.527	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and analyzes aerospace vehicle technologies in the three primary areas of structures, controls, and aeromechanics. Advanced structures concepts are explored and developed to exploit new materials, fabrication processes, and design techniques. Flight control technologies are developed and simulated for aerospace vehicles. Advanced aerodynamic vehicle configurations are developed and analyzed through simulations, experiments, and multi-disciplinary analysis. Resulting technologies reduce life cycle costs and improve the performance of existing and future manned and unmanned aerospace vehicles.

This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary aerospace vehicle technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	123.036	127.129	0.000	0.000	0.000
Current President's Budget	119.544	138.563	144.699	0.000	144.699
Total Adjustments	-3.492	11.434	144.699	0.000	144.699
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.586			
• Congressional Adds		12.020			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-3.492	0.000	144.699	0.000	144.699

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 622403: *Flight Controls and Pilot-Vehicle Interface*

Congressional Add: *Cognitive Unmanned Air Vehicles.*

Congressional Add Subtotals for Project: 622403

Project: 622404: *Aeromechanics and Integration*

Congressional Add: *Materials Integrity Management Research for the Air Force*

Congressional Add: *Unmanned Air Vehicle Sensor and Maintenance Development Center*

Congressional Add: *Unmanned Aerial System Exploitation*

Congressional Add: *Unmanned Sense, Track, and Avoid Radar*

Congressional Add Subtotals for Project: 622404

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	0.499	0.000
	0.499	0.000
	0.000	2.987
	0.000	3.900
	0.000	3.485
	0.000	1.593
	0.000	11.965
	0.499	11.965

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>
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Change Summary Explanation

Note 1: The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note 2: In FY 2010 Congress added \$1.5 million for Unmanned Sense, Track, and Avoid Radar, \$2.98 million for Materials Integrity Management Research for the Air Force, \$3.9 Unmanned Air Vehicle Sensor and Maintenance Development Center, and \$3.48 million for Unmanned Aerial System Exploitation.

(U) C. Performance Metrics
Under Development

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>				PROJECT 622401: <i>Structures</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622401: <i>Structures</i>	36.902	44.307	44.224	0.000	44.224	47.570	55.857	57.457	58.474	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops advanced structures concepts to exploit new materials and fabrication processes and investigates new structural concepts and design techniques. New structural concepts include incorporating subsystem hardware items (e.g., antennas, sensors, directed energy weapon components, and integrated energy storage) and adaptive mechanisms into the aerospace structures and/or skin of the aircraft. Resulting technologies strengthen and extend the life of current and future manned and unmanned aerospace vehicle structures, while providing increased capabilities. Payoffs to the warfighter include reduced weight and cost, as well as improved operability and maintainability of aerospace vehicles.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop an economic service life analysis capability comprised of analysis tools, methodologies, and structural health monitoring schemes.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued development of structural health management schemes for structures susceptible to damage. Continued the development of economic service life analysis and structural design tools for current and future aircraft, enhancing capabilities, component replacement, and technology direction. Continued the development of analysis tools into life prediction and failure analysis. Continued to develop failure criteria tools for advanced high temperature aircraft components and concepts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Initiate the development of health reasoners for determination of system health. Continue the development of economic service life analysis and structural design tools for current and future aircraft, enhancing capabilities, component replacement, and technology direction. Continue to incorporate newly developed analysis tools into life prediction and failure analysis. Continue to</p>	3.593	25.976	18.820	0.000	18.820

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622401: <i>Structures</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603112F: <i>Advanced Materials for Weapon Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Technology Dev/Demo.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>				PROJECT 622403: <i>Flight Controls and Pilot-Vehicle Interface</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622403: <i>Flight Controls and Pilot-Vehicle Interface</i>	32.169	28.752	39.283	0.000	39.283	39.679	37.755	38.841	39.532	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technologies that enable maximum affordable capability from manned and unmanned aerospace vehicles. Advanced flight control technologies are developed for maximum vehicle performance throughout the flight envelope and simulated in virtual environments. Resulting technologies contribute significantly towards the development of reliable autonomous unmanned air vehicles, space access systems with aircraft-like operations, and extended-life legacy aircraft. Payoffs to the warfighter include enhanced mission effectiveness, optimized flight safety, increased survivability, improved maintenance, and decreased size, weight, and cost. Leverages a network of synthetic environments for evaluation of advanced concepts.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop advanced flight control systems, components, and integrated vehicle monitoring systems for both manned and unmanned aircraft.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Furthered the development and assessment of advanced control mechanization technologies to provide highly reliable operations for manned and unmanned systems under adverse environments at significantly reduced size, weight, and cost. Initiated development of control architecture enhancements to enable design for certification to ease validation and verification for complex and adaptive unmanned systems. Initiated development of low-maintenance/fault tolerant control-effector technology for aerospace applications.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Further the development, assessment, and certification of advanced control mechanization technologies to provide highly reliable operations for manned and unmanned systems under adverse environments at significantly reduced size, weight, and cost. Develop control</p>	15.982	7.981	9.562	0.000	9.562

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>		PROJECT 622403: <i>Flight Controls and Pilot-Vehicle Interface</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Refine multi-disciplinary, net-centric simulation environments and models to enable the quantitative and qualitative assessment of advanced aerospace vehicle concepts and technologies under realistic mission conditions. Design and conduct simulation events to evaluate and assess the military utility and suitability of new technologies and new aerospace concepts. Continue simulation analyses and multi-directorate technology trade studies on strike, transport, access-to-space, and reconnaissance concepts. Continue technology trade studies of small and medium sized unmanned air vehicles in hostile urban environments.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Refine multi-disciplinary, net-centric simulation environments and models to enable the quantitative and qualitative assessment of advanced aerospace vehicle concepts and technologies under realistic mission conditions. Continue to design and conduct simulation events to evaluate and assess the military utility and suitability of new technologies and new aerospace concepts. Refine simulation analyses and multi-directorate technology trade studies on strike, transport, access-to-space, and reconnaissance concepts. Refine technology trade studies of unmanned air vehicles in manned/unmanned airspace and airbase operations, as well as in hostile mission environments.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				31.670	28.752	39.283	0.000	39.283
				FY 2009	FY 2010			
Congressional Add: Cognitive Unmanned Air Vehicles.				0.499	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622403: <i>Flight Controls and Pilot-Vehicle Interface</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Cognitive Unmanned Air Vehicles.		
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Adds Subtotals	0.499	0.000

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Technology Dev/Demo.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604015F: <i>Next Generation Bomber.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>				PROJECT 622404: <i>Aeromechanics and Integration</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622404: <i>Aeromechanics and Integration</i>	50.473	65.504	61.192	0.000	61.192	61.813	51.997	53.537	54.527	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops aerodynamic configurations of a broad range of revolutionary, affordable aerospace vehicles. It matures and applies modeling and numerical simulation methods for fast and affordable aerodynamics prediction and integrates and demonstrates multi-disciplinary advances in airframe, propulsion, weapon, and air vehicle control integration. Technologies developed will greatly enhance warfighter capability in aircraft, missiles, and high-speed aerospace vehicles. The payoffs from these technology programs include lower vehicle costs (both production and operations and support costs), increased payload and range capability, and improved supportability, safety, and survivability of aerospace vehicles.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop aerodynamic prediction efforts centered on expanding the design capabilities of manned and unmanned air vehicles.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued efforts to develop and assess aeronautical technologies that enable broad use of unmanned air vehicles in future missions, including offensive missions, to reduce life cycle costs. Continued to perform mission assessment and develop low-cost unmanned air vehicle concepts to perform tactical surveillance and weapon delivery.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue to perform mission assessments and develop low-cost unmanned air vehicle concepts to perform current and future missions including tactical surveillance and weapon delivery. Continue to develop and assess aeronautical technologies that enable broad use of unmanned air vehicles in future missions to reduce life cycle costs and decrease human risk. Continue development of technologies for improved weapon delivery and propulsion system performance. Continue work</p>	3.508	2.700	3.487	0.000	3.487

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010							
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>		PROJECT 622404: <i>Aeromechanics and Integration</i>							
B. Accomplishments/Planned Program (\$ in Millions)											
<table border="1"> <thead> <tr> <th></th> <th>FY 2009</th> <th>FY 2010</th> <th>FY 2011 Base</th> <th>FY 2011 OCO</th> <th>FY 2011 Total</th> </tr> </thead> </table>							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total						
<p>to develop and demonstrate flow control to enable fluidic thrust vectoring, area control, and thermal management for an unmanned air vehicle exhaust nozzle. Continue development of innovative aerodynamic control methods for small unmanned air vehicles.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to perform mission assessments and develop low-cost unmanned air vehicle concepts to perform current and future missions including tactical surveillance and weapon delivery. Continue to develop and assess aeronautical technologies that enable broad use of unmanned air vehicles in future missions to reduce life cycle costs and decrease human risk. Continue development of technologies for improved weapon delivery and propulsion system performance. Continue work to develop and demonstrate flow control to enable fluidic thrust vectoring, area control, and thermal management for an unmanned air vehicle exhaust nozzle. Continue development of innovative aerodynamic control methods for small unmanned air vehicles.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>											
<p>MAJOR THRUST: Develop new and improved concepts, designs, and analysis of technologies to enable revolutionary capabilities for sustained high-speed re-useable high altitude vehicle efforts.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued development and assessment of aerospace technologies that enable sustained high-speed flight to permit global reach. Initiated advanced high-speed aero/flight control development. Initiated study of interaction of high-load, high-temperature flexible structural materials and fluid mechanics of inlet.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue development and assessment of aerospace technologies for high-speed flight. Continue development of techniques for propulsion integration technologies. Continue to develop</p>											
<table border="1"> <tbody> <tr> <td></td> <td align="right">21.121</td> <td align="right">15.044</td> <td align="right">27.518</td> <td align="right">0.000</td> <td align="right">27.518</td> </tr> </tbody> </table>							21.121	15.044	27.518	0.000	27.518
	21.121	15.044	27.518	0.000	27.518						

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>		PROJECT 622404: <i>Aeromechanics and Integration</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Continue development of combined flow control and adaptive optics systems to optimize directed energy system performance on large low-speed aircraft. Initiate work to apply advanced analysis tools to predict the performance of flow control and adaptive optics systems for capabilities of interest to the Air Force.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue development of combined flow control and adaptive optics systems to optimize directed energy system performance on large low-speed aircraft. Continue work to apply advanced analysis tools to predict the performance of flow control and adaptive optics systems for problems of interest to the Air Force. Initiate development of combined flow control and adaptive optics systems for transonic/supersonic aircraft. Extend development of analysis tools for prediction of advanced flow control and adaptive optics to higher speed transonic/supersonic flows.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Develop and assess technologies for the next generation of multi-role large aircraft.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued development and assessment of aeronautical technologies including high-lift systems, transonic, and structural concepts that enable revolutionary tanker and transport aircraft designs for rapid global mobility. Continued to develop technologies that enable multiple roles and missions for delivery and support aircraft. Optimized configuration for trade-off between short take-off and landing performance and high speed cruise. Continued development of inlet and integration technologies for an advanced mobility platform designed to operate efficiently at transonic speeds and provide short take-off capabilities. Continued support to SECAF-directed effort (Energy Conservation - Assured Fuels Initiative). Conducted wind tunnel experiments and multidisciplinary design concept assessments to show the feasibility of mobility aircraft using 40% less energy through the use of</p>				18.042	31.525	27.654	0.000	27.654

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>		PROJECT 622404: <i>Aeromechanics and Integration</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>natural and artificial laminar boundary layers, alternative fuels, and very high bypass propulsion integration.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue development and assessment of aeronautical technologies including high-lift systems, transonic configuration optimization, and structural concepts that enable revolutionary tanker and transport aircraft designs for rapid global mobility. Continue to develop technologies that enable multiple roles and missions for delivery and support aircraft. Optimize configuration for trade-off between short take-off and landing performance and high speed cruise. Continue development of inlet and integration technologies for an advanced mobility platform designed to operate efficiently at transonic speeds and provide short take-off capabilities.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue development and assessment of aeronautical technologies including high-lift systems, transonic configuration optimization, and structural concepts that enable revolutionary tanker and transport aircraft designs for rapid global mobility. Continue to develop technologies that enable multiple roles and missions for delivery and support aircraft. Refine configuration for trade-off between short take-off and landing performance and high speed cruise. Continue development of inlet and integration technologies for an advanced mobility platform designed to operate efficiently at transonic speeds and provide short take-off capabilities. Continue support to SECAF-directed effort (Energy Conservation - Assured Fuels Initiative). Conduct wind tunnel experiments to show the feasibility of mobility aircraft using 40% less energy through the use of natural and artificial laminar boundary layers, alternative fuels and very high bypass propulsion integration.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				50.473	53.539	61.192	0.000	61.192

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622404: <i>Aeromechanics and Integration</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
Congressional Add: Materials Integrity Management Research for the Air Force <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally direct effort in materials integrity management research for the Air Force.	0.000	2.987
Congressional Add: Unmanned Air Vehicle Sensor and Maintenance Development Center <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally direct effort in unmanned air vehicle sensor and maintenance development center.	0.000	3.900
Congressional Add: Unmanned Aerial System Exploitation <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally direct effort in unmanned aerial system exploitation.	0.000	3.485
Congressional Add: Unmanned Sense, Track, and Avoid Radar	0.000	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622404: <i>Aeromechanics and Integration</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.		
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally direct effort in unmanned asense, track, and avoid radar.		
Congressional Adds Subtotals	0.000	11.965

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603211F: <i>Aerospace Technology Dev/Demo.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604015F: <i>Next Generation Bomber.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	93.954	93.527	87.452	0.000	87.452	89.331	89.185	92.014	93.763	Continuing	Continuing
621123: <i>Learning and Organizational Collaboration</i>	20.191	19.853	13.214	0.000	13.214	14.193	14.351	14.236	14.116	Continuing	Continuing
625328: <i>Human Dynamics Evaluation</i>	0.000	18.203	16.587	0.000	16.587	15.578	15.224	18.748	19.110	Continuing	Continuing
625329: <i>Sensory Evaluation and Decision Science</i>	0.000	21.910	22.492	0.000	22.492	24.166	24.345	24.555	25.317	Continuing	Continuing
627184: <i>Performance Evaluation in Extreme Environments</i>	54.937	18.486	18.436	0.000	18.436	17.765	17.715	16.318	16.623	Continuing	Continuing
627757: <i>Directed Energy Bioeffects</i>	18.826	15.075	16.723	0.000	16.723	17.629	17.550	18.157	18.597	Continuing	Continuing

Note
Note: In FY 2010, Human Dynamics Evaluation efforts will move from Project 7184 to Project 5328; Sensory Evaluation and Decision Science efforts will move from Project 7184 to Project 5329; and Performance Evaluation in Extreme Environments efforts within Project 7757 will move to Project 7184 to better align efforts.

A. Mission Description and Budget Item Justification
This program conducts applied research on Airmen training, Airmen system interfaces, directed energy bioeffects, deployment and sustainment of Airmen in extreme environments, and understanding and shaping adversarial behavior. The Learning and Organizational Collaboration project conducts research to measure, accelerate, and expand the cognitive skills necessary to improve Airmen training and mission performance. The Human Dynamics Evaluation project conducts research to advance information operations and intelligence operator-aiding technologies by developing and applying human-focused research to create and influence behavior signatures of existing and emerging adversaries. The Sensory Evaluation and Decision Science project conducts research to revolutionize the manner in which the human optimizes the capabilities of Air Force systems, including autonomous unmanned aerial systems (UAS) and adaptive teams of humans and machines. The Performance Evaluation in Extreme Environments project conducts research to enhance human sensory, cognitive, and physical capabilities to increase Airmen survivability and performance. The Directed Energy Bioeffects project conducts research on the effects of human exposure to electromagnetic energy (radio frequency to optical), scalable directed energy weapons, and non-lethal weapons. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	93.222	85.122	0.000	0.000	0.000
Current President's Budget	93.954	93.527	87.452	0.000	87.452
Total Adjustments	0.732	8.405	87.452	0.000	87.452
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.395			
• Congressional Adds		8.800			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.732	0.000	87.452	0.000	87.452

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 621123: *Learning and Organizational Collaboration*

Congressional Add: *Component Object Model (COM) Attitude Control System Simulation/Trainer.*

Congressional Add: *Ultra High Resolution Deployable Projector for Simulation.*

Congressional Add: *Center for Unmanned Aerial System (UAS) Research, Education and Training.*

Congressional Add Subtotals for Project: 621123

Project: 625329: *Sensory Evaluation and Decision Science*

Congressional Add: *Advanced Night Vision System - Cockpit Integration.*

Congressional Add Subtotals for Project: 625329

Project: 627184: *Performance Evaluation in Extreme Environments*

Congressional Add: *Imaging Tools for Human Performance Enhancement and Diagnostics.*

Congressional Add: *Homeland Emergency Learning and Preparedness (HELP) Center.*

	<u>FY 2009</u>	<u>FY 2010</u>
	1.596	0.000
	3.191	0.000
	0.000	6.373
	4.787	6.373
	0.000	0.797
	0.000	0.797
	1.995	1.593
	2.992	0.000

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R-1 Line Item #6

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Smart View Program (SVP).*

Congressional Add: *Tools and Technologies for Incident and Consequence Management.*

Congressional Add Subtotals for Project: 627184

Congressional Add Totals for all Projects

FY 2009	FY 2010
0.798	0.000
0.798	0.000
6.583	1.593
11.370	8.763

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

In FY 2010, Congress added \$6.4 million for Center for Unmanned Aerial System (UAS) Research, Education and Training, \$0.8 million for Advanced Night Vision System - Cockpit Integration, and \$1.6 million for Imaging Tools for Human Performance Enhancement.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>				PROJECT 621123: <i>Learning and Organizational Collaboration</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
621123: <i>Learning and Organizational Collaboration</i>	20.191	19.853	13.214	0.000	13.214	14.193	14.351	14.236	14.116	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research to measure, accelerate, and expand the cognitive skills necessary to improve Airmen training and mission performance. Research is conducted in three focus areas: immersive environments; continuous learning and aiding; and cognitive and behavioral modeling. The immersive environments effort creates live, virtual, and constructive (LVC) decision-making environments for use in developing revolutionary simulation technologies to increase training capabilities. Continuous learning and aiding enhances training effectiveness and efficiency by using learning theory to improve military training and mission performance. Cognitive and behavioral modeling creates realistic models and simulations of human behavior to advance the understanding of how people perform complex tasks.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Research enhances Distributed Mission Operations (DMO) and decision dominance environments; identifies requirements for aircrew training in live, immersive environments.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Performed human factors analyses, tests, and evaluations of visual and sensor simulation components for air-to-ground and air-to-air composite force training using air-to-surface operational testbed. Conducted perceptual evaluations of compact immersive display concepts and components. Transitioned results to address broader range of AF mission areas and initiated research on sensory-driven decision making in complex environments.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Research training and rehearsal issues for helmet cueing and targeting pod simulation systems that will allow for greater realistic composite force training. Expand sensory-driven modeling efforts to predict targeting pod performance and investigate how neural-sensory measurements</p>	2.060	4.264	4.094	0.000	4.094

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 621123: <i>Learning and Organizational Collaboration</i>	
B. Accomplishments/Planned Program (\$ in Millions)			
		FY 2009	FY 2010
Congressional Add: Component Object Model (COM) Attitude Control System Simulation/Trainer. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for COM Attitude Control System Simulation/Trainer. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		1.596	0.000
Congressional Add: Ultra High Resolution Deployable Projector for Simulation. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Ultra High Resolution Deployable Projector for Simulation. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		3.191	0.000
Congressional Add: Center for Unmanned Aerial System (UAS) Research, Education and Training. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for a Center for UAS Research, Education and Training.		0.000	6.373
Congressional Adds Subtotals		4.787	6.373

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 621123: <i>Learning and Organizational Collaboration</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602233N: <i>Human Systems Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602716A: <i>Human Factors Engineering Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602785A: <i>Personnel Performance and Training Technologies.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604227F: <i>Distributed Mission Training (DMT).</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>				PROJECT 625328: <i>Human Dynamics Evaluation</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625328: <i>Human Dynamics Evaluation</i>	0.000	18.203	16.587	0.000	16.587	15.578	15.224	18.748	19.110	Continuing	Continuing

Note

Note: In FY 2010, Human Dynamics Evaluation efforts will move from Project 7184 to Project 5328 to better align efforts.

A. Mission Description and Budget Item Justification

This project conducts applied research to advance information operations and intelligence operator-aiding technologies by developing and applying human-focused research to create and influence behavior signatures of existing and emerging adversaries. Research will be in six focus areas: mission-essential human capabilities for air, space, and cyber operations; enhancing human components of intelligence, surveillance, and reconnaissance (ISR); anticipatory command, control, and intelligence (C2I); adversarial modeling and cross-cultural communication; predicting and evaluating organizational effectiveness alignment and collaboration readiness; and electromagnetic theory. These focus areas will enhance capabilities in layered sensing, decision aids for computer network attack/defense/survive, and human-centric exploitation of measurement and signatures intelligence.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Identify methods to enhance mission-essential human capabilities for cyber operations. Develop measures of effectiveness for cyber capabilities.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct research to enhance performance and increase situational awareness within cyber operations, including operations support center environments. Develop the operator's ability to anticipate and influence the behavior of adversaries. Conduct foundational studies toward enhancing cognitive cyber performance.</p>	0.000	6.104	3.971	0.000	3.971

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625328: <i>Human Dynamics Evaluation</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>				PROJECT 625329: <i>Sensory Evaluation and Decision Science</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625329: <i>Sensory Evaluation and Decision Science</i>	0.000	21.910	22.492	0.000	22.492	24.166	24.345	24.555	25.317	Continuing	Continuing

Note

Note: In FY 2010, Sensory Evaluation and Decision Science efforts will move from Project 7184 to Project 5329 to better align efforts.

A. Mission Description and Budget Item Justification

This project conducts applied research to revolutionize the manner in which the human optimizes the capabilities of AF systems, including autonomous unmanned aerial systems (UAS) and adaptive teams of humans and machines. Research optimizes situational awareness, improves the human-machine interface, and seamlessly integrates warfighters with their weapon systems across air, space, and cyber domains. Research is conducted in four focus areas: network-centric collaboration, supervisory control, battlespace visualization, and battlespace acoustics. The network-centric collaboration area develops warfighter interface technologies to enhance human-human and human-machine collaborations and system interactions in distributed decision-making environments. The supervisory control area develops new control/display concepts and technologies to optimize AF platform capabilities. The battlespace visualization area advances the science and technology associated with collecting, optimizing, displaying, and assimilating sensory information to enhance warfighter decision-making. The battlespace acoustics area researches human-human and human-machine communications to exploit the use of voice and acoustic data in collaborative, net-centric environments while accounting for the effects of acoustic propagation.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develops warfighter interface technologies to enhance human-human and human-machine collaboration and system interaction in distributed decision-making environments. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	4.996	4.881	0.000	4.881

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625329: <i>Sensory Evaluation and Decision Science</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
display concepts to optimize the flow of information across distributed teams, emphasizing how intuitive displays can promote shared situational awareness between C2ISR assets and operators. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	21.113	22.492	0.000	22.492

	FY 2009	FY 2010
Congressional Add: Advanced Night Vision System - Cockpit Integration. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Night Vision System - Cockpit Integration.	0.000	0.797
Congressional Adds Subtotals	0.000	0.797

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625329: <i>Sensory Evaluation and Decision Science</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>				PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
627184: <i>Performance Evaluation in Extreme Environments</i>	54.937	18.486	18.436	0.000	18.436	17.765	17.715	16.318	16.623	Continuing	Continuing

Note

Note: In FY 2010, Human Dynamics Evaluation efforts will move from Project 7184 to Project 5328; Sensory Evaluation and Decision Science efforts will move from Project 7184 to Project 5329; and Performance Evaluation in Extreme Environments efforts within Project 7757 will move to Project 7184 to better align efforts.

A. Mission Description and Budget Item Justification

This project conducts applied research to enhance human sensory, cognitive, and physical capabilities to increase Airmen survivability and performance. The research is focused in four areas: biobehavioral performance, biomechanics, applied biotechnology, counterproliferation. Both biobehavioral and biomechanics focus areas enhance Airmen performance and survivability through dynamic human modeling techniques that define the capabilities and limits of system operators under military-unique stressors, as well as assessing and identifying adversarial threats. Applied biotechnology advances bioscience, nanotoxicology, and neuroscience research to protect Airmen from the effects of toxic chemicals and materials, and to monitor and enhance cognitive and physiological performance. Counterproliferation research focuses on biotechnology for the detection, identification, monitoring, and neutralization of biological threat agents.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop interface technologies that enhance human-human and human-machine collaboration in network-centric warfare environments. <i>FY 2009 Accomplishments:</i> In FY 2009: Explored the use of transparent multilingual collaboration tools for distributed multi-entity teaming. Developed multinational speech translation technologies for obscure languages. Determined the effects of collaboration technologies on performance efficiency, shared situational awareness, workload and decision making for tactical command and control. Began development of adaptive automated human-machine interfaces to improve real-time human-machine task sharing. Developed predictive operator state models and assessment tools for dynamic workflow and workload	4.896	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>		PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>																			
B. Accomplishments/Planned Program (\$ in Millions)																							
<table border="1"> <thead> <tr> <th></th> <th>FY 2009</th> <th>FY 2010</th> <th>FY 2011 Base</th> <th>FY 2011 OCO</th> <th>FY 2011 Total</th> </tr> </thead> <tbody> <tr> <td> management. NOTE: In FY 2010, efforts from this major thrust will move to Project 5328 and Project 5329 to better align efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A </td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td> MAJOR THRUST: Develop cognitive system interface technologies to achieve common understanding at all echelons of operations and to improve decision-making and predictive battlespace awareness. <i>FY 2009 Accomplishments:</i> In FY 2009: Expanded contents of DoD software design patterns library. Embedded design patterns in graphical user interface building tools. Demonstrated collaboration techniques in a distributed net-centric environment. Investigated how collaboration techniques can enable distributed team self-synchronization. Researched the cultural and ethnic bases of human decision making and developed human performance models that reflect cultural differences to enable effects-based operations. NOTE: In FY 2010, efforts from this major thrust will move to Project 5328 to better align efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. </td> <td align="center">4.296</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> </tr> </tbody> </table>							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	management. NOTE: In FY 2010, efforts from this major thrust will move to Project 5328 and Project 5329 to better align efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A						MAJOR THRUST: Develop cognitive system interface technologies to achieve common understanding at all echelons of operations and to improve decision-making and predictive battlespace awareness. <i>FY 2009 Accomplishments:</i> In FY 2009: Expanded contents of DoD software design patterns library. Embedded design patterns in graphical user interface building tools. Demonstrated collaboration techniques in a distributed net-centric environment. Investigated how collaboration techniques can enable distributed team self-synchronization. Researched the cultural and ethnic bases of human decision making and developed human performance models that reflect cultural differences to enable effects-based operations. NOTE: In FY 2010, efforts from this major thrust will move to Project 5328 to better align efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.	4.296	0.000	0.000	0.000	0.000
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total																		
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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A						
<p>MAJOR THRUST: Establish technology base for decision support environment that enables interrelation of past, present, and future battlefield missions and to predict the intent/actions of adversaries.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Analyzed the results of the initial demonstration of the integration of the displays and technologies. Completed the transition of advanced uncertainty visualization techniques for command center display. Transitioned methods needed to simulate enemy potential courses of action, including more complex adversary behavior. Incorporated more extrapolated “sensemaking” results into displays. Refined the knowledge representation techniques to model potential adversaries and complex systems of systems and began integrating into displays. Transitioned the integrated set of anticipatory planning and operations work aids to achieve persistent operational planning, persistent prediction, and focused execution and evaluated the effect. Conducted follow-on demonstration of the integration of the developed displays and technologies. NOTE: In FY 2010, efforts from this major thrust will move to Project 5328 and Project 5329 to better align efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>		2.192	0.000	0.000	0.000	0.000
MAJOR THRUST: Develop system control interface concepts enabling operator exploitation of AF platform capabilities. Identify best mix of methods/traditional design to direct operator's attention.		4.423	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
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	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total																		
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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A						
<p>MAJOR THRUST: Develop logistics readiness technology options and perform feasibility studies to support large-scale advanced technology development programs.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Explored and applied integrated, multifunction job aiding concepts in laboratory and controlled field tests. Investigated the usefulness of collaboration support for troubleshooting and complex field repair problems. Explored the hardware, software, and packaging issues for combined job aid and on-the-job training devices for maintenance work. NOTE: In FY 2009, this effort is terminated due to higher AF priorities.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>		1.305	0.000	0.000	0.000	0.000
<p>MAJOR THRUST: Conduct counterproliferation research to support detection, identification, neutralization, and assessment of threat agents and provide information for air operations.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p>		0.000	4.894	5.307	0.000	5.307

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>		PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Conduct research to develop nanoparticle taggants for line-of-sight, standoff assessment of preemptive airstrike destruction of biological warfare agents. Define preliminary techniques to effectively neutralize genetically-modified biological threat agents. Perform initial research to anticipate impacts of high threat environments on air operations and to provide post-attack situational awareness. NOTE: In FY 2010, this major thrust will move from Project 7757 to better align efforts.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Expand and refine nanoparticle taggants for line-of-sight, standoff assessment of preemptive destruction of biological warfare agents. Develop technologies to neutralize genetically modified biological threat agents. Develop technologies to anticipate high threat environments on air operations and to provide post-attack situational awareness.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				48.354	16.893	18.436	0.000	18.436
				FY 2009	FY 2010			
<p>Congressional Add: Imaging Tools for Human Performance Enhancement and Diagnostics.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Imaging Tools for Human Performance Enhancement and Diagnostics.</p>				1.995	1.593			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Imaging Tools for Human Performance Enhancement and Diagnostics.		
Congressional Add: Homeland Emergency Learning and Preparedness (HELP) Center. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for HELP Center. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	2.992	0.000
Congressional Add: Smart View Program (SVP). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for SVP. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.798	0.000
Congressional Add: Tools and Technologies for Incident and Consequence Management. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Tools and Technologies for Incident and Consequence Management. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.798	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Adds Subtotals	6.583	1.593

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702F: <i>Command, Control, and Communications.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603205F: <i>Flight Vehicle Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603245F: <i>Flight Vehicle Technology Integration.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604706F: <i>Life Support Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>				PROJECT 627757: <i>Directed Energy Bioeffects</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
627757: <i>Directed Energy Bioeffects</i>	18.826	15.075	16.723	0.000	16.723	17.629	17.550	18.157	18.597	Continuing	Continuing

Note

Note: In FY 2010, Performance Evaluation in Extreme Environments efforts will move from Project 7757 to Project 7184 to better align efforts.

A. Mission Description and Budget Item Justification

This project conducts applied research on the effects of human exposure to electromagnetic energy (radio frequency to optical), scalable directed energy weapons, and non-lethal weapons. This research addresses fundamental physical principles as well as the psychophysical interaction between directed energy and the individual or groups of individuals. Research is divided into three core focus areas: optical radiation bioeffects, radio frequency radiation (RFR) bioeffects, and biobehavioral systems. Optical radiation bioeffects research enhances combat survivability and systems effectiveness through technologies that enable deployed forces to counter optical threats and exploit optical systems for offensive applications. The RFR bioeffects research focuses on theoretical and empirical dosimetry, bioeffects of short- and long-term exposure, methods to counter RFR threats, and exploitation of directed energy systems for offensive capabilities. Biobehavioral systems research concentrates on the design and characterization of scalable directed energy and novel-effects weapons, and their ability to modify human behavior.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Conducts laboratory experiments and field research on laser bioeffects, enabling military exploitation of laser technology while providing countermeasures for optical hazards/threats.	6.606	7.497	8.186	0.000	8.186
<i>FY 2009 Accomplishments:</i> In FY 2009: Performed field and laboratory experiments to verify and validate optical physics model of bidirectional reflectivity distribution calculations for use as high energy laser collateral hazard assessment tool. Integrated collateral hazard assessment software model into airborne laser platform performing high energy laser system demonstrations. Initiated experiments for future high energy laser weapon systems to predict, evaluate, and explore target bioeffects.					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 627757: <i>Directed Energy Bioeffects</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602720A: <i>Environmental Quality Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604617F: <i>Agile Combat Support.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604706F: <i>Life Support Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	244.890	221.503	207.049	0.000	207.049	209.957	208.178	193.981	192.019	Continuing	Continuing
623012: <i>Advanced Propulsion Technology</i>	17.276	17.494	22.859	0.000	22.859	20.455	23.235	20.850	21.336	Continuing	Continuing
623048: <i>Combustion and Mechanical Systems</i>	27.086	19.638	18.679	0.000	18.679	20.087	18.995	16.640	15.778	Continuing	Continuing
623066: <i>Turbine Engine Technology</i>	85.675	60.655	67.274	0.000	67.274	69.169	65.198	55.689	52.170	Continuing	Continuing
623145: <i>Aerospace Power Technology</i>	48.865	41.254	32.604	0.000	32.604	32.781	33.037	31.897	32.657	Continuing	Continuing
6233SP: <i>Space Rocket Component Tech</i>	56.539	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
624847: <i>Rocket Propulsion Technology</i>	9.449	75.582	58.954	0.000	58.954	61.231	61.141	62.337	63.534	Continuing	Continuing
625330: <i>Aerospace Fuel Technology</i>	0.000	6.880	6.679	0.000	6.679	6.234	6.572	6.568	6.544	0.000	0.000

Note
Note: In FY 2010, funds from Project 33SP have been moved to Project 4847 within this program element and from Project 3048 to Project 5330 within this program element to better align efforts.

A. Mission Description and Budget Item Justification
This program develops propulsion and power technologies to achieve enabling and revolutionary aerospace technology capabilities. The program has seven projects, each focusing on a technology area critical to the Air Force. The Advanced Propulsion Technology project develops high-speed air breathing propulsion engines to include combined cycle, ramjet, and hypersonic scramjet technologies to enable revolutionary propulsion capability for the Air Force. The Combustion and Mechanical Systems project evaluates lubricants and combustion concepts and technologies for new and existing engines and directly supports the Versatile Affordable Advanced Turbine Engine (VAATE) program. The Turbine Engine Technology project develops enabling capabilities to enhance performance and affordability of existing weapon

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>
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systems to include efforts that are part of the VAATE program. This project also develops component technologies for adaptive cycle engine architecture to provide optimized performance/fuel efficiency for widely varying mission needs. The Aerospace Power Technology project develops electrical power and thermal management technologies for military applications that are part of the Integrated Vehicle Energy Technology (INVENT) program. The Rocket Propulsion Technology project develops advances in rocket propulsion technologies for space access, space maneuver, missiles, the sustainment of strategic systems and tactical rockets. The Aerospace Fuel Technology project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse detonation, and combined-cycle engines. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	252.024	196.529	0.000	0.000	0.000
Current President's Budget	244.890	221.503	207.049	0.000	207.049
Total Adjustments	-7.134	24.974	207.049	0.000	207.049
• Congressional General Reductions		-5.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.938			
• Congressional Adds		30.912			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-7.134	0.000	207.049	0.000	207.049

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 623048: *Combustion and Mechanical Systems*

Congressional Add: *National Test Facility for Aerospace Fuels and Propulsion.*

Congressional Add: *Hybrid Bearings.*

Congressional Add Subtotals for Project: 623048

Project: 623066: *Turbine Engine Technology*

Congressional Add: *Split Discharge Variable Delivery Pump for Military Aircraft.*

	FY 2009	FY 2010
	1.356	0.000
	1.596	0.797
	2.952	0.797
	0.000	1.593

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	
<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>		FY 2009	FY 2010
Congressional Add Subtotals for Project: 623066		0.000	1.593
Project: 623145: <i>Aerospace Power Technology</i>			
Congressional Add: <i>Advanced Fuel Cell Based Power System for Small UAVs.</i>		1.197	0.000
Congressional Add: <i>Affordable Lightweight Power Supply Development.</i>		0.997	0.000
Congressional Add: <i>Electronics Liquid Cooling For Advanced Military Ground and Aerospace Vehicle Projects.</i>		0.997	0.000
Congressional Add: <i>Integrated Aircraft Energy Management.</i>		1.995	0.000
Congressional Add: <i>Integrated Power for Aircraft Technologies (INPACT II).</i>		3.491	0.000
Congressional Add: <i>Lithium Ion Domestic Materials Development.</i>		1.596	0.000
Congressional Add: <i>Advanced Lithium Battery Scale-Up and Manufacturing.</i>		1.596	1.593
Congressional Add: <i>Energy Superior Lithium Battery Technology for Defense Applications.</i>		5.983	1.593
Congressional Add: <i>Integrated Engine Starter/Generator.</i>		1.596	1.593
Congressional Add: <i>Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller.</i>		0.798	1.195
Congressional Add: <i>High-Energy Li-Ion Technology for Aviation Batteries.</i>		0.000	1.195
Congressional Add: <i>Thermal and Energy Management for Aerospace.</i>		0.000	3.187
Congressional Add Subtotals for Project: 623145		20.246	10.356
Project: 6233SP: <i>Space Rocket Component Tech</i>			
Congressional Add: <i>Advanced Vehicle and Propulsion Center.</i>		1.197	0.000
Congressional Add: <i>Hydrocarbon Boost Technology Demonstrator.</i>		1.396	0.000
Congressional Add: <i>Development and Testing of Advanced Paraffin Based Hybrid Rockets for Space Applications.</i>		2.792	0.000
Congressional Add: <i>Integrated Propulsion Analysis Tool (IPAT).</i>		1.995	0.000
Congressional Add: <i>Multi-Mode Space Propulsion.</i>		0.798	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>
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<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>	FY 2009	FY 2010
Congressional Add: <i>Vortex Low Cost Rocket Engine.</i>	2.393	0.000
Congressional Add Subtotals for Project: 6233SP	10.571	0.000
Project: 624847: <i>Rocket Propulsion Technology</i>		
Congressional Add: <i>Aerospace Lab Equipment Upgrade.</i>	0.798	1.195
Congressional Add: <i>Advanced Vehicle Propulsion Center.</i>	0.000	2.390
Congressional Add: <i>AFRL Edwards Rocket Test Stand 2-A Technical Improvements.</i>	0.000	3.187
Congressional Add: <i>Development and Testing of Advanced Hybrid Rockets for Space Applications.</i>	0.000	2.788
Congressional Add: <i>Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET).</i>	0.000	4.780
Congressional Add: <i>Multi-Mode Propulsion Phase IIA: High Performance Green Propellant.</i>	0.000	1.593
Congressional Add: <i>Next Generation Solar Electric In-Space Propulsion.</i>	0.000	0.797
Congressional Add Subtotals for Project: 624847	0.798	16.730
Project: 625330: <i>Aerospace Fuel Technology</i>		
Congressional Add: <i>National Test Facility for Aerospace Fuels Propulsion.</i>	0.000	1.306
Congressional Add Subtotals for Project: 625330	0.000	1.306
Congressional Add Totals for all Projects	34.567	30.782

Change Summary Explanation

In FY 2009 and 2010, the change in funding is due to increased emphasis on component development in support of adaptive cycle technologies, improved fuel efficiency, and highly efficient embedded turbine engines. Starting in FY 2010, Funds from Project 33SP have been moved to Project 4847 within this Program Element to more accurately align efforts.

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>
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In FY 2010, Congress added \$1.6 million for Advanced Lithium Battery Scale-up and Manufacturing, \$2.4 million for Advanced Vehicle Propulsion Center, \$1.2 million for Aerospace Lab Equipment Upgrade, \$3.2 million for AFRL Edwards Rocket Test Stand 2-A Technical Improvements, \$2.8 million for Development and Testing of Advanced Hybrid Rockets for Space Applications, \$1.6 million for Energy Superior Lithium Battery Technology for Defense Applications, \$1.2 million for High-Energy Li-Ion Technology for Aviation Batteries, \$0.8 million for Hybrid Bearings, \$1.6 million for Integrated Engine Starter/Generator, \$4.8 million for Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET), \$1.6 million for Multi-Mode Propulsion Phase IIA: High Performance Green Propellant, \$1.312 million for National Test Facility for Aerospace Fuels Propulsion, \$0.8 million for Next Generation Solar Electric In-Space Propulsion, \$1.6 million for Split Discharge Variable Delivery Pump for Military Aircraft, \$3.2 million for Thermal and Energy Management for Aerospace, and \$1.2 million for Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller.

C. Performance Metrics
(U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623012: <i>Advanced Propulsion Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
623012: <i>Advanced Propulsion Technology</i>	17.276	17.494	22.859	0.000	22.859	20.455	23.235	20.850	21.336	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops combined/advanced cycle air breathing high-speed (up to Mach 4) and hypersonic (Mach 4 to 8+) propulsion technologies to provide revolutionary propulsion options for the Air Force. These new engine technologies will enable future high-speed/hypersonic weapons and aircraft concepts. The primary focus is on hydrocarbon-fueled engines capable of operating over a broad range of flight Mach numbers. Efforts include modeling, simulations, and proof of concept demonstrations of critical components; advanced component development; and ground-based demonstrations.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop advanced fuel-cooled scramjet engine technologies to support flight demonstration and enable the broad application of hypersonics to meet future warfighter needs. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued development and demonstration of flight weight engine components and advanced engine control logic. Continued performing trajectory optimization for flight test. Continued evaluating options for scramjet start, including gas generator/heat exchanger system, barbotage fuel injection, plasma ignition, and silane injection with a mechanical throat or air throttle. Conducted design of ground test hardware of advanced scramjet start techniques. Completed development of scramjet engine control logic for flight test engines. Continued verification of operation of engine control techniques, based on rapid shock train identification/characterization coupled with fuel control logic, to ensure stable scramjet operation.	3.200	1.650	1.150	0.000	1.150

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623012: <i>Advanced Propulsion Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Develop low internal drag flame stabilization devices and flight test engine components. Ground test subscale components/combustors to represent medium scale (5 to 20 times) scramjet engines.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>					
Accomplishments/Planned Programs Subtotals	17.276	17.494	22.859	0.000	22.859

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Tech.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602602F: <i>Conventional Munitions.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702E: <i>Tactical Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Structures.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623012: <i>Advanced Propulsion Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0603216F: <i>Aerospace Propulsion and Power Technology.</i>											
• PE 0603601F: <i>Conventional Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE Not Provided (5580): <i>Program is reported to/coordinated by the Joint Army/Navy/NASA/Air Force (JANNAF) Executive Committe</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>				PROJECT 623048: <i>Combustion and Mechanical Systems</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
623048: <i>Combustion and Mechanical Systems</i>	27.086	19.638	18.679	0.000	18.679	20.087	18.995	16.640	15.778	Continuing	Continuing

Note

Note: In FY 2010, the fuels portion of this Project was moved to PE 0602203F Project 5330 within this Program Element to more accurately align efforts with organizational structure.

A. Mission Description and Budget Item Justification

This project evaluates fuels, lubricants, mechanical systems, and combustion concepts for advanced turbine engines, scramjets, pulsed detonation, and combined cycle engines. This project also develops technologies to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include missiles, aircraft, sustained high-speed vehicles, and responsive space launch. Analytical and experimental areas of emphasis include fuels and fuels logistics, lubricants, bearings, electromagnetic rotor, oil-less engine technology, optical diagnostics, fundamental combustion, detonations, combustors and afterburners. Fuels and lubricants for these engines must be thermally stable, cost-effective, and operate over a broad range of conditions. Advanced combustion concepts must be cost-effective, durable, and reduce pollutant emissions. A portion of this project supports adaptive cycle technologies. This effort develops component technology for an adaptive cycle engine architecture that provides optimized performance/fuel efficiency for widely varying mission needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop low-cost additive and fuel system approaches to improve fuel properties. Determine fuel cooling requirements and specifications for adaptive cycle engine architecture.	3.000	0.000	0.000	0.000	0.000
<i>FY 2009 Accomplishments:</i> In FY 2009: Conducted lab-scale evaluation of approaches to increase JP-8 temperature capability to 900 degrees Fahrenheit including thermal stability additives, fuel deoxygenation, advanced alternative energy fuels, and improved materials and coatings. Continued efforts to validate component performance models on aircraft thermal management simulator. Tested fuel candidates in bench scale					

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B. Accomplishments/Planned Program (\$ in Millions)	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>					
<p>MAJOR THRUST: Develop, test, and evaluate revolutionary combustion and propulsion concepts for gas turbine, pulsed detonation, and combined cycle engines for missiles, manned and unmanned systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Evaluated advanced combustion system performance at realistic operating conditions. Demonstrated small-scale inter-turbine burning concepts in small engines. Identified concept designs of inter-turbine burning concepts for large gas turbine engines. Optimized component efficiency of the integrated pulsed detonation/hybrid turbine. Evaluated and optimized advanced combustor, augmentor, and pulse detonation engine concepts using modeling and simulation tools covering wider flight conditions and applications.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Test concept designs for larger-scale inter-turbine burners at relevant gas turbine engine conditions. Evaluate performance characteristics in small internal combustion engines burning military fuels. Identify potential performance improvements for small engines. Investigate novel combustor, augmentor, continuous detonation, and pulse-detonation concepts that reduce fuel burn and improve system performance. Study combustion processes using alternative fuels. Develop new chemistry models for combustion processes. Employ modeling and simulation tools to evaluate advanced combustion systems. Investigate high-efficiency direct injection methods for pulse detonation engines.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Test full-scale inter-turbine burner concepts at relevant engine conditions. Investigate novel valving concepts for pulse detonation engines. Study pulse detonation engine-turbine</p>	7.061	7.100	8.128	0.000	8.128

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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed high-speed techniques for measuring carbon monoxide (CO) to evaluate CO oxidation/combustion efficiency in near constant volume combustion turbine environments. Exploited ultrafast (e.g., femtosecond), ultraintense (e.g., terawatt) laser systems to generate ultrashort x-ray bursts for soot-mitigation studies and dense-fuel-spray imaging. Developed multi-pulse femtosecond ballistic imaging to understand and improve fuel sprays in combustor, augmentor, scramjet, and rocket applications. Developed ultrafast (picosecond, femtosecond) coherent anti-Stokes Raman scattering (CARS) for measuring temperature and critical species in combustion devices. Applied advanced optical diagnostics suites to characterization and improvement of engine combustors and afterburners.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop MHz-rate high-speed measurement techniques for combustion species. Use two-color planar laser-induced fluorescence techniques to measure temperature in experimental combustion systems. Develop robust line-of-sight measurement techniques for temperature and species and apply to relevant combustion devices. Apply ultrafast CARS techniques developed in FY 2009 to practical combustion devices and engine systems. Apply advanced optical diagnostics suites to characterize and improve engine combustors and afterburners.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Use two-color planar laser induced fluorescence techniques to measure temperature in relevant-environment combustion systems. Develop robust line-of-sight measurement techniques for temperature and species and apply to engine systems. Develop simultaneous high-speed planar laser-induced fluorescence and particle-image velocimetry for measurements of species and velocity fields in practical combustion devices. Expand line-of-sight measurement techniques for temperature and species to include many simultaneous lines of sight and tomographic reconstruction of complex reacting flowfields characteristic of real-world hardware. Apply advanced optical diagnostics suites for characterization and improvement of engine combustors and afterburners.</p>								

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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
<p>MAJOR THRUST: Develop, test, and qualify advanced turbine engine lubricants. Generate and maintain military specifications for aviation engine lubricants.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated enhanced 5cSt ester lubricant in JSF thrust growth demo engines. Finalized new enhanced 5cSt oil specification. Began initial testing of new high-mach 7cSt ester lubricant. Demonstrated an integrated bearing/oil health monitoring/prognostic system in full-scale setting and validate life models. Fabricated and tested an efficient mechanical system for ultra efficient turbine engine components and adaptive components for high efficiency. Continued development of high-temperature lubricants for Long Range Strike aircraft.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Complete testing of Joint Enhanced Ester oils in technology readiness level 5 full-scale bearing endurance rigs and in XTE68/LF1 and XTE78/LF1 VAATE-I technology demonstrator engines. Finalize elastomer and load capacity limits jointly with US Navy, Draft Joint USAF-Navy enhanced ester oil specification and support initial transition activities to F-35, C-17, F-16 aircraft. Conduct TRL 2-3 component level testing of high-Mach ester lubricant for future High-Mach Turbine Engine (HMTE) aircraft. Investigate anti-coke lube system surface modifiers using vapor phase coke (VPC) test rig for sustained supersonic engine oil system. Develop intelligent prognostics for lubrication system health monitoring.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Support full transition of Joint Enhanced Ester to F-35 and operational fleet by coordinating with engine manufacturers and users. Conduct adaptive components for high efficiency risk mitigation bearing and gear rig tests with Joint Enhanced Ester in preparation for 2012 demo engine test. Conduct TRL 3-4 component level testing of hi-Mach ester lubricant for HMTE.</p>				5.004	5.241	4.620	0.000	4.620

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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>Demonstrate anti-coke surface modifiers on sub-scale supersonic lube system components. Expand development of intelligent prognostics for lubrication system health monitoring.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
<p>MAJOR THRUST: Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-sized turbine engine applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued sub-scale fatigue life and spall propagation studies of bearing materials and validated spall propagation models with oil candidates and begin full-scale tests. Conducted full-scale bearing evaluation to map out and transfer thermal models in support of adaptive components for high efficiency.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Investigate spall propagation of nitrided bearings. Continue experimental validation of bearing heat generation models. Initiate fabrication of adaptive components for high efficiency and ultra efficient turbine engine mechanical systems components and initiate risk mitigation tests. Test bearing concepts, such as foil bearings for high Mach missile and other future applications. Continue developing in-house rotor dynamic modeling expertise in support of adaptive components for high efficiency, ultra efficient turbine engine components, and future advanced turbine engine efforts.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Investigate fatigue life and spall propagation of VIM VAR 52100 bearings. Complete mechanical systems risk mitigation test activities for adaptive components for high efficiency. Develop coupled bearing & rotor dynamic models for virtual simulation of mechanical systems for advanced engines. Continue developing reliable bearing technologies for sustained hi-mach reusable and limited-life engines. Note: In FY 2011, the efforts in this thrust are reduced due to higher AF priorities.</p>				5.069	5.500	4.719	0.000	4.719

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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.								
Accomplishments/Planned Programs Subtotals				24.134	18.841	18.679	0.000	18.679
				FY 2009	FY 2010			
Congressional Add: National Test Facility for Aerospace Fuels and Propulsion. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed test capability for aerospace fuels and propulsion, focusing on alternative fuel/ combustion testing. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				1.356	0.000			
Congressional Add: Hybrid Bearings. <i>FY 2009 Accomplishments:</i> In FY 2009: Completed crack propagation modeling of C-crack flaws in Si3N4 rolling elements for hybrid bearings. Completed full-scale bearing rig tests of light-weight carbon-carbon composite bearing cages and CSS42L cages. Completed heat treat optimization of 2nd generation P675 bearing steel and fabrication of full-scale hybrid bearing hardware is underway. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Hybrid Bearings.				1.596	0.797			
Congressional Adds Subtotals				2.952	0.797			

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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602805F: <i>Dual Use Science and Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603216F: <i>Aerospace Propulsion and Power Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>				PROJECT 623066: <i>Turbine Engine Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
623066: <i>Turbine Engine Technology</i>	85.675	60.655	67.274	0.000	67.274	69.169	65.198	55.689	52.170	Continuing	Continuing

Note

Note: The funding in this project was increased in FY 2009 to provide emphasis on adaptive cycle technologies, increased fuel efficiency, and ultra efficient turbine engine components.

A. Mission Description and Budget Item Justification

This project develops technology to increase turbine engine operational reliability, durability, mission flexibility, and performance, while reducing weight, fuel consumption, and cost of ownership. Analytical and experimental areas of emphasis are fans and compressors, high temperature combustors, turbines, internal flow systems, controls, augmentor and exhaust systems, integrated power and thermal management systems, engine inlet integration, mechanical systems, and structural design. This project supports the Integrated Versatile Affordable Advanced Turbine Engine (VAATE) program, which is a joint DoD agency and industry effort to focus turbine propulsion technology on national needs. The program plan reflects the technology base support for VAATE activity applicable to global responsive strike, capable unmanned war-fighting, tactical and global mobility, responsive space lift, and persistent intelligence, surveillance, and reconnaissance (ISR). A portion of this project supports adaptive cycle technologies. This effort develops component technology for an adaptive cycle engine architecture that provides optimized performance/fuel efficiency for widely varying mission needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop core turbofan/turbojet engine components (i.e., compressors, combustors, and turbines) for fighters, bombers, sustained supersonic/hypersonic cruise vehicles, and transports.	63.346	42.506	41.097	0.000	41.097
<i>FY 2009 Accomplishments:</i> In FY 2009: Developed and applied advanced modeling and simulation rules and tools for advanced components. Conducted rig testing of advanced high pressure turbine vane and applied blade nano-laminate thermal barrier coating. Began developing computational fluid dynamics methodology for analyzing turbine flows. Began developing ceramic matrix composites lifing models. Conducted bench					

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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Develop and apply advanced modeling and simulation rules and tools for advanced limited life components.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop and apply advanced modeling and simulation rules and tools for advanced limited life components.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				85.675	59.062	67.274	0.000	67.274
				FY 2009	FY 2010			
<p>Congressional Add: Split Discharge Variable Delivery Pump for Military Aircraft.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Split Discharge Variable Delivery Pump for Military Aircraft.</p>				0.000	1.593			
Congressional Adds Subtotals				0.000	1.593			

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C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603216F: <i>Aerospace Propulsion and Power Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602122N: <i>Aircraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603210N: <i>Aircraft Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603003A: <i>Aviation Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
623145: <i>Aerospace Power Technology</i>	48.865	41.254	32.604	0.000	32.604	32.781	33.037	31.897	32.657	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops electrical and thermal management technologies for military aerospace applications. Power component technologies are developed to increase reliability, maintainability, commonality, affordability, and supportability of aircraft and flight line equipment. Research is conducted in energy storage and hybrid power system technologies to enable special purpose applications. Electrical power and thermal management technologies enable all future military directed energy weapon systems. This project supports development of electrical power and thermal management component and systems suitable for applications to legacy and future aircraft platforms including strike and mobility concepts. Lightweight power systems suitable for other aerospace applications are also developed.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop electrical power and thermal management component and subsystem technologies for manned and unmanned systems. Develop hybrid electrical power for special purpose applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Fabricated, integrated, and tested high efficiency, high power, wide temperature range power electrical components. Initiated integration and test air vehicle electromagnetic and radio frequency effects immune components. Integrated and tested thermal management components and subsystems.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Assess component performance objectives needed to meet systems level, energy optimized performance goals.</p>	23.182	25.620	27.521	0.000	27.521

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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Integrated and tested thermal management components and subsystems. Integrated and initiated subsystems test of flight-weight, efficient, energy harvesting, hybrid battery and fuel cell components.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Investigate and develop hybrid energy harvesting storage, management, and distribution architectures. Integrate the energy harvesting technologies with novel battery, and fuel cell technologies. Integrate and test thermal management components and subsystems. Implement methods of energy harvesting and increased energy savings for special purpose applications. Demonstrate long endurance flight tests of integrated systems for unmanned aerial systems.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop increased fuel flexibility and integrated energy harvesting technologies for expanded special purpose applications for improved power and energy density. Perform integrated flight-weight subsystems flight tests to demonstrate power and energy dense goals.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				28.619	30.898	32.604	0.000	32.604
				FY 2009	FY 2010			
Congressional Add: Advanced Fuel Cell Based Power System for Small UAVs.				1.197	0.000			

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued development of micro fuel cell technology for Micro Air Vehicle (MAV) applications. Continued improvements to balance of plant, reactor and power electronics to increase power density of the system and integrate into MAV vehicle.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Affordable Lightweight Power Supply Development.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed novel high-performance and low-cost Membrane Electrode Assemblies, which are capable of operating at high temperatures, reduced humidities and which enable decreased system complexity. Demonstrated their ability to provide an improved Proton Exchange Membrane Fuel Cell system for US military/Air Force applications.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	0.997	0.000
<p>Congressional Add: Electronics Liquid Cooling For Advanced Military Ground and Aerospace Vehicle Projects.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed bonding processes required to fabricate aluminum macrolaminate cold plates for thermal management devices.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	0.997	0.000

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
Congressional Add: Integrated Aircraft Energy Management. <i>FY 2009 Accomplishments:</i> In FY 2009: Integrated engine specifications, data, and propulsion subsystem-level assessments for use in aircraft system design and modeling to develop an energy optimized aircraft. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.995	0.000
Congressional Add: Integrated Power for Aircraft Technologies (INPACT II). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted research to advance the state of the art of energy, power and thermal technologies for aerospace applications. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	3.491	0.000
Congressional Add: Lithium Ion Domestic Materials Development. <i>FY 2009 Accomplishments:</i> In FY 2009: Synthesized, characterized, and scaled-up domestically fabricated cathode material for lithium ion batteries. First step in establishing a stable, domestic capability to produce high quality cathodes with similar or improved performance characteristics as prior material. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.596	0.000
	1.596	1.593

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p>Congressional Add: Advanced Lithium Battery Scale-Up and Manufacturing.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed lithium-ion cathode material selection and initial characterization studies. Conducted preliminary battery performance tests and completed evaluation of cell packaging methods.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Advanced Lithium Battery Scale-Up and Manufacturing.</p>		
<p>Congressional Add: Energy Superior Lithium Battery Technology for Defense Applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed a high energy nano cell design, a high power (HP) cell design for aviation applications, and developed a 270 V aircraft module using the HP cell design. Sample production batteries delivered to the different services for development, test, and evaluation.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Energy Superior Lithium Battery Technology for Defense Applications.</p>	5.983	1.593
<p>Congressional Add: Integrated Engine Starter/Generator.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Fabricated initial prototypes of the lightweight, compact, high temperature starter/generator and Inverter-Converter Controllers to increase the technology readiness level.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Integrated Engine Starter/Generator.</p>	1.596	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623145: <i>Aerospace Power Technology</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
Congressional Add: Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued to develop battery controlling/monitoring technology. Continued to develop an O2 sensor for potential fuel tank applications. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller.	0.798	1.195
Congressional Add: High-Energy Li-Ion Technology for Aviation Batteries. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in High-Energy Li-Ion Technology for Aviation Batteries.	0.000	1.195
Congressional Add: Thermal and Energy Management for Aerospace. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Thermal and Energy Management for Aerospace.	0.000	3.187
Congressional Adds Subtotals	20.246	10.356

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623145: <i>Aerospace Power Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602102F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602805F: <i>Dual Use Science and Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapon Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603216F: <i>Aerospace Propulsion and Power Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>				PROJECT 6233SP: <i>Space Rocket Component Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6233SP: <i>Space Rocket Component Tech</i>	56.539	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note

Note: In FY 2010, work in this project was moved to Project 4847 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops advances in rocket propulsion technologies for space access, space maneuver, tactical and ballistic missiles. Analytical and experimental areas of emphasis are propellants, propellant management, combustion, rocket material applications, Technology for Sustainment of Strategic Systems (TSSS), and novel space propulsion concepts. Technologies of interest will improve reliability, performance, survivability, affordability, and environmental compatibility of future space and missile launch subsystems. Technologies are developed to reduce the weight and cost of components using new materials and improved designs and manufacturing techniques. All efforts in this project contribute to the Integrated High Payoff Rocket Propulsion Technology (IHRPT) program, a joint Department of Defense, NASA, and industry effort to focus rocket propulsion technology on national needs. Technologies developed under this program enable capabilities of interest to both the Department of Defense and the NASA. Efforts include modeling and simulation, proof of concept tests of critical components, advanced component development, and ground-based tests.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop, characterize, and test advanced hydrocarbons, energetics, solid propellant ingredients, and reduced-toxicity monopropellants to increase space launch payload capability. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued evaluation and development of potential hydrocarbon fuel additives to improve performance of kerosene. Continued downselect process and continued scaling-up promising high energy-density materials candidates. Continued development and characterization of high nitrogen ingredients. Evaluated scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Continued exploration	4.241	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>		PROJECT 6233SP: <i>Space Rocket Component Tech</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
component developments. Developed advanced multi-mode chemical-electric propulsion concepts for satellites, down-selected to single design concept and began component developments. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.								
Accomplishments/Planned Programs Subtotals				45.968	0.000	0.000	0.000	0.000
				FY 2009	FY 2010			
Congressional Add: Advanced Vehicle and Propulsion Center. <i>FY 2009 Accomplishments:</i> In FY 2009: Refined analytical tools helping assess feasibility and cost benefit of using "common" boosters/engines across multiple launch platforms. Continued model developments that will support Prompt Global Strike, future ballistic missile development efforts, and other missile/boost concepts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				1.197	0.000			
Congressional Add: Hydrocarbon Boost Technology Demonstrator.				1.396	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 6233SP: <i>Space Rocket Component Tech</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted additional modeling, simulation, and analysis work for liquid rocket engines which accelerate the development of technologies for highly operable and reusable spacelift.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Development and Testing of Advanced Paraffin Based Hybrid Rockets for Space Applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued to scale-up motors. Designed, built, and initiated testing of 24-inch diameter, 30,000 pound thrust-class motors.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	2.792	0.000
<p>Congressional Add: Integrated Propulsion Analysis Tool (IPAT).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Increased fidelity of rocket engine analysis and assessment tools and broadened application to advanced concepts being considered by the Air Force.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.995	0.000
<p>Congressional Add: Multi-Mode Space Propulsion.</p>	0.798	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 6233SP: <i>Space Rocket Component Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Provided added risk reduction efforts to existing scope of work developing multi-mode propulsion technology.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Vortex Low Cost Rocket Engine.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed small launch vehicle that utilizes vortex combustion processes to generate improved performance and/or operability.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	2.393	0.000
Congressional Adds Subtotals	10.571	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (7378): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 6233SP: <i>Space Rocket Component Tech</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 624847: <i>Rocket Propulsion Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624847: <i>Rocket Propulsion Technology</i>	9.449	75.582	58.954	0.000	58.954	61.231	61.141	62.337	63.534	Continuing	Continuing

Note

Note: Funding increase in FY 2010 and out due to multiple programs scheduled for major hardware scale-up and production in preparation for testing in the following years, and to feed technologies into the Hydrocarbon Boost Demo. These have been planned for and are expected. In FY 2010, funds from PE 0602203F Project 33SP have been moved to this project within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops rocket propulsion technologies for space access, space maneuver, missiles, the sustainment of strategic systems (including solid boost/missile propulsion, post boost control, aging and surveillance efforts), and tactical missiles. Analytical and experimental areas of emphasis are propellants, propellant management, combustion, rocket material applications, Technology for Sustainment of Strategic Systems (TSSS), and novel space propulsion concepts. Technologies of interest will improve reliability, performance, survivability, affordability, and environmental compatibility of these systems. Technologies are developed to reduce the weight and cost of components using new materials and improved designs and manufacturing techniques. All efforts in this project contribute to the Technology for the Sustainment of Strategic Systems (TSSS) program and the Integrated High Payoff Rocket Propulsion Technology (IHRPRT) program, a joint Department of Defense, NASA, and industry effort to focus rocket propulsion technology on national needs. Technologies developed under this program enable capabilities of interest to both the Department of Defense and the NASA. Efforts include modeling and simulation, proof of concept tests of critical components, advanced component development, and ground-based tests. Aging and surveillance efforts could reduce lifetime prediction uncertainties for individual motors by 50 percent, enabling motor replacement for cause.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	4.689	3.838	0.000	3.838

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>		PROJECT 624847: <i>Rocket Propulsion Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Conduct advanced service life prediction technology program. Develop and apply existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Continue efforts to integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior. Continue development of next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Conduct advanced service life prediction technology program. Develop and apply existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Continue efforts to integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior. Continue development of next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				8.651	58.852	58.954	0.000	58.954
				FY 2009	FY 2010			
Congressional Add: Aerospace Lab Equipment Upgrade.				0.798	1.195			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 624847: <i>Rocket Propulsion Technology</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Upgraded/augmented existing university facilities/capabilities to train future aerospace engineers.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in the Aerospace Lab Equipment Upgrade.</p>		
<p>Congressional Add: Advanced Vehicle Propulsion Center.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort at the Advanced Vehicle Propulsion Center.</p>	0.000	2.390
<p>Congressional Add: AFRL Edwards Rocket Test Stand 2-A Technical Improvements.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort for AFRL Edwards Rocket Test Stand 2-A Technical Improvements.</p>	0.000	3.187
<p>Congressional Add: Development and Testing of Advanced Hybrid Rockets for Space Applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p>	0.000	2.788

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 624847: <i>Rocket Propulsion Technology</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Development and Testing of Advanced Hybrid Rockets for Space Applications.		
Congressional Add: Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET). <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET).	0.000	4.780
Congressional Add: Multi-Mode Propulsion Phase IIA: High Performance Green Propellant. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Multi-Mode Propulsion Phase II-A: High Performance Green Propellant.	0.000	1.593
Congressional Add: Next Generation Solar Electric In-Space Propulsion. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	0.797

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 624847: <i>Rocket Propulsion Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Next Generation Solar Electric In-Space Propulsion.		
Congressional Adds Subtotals	0.798	16.730

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602303A: <i>Missile Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Tech.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603311F: <i>Ballistic Missile Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603401F: <i>Advanced Spacecraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>				PROJECT 625330: <i>Aerospace Fuel Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625330: <i>Aerospace Fuel Technology</i>	0.000	6.880	6.679	0.000	6.679	6.234	6.572	6.568	6.544	0.000	0.000

Note

Note: The funding in this project was moved from PE 0602203F Project 3048 starting in FY 2010 to more accurately align efforts with organizational structure.

A. Mission Description and Budget Item Justification

This project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse detonation and combined cycle engines. This project also considers fuel related concepts that can increase turbine engine operational reliability, durability, mission flexibility, energy efficiency, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include missiles, aircraft, sustained high-speed vehicles, and responsive space launch. Analytical and experimental areas of emphasis include evaluations of fuel properties and characteristics of alternative fuels developed from unconventional sources (such as coal, natural gas, biomass, and combinations thereof), fuels and components used in integrated thermal and energy management systems including high heat sink fuel capability, fuels logistics and associated vulnerabilities, and combustion diagnostics and engine emissions measurements.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Conduct research and perform technical assessments of alternative hydrocarbon fuels derived from coal, natural gas, and biomass for use in legacy and advanced aerospace systems. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Complete component evaluations of 50 percent synthetic paraffinic kerosene (SPK) produced by Fischer-Tropsch synthesis blended with 50 percent conventional aviation fuel. Conduct component "fit-for-purpose" evaluations of up to 100 percent SPK. Conduct initial evaluations of biomass derived aviation fuels, both blended with conventional aviation fuel and used 100 percent.	0.000	2.891	3.200	0.000	3.200

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>		PROJECT 625330: <i>Aerospace Fuel Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Complete combustion emissions evaluations of high pressure combustor sectors operating on 100 percent pure and blends of synthetic paraffinic kerosene with conventional aviation fuel and compare to analytical predictions. Develop diagnostic protocols for aircraft ground emissions measurements and perform emissions evaluations on fielded engines to investigate particulate formation and composition. Initiate development of emissions diagnostics applicable to advanced high pressure combustor systems. Conduct preliminary assessment of combustion emissions from biomass derived aviation fuels.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop diagnostic protocols for aircraft ground emissions measurements and perform emissions evaluations on fielded engines to investigate particulate formation and composition. Develop emissions diagnostics applicable to advanced high pressure combustor systems. Assess combustion emissions from biomass derived aviation fuels. Conduct assessment of combustion emissions from blends of coal/biomass derived aviation fuels.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				0.000	5.574	6.679	0.000	6.679
				FY 2009	FY 2010			
Congressional Add: National Test Facility for Aerospace Fuels Propulsion.				0.000	1.306			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 625330: <i>Aerospace Fuel Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.		
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort at the National Test Facility for Aerospace Fuels Propulsion.		
Congressional Adds Subtotals	0.000	1.306

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602805F: <i>Dual Use Science and Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603216F: <i>Aerospace Propulsion and Power Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>							
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	130.902	136.012	157.497	0.000	157.497	137.261	140.206	144.546	147.563	Continuing	Continuing
622002: <i>Electronic Component Technology</i>	36.556	40.251	34.458	0.000	34.458	43.702	44.670	51.281	52.895	Continuing	Continuing
622003: <i>EO Sensors & Countermeasures Tech</i>	18.447	18.603	21.430	0.000	21.430	28.644	29.756	30.694	31.299	Continuing	Continuing
6244SP: <i>Space Sensors</i>	8.438	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
624916: <i>Electromagnetic Tech</i>	17.470	19.056	18.905	0.000	18.905	0.000	0.000	0.000	0.000	Continuing	Continuing
626095: <i>Sensor Fusion Technology</i>	25.187	22.179	27.008	0.000	27.008	24.962	25.520	26.017	26.239	Continuing	Continuing
627622: <i>RF Sensors & Countermeasures Tech</i>	24.804	35.923	55.696	0.000	55.696	39.953	40.260	36.554	37.130	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops the technology base for Air Force aerospace sensors and electronic combat. Advances in aerospace sensors are required to increase combat effectiveness by providing "anytime, anywhere" surveillance, reconnaissance, precision targeting, and electronic warfare capabilities. To achieve this progress, this program pursues simultaneous advances in: 1) generating, controlling, receiving, and processing electronic and photonic signals for radio frequency (RF) sensor aerospace applications; 2) electro-optical (EO) aerospace sensor technologies for a variety of offensive and defensive uses; 3) radio frequency antennas and associated electronics for airborne and space surveillance, together with active and passive electro-optical sensors; 4) technologies to manage and fuse on-board sensor information for timely, comprehensive situational awareness; and 5) technology for reliable, all-weather surveillance, reconnaissance, and precision strike radio frequency sensors and electronic combat systems. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary sensor, electronics, and electronic combat technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	128.447	121.768	0.000	0.000	0.000
Current President's Budget	130.902	136.012	157.497	0.000	157.497
Total Adjustments	2.455	14.244	157.497	0.000	157.497
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.576			
• Congressional Adds		14.820			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	2.455	0.000	157.497	0.000	157.497

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 622002: *Electronic Component Technology*

Congressional Add: *Optically Pumped Atomic Laser (OPAL).*

Congressional Add: *Low Voltage, Wideband Electro-Optic Polymer Modulator.*

Congressional Add: *Advanced Electronic Components for Sensor Arrays.*

Congressional Add: *Advanced Integrated Microsystems for Military Electronic Systems .*

Congressional Add: *On-Chip Integrated Photonic Polymer Transceiver.*

Congressional Add Subtotals for Project: 622002

Project: 622003: *EO Sensors & Countermeasures Tech*

Congressional Add: *Super-resolution Sensor System (S3).*

Congressional Add: *Watchkeeper.*

Congressional Add Subtotals for Project: 622003

	<u>FY 2009</u>	<u>FY 2010</u>
	2.792	0.000
	2.992	0.000
	0.000	2.390
	0.000	2.470
	0.000	4.481
	5.784	9.341
	1.995	0.000
	0.798	1.593
	2.793	1.593

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2009	FY 2010
Project: 624916: <i>Electromagnetic Tech</i>		
Congressional Add: <i>Wideband Digital Airborne Electronic Sensing Array (WDAESA).</i>	2.393	0.000
Congressional Add Subtotals for Project: 624916	2.393	0.000
Project: 626095: <i>Sensor Fusion Technology</i>		
Congressional Add: <i>Sensor Fusion.</i>	2.394	0.000
Congressional Add: <i>Advanced Data Exploitation and Visualization.</i>	0.798	0.000
Congressional Add: <i>Information Quality Tools for Persistent Surveillance Data Sets.</i>	1.596	1.434
Congressional Add: <i>Net-Centric Sensor Grids.</i>	0.798	2.390
Congressional Add: <i>Persistent Sensing Data Processing, Storage and Retrieval.</i>	1.596	0.000
Congressional Add Subtotals for Project: 626095	7.182	3.824
Project: 627622: <i>RF Sensors & Countermeasures Tech</i>		
Congressional Add: <i>Weather Sensors for Cursor On Target.</i>	1.596	0.000
Congressional Add Subtotals for Project: 627622	1.596	0.000
Congressional Add Totals for all Projects	19.748	14.758

Change Summary Explanation

Note: In FY 2010, Congress added \$2.4 million for Advanced Electronic Components for Sensor Arrays, \$2.48 million for Advanced Integrated Microsystems for Military Electronic Systems, \$1.44 million for Information Quality Tools for Persistent Surveillance Data Sets, \$2.4 million for Net-Centric Sensor Grids, \$4.5 million for On-Chip Integrated Photonic Polymer Transceiver, and \$1.6 million for Watchkeeper. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 622002: <i>Electronic Component Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622002: <i>Electronic Component Technology</i>	36.556	40.251	34.458	0.000	34.458	43.702	44.670	51.281	52.895	Continuing	Continuing

Note
Note: In FY 2010, funds from Project 44SP are being moved to Project 2002 to better align efforts.

A. Mission Description and Budget Item Justification

This project focuses on generating, controlling, receiving, and processing electronic signals for radio-frequency sensor aerospace applications. The enabling technologies developed under this project will be used for intelligence, surveillance, reconnaissance (ISR), electronic warfare, battlespace access, and precision engagement capabilities. The technologies developed include: exploratory device concepts, solid state power devices and amplifiers; low noise and signal control components; photonic components; high-temperature electronics; signal control and distribution; signal processing; multi-function monolithic integrated circuits; high-speed analog-to-digital and digital-to-analog mixed mode integrated circuits; reconfigurable electronics; power distribution; multi-chip modules; and high density packaging and interconnect technologies. This project also designs, develops, fabricates, and evaluates techniques for integrating combinations of these electronic component technologies. The project aims to demonstrate significantly improved military sensors of smaller size, lower weight, lower cost, lower power dissipation, higher reliability, and improved performance. The device and component technology developments under this project are military unique; they are based on Air Force and other Department of Defense weapon systems requirements in the areas of radar, communications, electronic warfare, navigation, and smart weapons.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop compact, affordable, multi-function components for aerospace sensors. Develop advanced electronic and optoelectronic aperture subsystems for affordable and scalable sensors.	12.478	6.368	9.975	0.000	9.975
<i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated integrated wideband subarray for future multi-intelligence electronic warfare and radar applications. Designed and developed digital receiver components to enable full digital receiver and exciter capabilities per transmit/receive site to enable future software-controlled phased arrays. Developed new hardware to exploit emerging metamaterials for compact radiating					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.						
<p>MAJOR THRUST: Develop and demonstrate innovative radio-frequency component technology to lower system cost through reduction of part count, chip size, and design, production, and integration costs.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed and demonstrated highly integrated phase control components for use in wideband multi-function sensors.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Design and develop highly reconfigurable fully programmable microwave array and flexible optoelectronic integrated circuits using highly integrated techniques for lighter weight radio-frequency and optical apertures.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. Effort eliminated due to higher Air Force priorities.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>		2.169	1.013	0.000	0.000	0.000
<p>MAJOR THRUST: Develop integrated design, modeling and simulation tools, and integration techniques for complex mixed-signal component development in advanced electronic component technologies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated closed loop characterization of performance driven component and device design, fabrication, and characterization with first pass success.</p>		2.169	5.127	5.670	0.000	5.670

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.						
Accomplishments/Planned Programs Subtotals		30.772	30.910	34.458	0.000	34.458
		FY 2009	FY 2010			
Congressional Add: Optically Pumped Atomic Laser (OPAL). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for the OPAL. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		2.792	0.000			
Congressional Add: Low Voltage, Wideband Electro-Optic Polymer Modulator. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Low Voltage, Wideband Electro-Optic Polymer Modulator. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		2.992	0.000			
Congressional Add: Advanced Electronic Components for Sensor Arrays.		0.000	2.390			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>	
B. Accomplishments/Planned Program (\$ in Millions)			
		FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.			
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Electronic Components for Sensor Arrays.			
Congressional Add: Advanced Integrated Microsystems for Military Electronic Systems . <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.		0.000	2.470
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Integrated Microsystems for Military Electronic Systems.			
Congressional Add: On-Chip Integrated Photonic Polymer Transceiver. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.		0.000	4.481
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for On-Chip Integrated Photonic Polymer Transceiver.			
Congressional Adds Subtotals		5.784	9.341

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (8720): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 622003: <i>EO Sensors & Countermeasures Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622003: <i>EO Sensors & Countermeasures Tech</i>	18.447	18.603	21.430	0.000	21.430	28.644	29.756	30.694	31.299	Continuing	Continuing

Note

Note: In FY 2010, funds from Project 44SP move to Project 2003 within this Program Element to better align efforts.

A. Mission Description and Budget Item Justification

This project determines the technical feasibility of advanced electro-optical aerospace sensor technologies for a variety of offensive and defensive uses. The sensor technologies under development range from the ultraviolet through the infrared portion of the spectrum. Related efforts include improvements in avionics integration, digital processing, analysis tools, and sensor architectures. One of the project's main goals is to improve electro-optical and related technologies for the detection, tracking, and identification of non-cooperative and difficult targets, such as those obscured by camouflage. This project also develops the passive and active imaging sensors and algorithms needed to enable precision targeting in severe weather. These technologies are critical to future aerospace surveillance and targeting. Other project goals include advanced electro-optical threat warning and countermeasures.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop technology for non-cooperative detection and identification of airborne and ground-based targets. <i>FY 2009 Accomplishments:</i> In FY 2009: Performed sensor concept demonstrations for multi-discriminant active and passive sensing and quantified expected system performance. Characterized target discrimination and shape extraction performance using passive multispectral and polarimetric sensing techniques. Demonstrated hybrid focal planes and read-out electronics for simultaneous multi-discriminant active and passive sensing, and refined image processing techniques for sensor data enhancement. Performed trade-off studies for long range target identification using passive and active techniques, including polarimetric discrimination and synthetic aperture laser radar.	2.719	2.334	10.972	0.000	10.972

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622003: <i>EO Sensors & Countermeasures Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate integrated beam rider laser, direct tactical and indirect tactical laser detection sensors supporting proactive infrared countermeasure hand-off goals.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>					
Accomplishments/Planned Programs Subtotals	15.654	17.010	21.430	0.000	21.430

	FY 2009	FY 2010
<p>Congressional Add: Super-resolution Sensor System (S3).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for the Super-resolution Sensor System.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.995	0.000
<p>Congressional Add: Watchkeeper.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for the Watchkeeper.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Watchkeeper.</p>	0.798	1.593
Congressional Adds Subtotals	2.793	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622003: <i>EO Sensors & Countermeasures Tech</i>

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (8997): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603253F: <i>Advanced Sensor Integration.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 6244SP: <i>Space Sensors</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6244SP: <i>Space Sensors</i>	8.438	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, funds from Project 44SP are being moved to Projects 2002, 2003, and 7622 to better align efforts.

A. Mission Description and Budget Item Justification

This project focuses on developing methods of generating, controlling, receiving, transmitting, and processing electronic, photonic, optical, and opto-electronic (mixed) signals for radio frequency space sensor applications. The enabling technologies will be used for intelligence, surveillance, reconnaissance, electronic warfare, and precision engagement sensors based in space. This project develops the baseline technologies required to manage and perform on-board space sensor information fusion for timely and comprehensive communications and situational awareness. Through modeling and simulation, this project develops and evaluates innovative electromagnetic and electronic countermeasures for space applications. This project aims to demonstrate significantly improved military space sensors of smaller size, lower weight, lower cost, lower power dissipation, higher reliability, and improved performance. This project also develops and assesses multi-dimensional adaptive techniques in radar technology for affordable and reliable space surveillance and reconnaissance systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop hybrid space-based sensor solutions to be responsive to space needs and detect difficult targets. Develop jam-resistant space-qualified time, position, and velocity sensors. <i>FY 2009 Accomplishments:</i> In FY 2009: Experimentally assessed responsive "plug-and-play" satellite implementation concept. Designed size-, weight-, and power-restricted precision time, position, and velocity sensor techniques for space-based applications. Demonstrated constructive systems engineering model to assess space-based assured reference techniques in terms of measures of performance and warfighter utility. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	2.600	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>		PROJECT 6244SP: <i>Space Sensors</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
<p>MAJOR THRUST: Develop advanced component technology for space-based sensors that focuses on improving performance and reducing size, mass, and prime power.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed compact tunable filters for interference signal rejection in dense signal environments.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>				1.425	0.000	0.000	0.000	0.000
<p>MAJOR THRUST: Develop sensor techniques to achieve highly accurate and robust navigation performance for hypersonic air vehicles in prompt global strike applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Designed a radio-frequency hardware-in-the-loop testbed to implement hypersonic air vehicle plasma characteristics, platform trajectories, and highly accurate and robust navigation techniques for space-based applications. Developed a constructive systems engineering model to assess hypersonic navigation techniques in terms of measures of performance and warfighter utility.</p>				1.317	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 6244SP: <i>Space Sensors</i>
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B. Accomplishments/Planned Program (\$ in Millions)	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>					
Accomplishments/Planned Programs Subtotals	8.438	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (9214): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Tech.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy
Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 624916: <i>Electromagnetic Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624916: <i>Electromagnetic Tech</i>	17.470	19.056	18.905	0.000	18.905	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technologies for sensor systems that cover the electromagnetic spectrum from radio-frequency to electro-optical. It develops radio-frequency antennas and associated electronics for airborne and space-based surveillance. It also investigates radio-frequency scattering phenomenology for applications in ground and air moving target indicators in extremely cluttered environments. The project develops active and passive electro-optical sensors for use in concert with radio-frequency sensors. It develops low-cost active sensors that use reliable high-performance solid state components for target detection and identification and missile threat warning. The project also develops passive multi-dimensional sensors to improve battlefield awareness and identify threats at long-range.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Investigate detection of difficult airborne and ground-based targets in clutter from airborne or space-based surveillance platforms.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed analytical and computationally efficient tools for multi-sensor integration for target detection, tracking, and classification in a knowledge-aided framework exploiting physics-based and data dependent electromagnetic models of targets and clutter.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue to develop analytical and computationally efficient tools for multi-sensor integration for target detection, tracking, and classification in a knowledge-aided framework exploiting physics-based and data dependent electromagnetic models of targets and clutter.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete development of analytical and computationally efficient tools for multi-sensor integration for target detection, tracking, and classification in a knowledge-aided framework exploiting</p>	2.462	3.131	3.489	0.000	3.489

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>		PROJECT 624916: <i>Electromagnetic Tech</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Continue development of electro-optical sensor hardware for detecting chemical, biological, radioactive, nuclear or high explosive weapons using spectral or spectral temporal intelligence. Continue development of chemical biological standoff detection hardware. Complete spectral temporal sensor demonstration for cueing electro-optical and infrared persistent surveillance sensors.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not applicable.</p>								
Accomplishments/Planned Programs Subtotals				15.077	19.056	18.905	0.000	18.905
				FY 2009	FY 2010			
<p>Congressional Add: Wideband Digital Airborne Electronic Sensing Array (WDAESA).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for WDAESA.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				2.393	0.000			
Congressional Adds Subtotals				2.393	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 624916: <i>Electromagnetic Tech</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (9431): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 626095: <i>Sensor Fusion Technology</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
626095: <i>Sensor Fusion Technology</i>	25.187	22.179	27.008	0.000	27.008	24.962	25.520	26.017	26.239	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the technologies required to perform management and fusion of sensor information for timely, comprehensive situational awareness, automatic target recognition, integrated fire control, and bomb damage assessment. This project determines the feasibility of technologies and concepts for fire control that help to precisely locate, identify, and target airborne and surface targets. The project emphasizes finding reduced signature targets and targets of opportunity. It will enable new covert tactics for successful air-to-air and air-to-surface strikes. This project also develops the technologies required to create trusted autonomic, distributed, collaborative, and self-organizing sensor systems that provide anticipatory and persistent intelligence, surveillance, and reconnaissance (ISR), situational awareness, and decision support for multi-layered sensing. This program provides the technologies for: 1) trusted sensors and trusted sensor systems that will deter reverse engineering and exploitation of our critical hardware and software technology and impede unwanted technology transfer, alteration of system capability, and prevent the development of countermeasures to U.S. systems; 2) collaborative tasking of our own distributed heterogeneous sensor networks across a region and co-opted tasking of both traditional and non-traditional adversary sensors; 3) secure sensor web backbone technologies, sensor web physical topologies, and related protocols to assure reliable trusted sensor interactions; and 4) defining architectures for distributed trusted collaborative heterogeneous sensor systems and semantic sensor networks, developing new methodologies for system of systems sensor engineering and analysis, and new techniques for sensor network situation awareness and predictive analytics.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and assess single and multi-sensor automatic target recognition (ATR) and sensor fusion algorithms for rapidly finding, tracking, and targeting mobile targets. <i>FY 2009 Accomplishments:</i> In FY 2009: Assessed the image formation and processing of synthetic aperture radar, electro-optical/infrared/hyper-spectral imagery data from research and development data collections taking advantage of disparate phenomenology to improve automatic target recognition detection, classification and identification performance. Developed and validated multi-sensor/multi-	1.387	2.010	7.261	0.000	7.261

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 626095: <i>Sensor Fusion Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>frequency synthetic data generation tools required to augment and enhance collected research, development, and operational data sets. Initiated development of tools and technology supporting other phenomenological features that heretofore have not been exploited. Conducted laboratory tests and assessment of multi-sensor and sensor fusion algorithms for automated exploitation and weapon delivery systems. Enhanced automatic target recognition performance evaluation theory for radar automatic target recognition technology and for electro-optical and multiple-sensor automatic target recognition technologies. Assessed methods and measures for moving target tracking and identification approaches using multiple sensor types. Developed analysis methods and measures for assessing automated exploitation and rapid response systems proposed for post-conflict force protection, stability, and security operations.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue to assess the image formation and processing of synthetic aperture radar, electro-optical/infrared/hyper-spectral imagery data from research and development data collections taking advantage of disparate phenomenology to improve automatic target recognition detection, classification and identification performance. Continue to develop and validate multi-sensor/multi-frequency synthetic data generation tools required to augment and enhance collected research, development, and operational data sets. Search out unexploited phenomenological features and initiate development of tools and technology required to exploit said features. Continue laboratory tests and assessment of multi-sensor and sensor fusion algorithms for automated exploitation and weapon delivery systems. Continue enhancements to databases, tools and laboratory environments as required to support assessment and validation of models and exploitation technologies. Continue to improve automatic target recognition performance evaluation theory for automatic target recognition technologies. Continue to develop assessment methods and measures for moving target tracking and identification approaches using multiple sensor types. Continue development of analysis methods and measures for assessing automated exploitation and rapid response systems proposed for post-conflict force protection, stability, and security operations.</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 626095: <i>Sensor Fusion Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>system trustworthiness for collaborative and distributed heterogeneous sensing system architectures and semantic sensor networks. Continue development of new technologies and methodologies for producing adaptive, trusted architectures for multi-layered sensing.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete development of new technologies and methodologies for producing adaptive, trusted architectures for multi-layered sensing. Initiate development of advanced trusted sensor web services, middleware, and frameworks for multi-layered sensing and cyber sensing. Initiate development of methodologies and techniques for visualization and portrayal of a global trust picture. Initiate development of technologies for assessing, evaluating, and managing trust at a distance in for distributed heterogeneous sensor systems.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>						
<p>MAJOR THRUST: Develop technologies that enable autonomic trusted features in sensor systems to deter reverse engineering and exploitation of critical military hardware and software systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop and demonstrate critical technologies for trusted sensors for multi-layered ISR sensing systems to assure anti-tamper and software protection of key military capabilities. Assess and evaluate commercial technologies for application to military trusted systems. Develop and demonstrate secure cyber sensing station for ISR and cyberspace applications. Initiate development of autonomic trusted sensor technologies to address self-ware, self-healing, and self-organizing sensor systems.</p>		0.000	1.098	1.429	0.000	1.429

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>		PROJECT 626095: <i>Sensor Fusion Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Continue demonstration of laboratory prototype of sensor web backbone and physical topologies. Continue development of advanced sensor bus technologies for trusted sensing. Continue analysis to exploit wired and wireless sensor web systems and begin analysis of technologies to defend sensor web systems. Complete development of the sensor web backbone integration laboratory.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				18.005	18.355	27.008	0.000	27.008
				FY 2009	FY 2010			
Congressional Add: Sensor Fusion.				2.394	0.000			
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Sensor Fusion.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>								
Congressional Add: Advanced Data Exploitation and Visualization.				0.798	0.000			
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advanced Data Exploitation and Visualization.</p>								

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 626095: <i>Sensor Fusion Technology</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Information Quality Tools for Persistent Surveillance Data Sets. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Information Quality Tools for Persistent Surveillance Data Sets. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Information Quality Tools for Persistent Surveillance Data Sets.	1.596	1.434
Congressional Add: Net-Centric Sensor Grids. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Net-Centric Sensor Grids. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for net-centric sensor grids	0.798	2.390
Congressional Add: Persistent Sensing Data Processing, Storage and Retrieval. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Persistent Sensing Data Processing, Storage and Retrieval.	1.596	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 626095: <i>Sensor Fusion Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Adds Subtotals	7.182	3.824

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (9846): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602602F: <i>Conventional Munitions.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603270F: <i>Electronic Combat Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603226E: <i>Experimental Evaluation of Major Innovative Technologies.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 627622: <i>RF Sensors & Countermeasures Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
627622: <i>RF Sensors & Countermeasures Tech</i>	24.804	35.923	55.696	0.000	55.696	39.953	40.260	36.554	37.130	Continuing	Continuing

Note
Note: In FY 2010, funds from Project 44SP are being moved to Project 7622 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops and assesses affordable, reliable all weather radio-frequency sensing and countermeasure concepts for aerospace applications covering the range of radio frequency sensors including communications, navigation, intelligence, surveillance, reconnaissance, and radar, both active and passive, across the air, land, sea, space and cyber domains. This project also develops and evaluates technology for intelligence, surveillance, and reconnaissance sensors, fire control radars, electronic warfare, integrated radar and electronic warfare systems, and offensive information operations systems. It emphasizes the detection and tracking of surface and airborne targets with radio-frequency signatures that are difficult to detect due to reduced radar cross sections, concealment and camouflage measures, severe clutter, or heavy jamming. Techniques exploited include the use of multiple radio-frequency phenomenologies, multi dimensional adaptive processing, advanced waveforms and knowledge-aided processing techniques. This project also develops the radio-frequency warning and countermeasure technology for advanced electronic warfare and information operations applications. Specifically, it develops techniques and technologies to detect and counter the communications links and sensors of threat air defense systems and hostile command and control networks. The project also exploits emerging technologies and components to provide increased capability for offensive and defensive radio-frequency sensors, including radar warning, radio-frequency electronic warfare, and electronic intelligence applications.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop technology to reduce size, weight, and power of RF sensors. Develop technology to enable affordable upgrades and optimally control RF and multi-intelligence sensors. <i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated integration of an electronic warfare and surveillance suite in a size, weight, and power constrained environment. Developed and evaluated advanced mode control concepts to	7.668	5.380	4.588	0.000	4.588

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 627622: <i>RF Sensors & Countermeasures Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Weather Sensors for Cursor On Target.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
Congressional Adds Subtotals	1.596	0.000

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (10219): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603253F: <i>Advanced Avionics Integration.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602782A: <i>Command, Control, Communications Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602232N: <i>Navy C3 Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 627622: <i>RF Sensors & Countermeasures Tech</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	136.072	119.125	111.857	0.000	111.857	117.238	117.382	122.143	128.614	Continuing	Continuing
621010: <i>Space Survivability & Surveillance</i>	48.855	52.983	48.216	0.000	48.216	46.479	43.864	44.915	45.815	Continuing	Continuing
624846: <i>Spacecraft Payload Technologies</i>	26.837	15.797	20.299	0.000	20.299	20.251	19.990	20.188	18.343	Continuing	Continuing
625018: <i>Spacecraft Protection Technology</i>	6.687	7.992	7.556	0.000	7.556	9.006	13.287	13.338	13.156	Continuing	Continuing
628809: <i>Spacecraft Vehicle Technologies</i>	53.693	42.353	35.786	0.000	35.786	41.502	40.241	43.702	51.300	Continuing	Continuing

A. Mission Description and Budget Item Justification

This PE focuses on four major areas. First, space environmental protection develops technologies to understand, mitigate, and exploit effects of weather and geophysics environments on the design and operation of Air Force systems. Second, spacecraft payload technologies improve satellite payload operations by investigating advanced component and subsystem capabilities. Third, spacecraft protection develops technologies for protecting U.S. space assets in potential hostile settings. The last major area, spacecraft vehicles, focuses on spacecraft platform, payload, and control technologies, and their interactions. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary space technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	138.980	104.148	0.000	0.000	0.000
Current President's Budget	136.072	119.125	111.857	0.000	111.857
Total Adjustments	-2.908	14.977	111.857	0.000	111.857
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.503			
• Congressional Adds		15.480			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-2.908	0.000	111.857	0.000	111.857

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 621010: *Space Survivability & Surveillance*

Congressional Add: *Nuclear Test Seismic Research/AFRL Seismic Research Program.*

Congressional Add Subtotals for Project: 621010

Project: 624846: *Spacecraft Payload Technologies*

Congressional Add: *Field Programmable Gate Arrays/ Field Programmable Gate Arrays Mission Assurance Center.*

Congressional Add: *Radiation Hardened Non-Volatile Memory Technology.*

Congressional Add: *Reconfigurable Electronic and Non-Volatile Memory Research.*

Congressional Add Subtotals for Project: 624846

Project: 625018: *Spacecraft Protection Technology*

Congressional Add: *Defensive Counterspace Testbed.*

	<u>FY 2009</u>	<u>FY 2010</u>
	1.995	4.979
	1.995	4.979
	2.992	0.000
	1.596	0.000
	1.995	0.797
	6.583	0.797
	0.798	0.000
	0.798	0.000

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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Congressional Add Subtotals for Project: 625018		
Project: 628809: <i>Spacecraft Vehicle Technologies</i>		
Congressional Add: <i>Multicontinuum Technology for Space Structures.</i>	2.872	0.000
Congressional Add: <i>Shielding Rocket Payloads.</i>	0.399	0.000
Congressional Add: <i>Center for Responsive Space Systems.</i>	0.798	0.000
Congressional Add: <i>Lightweight, High-Efficiency Solar Cells for Spacecraft.</i>	0.798	0.000
Congressional Add: <i>Massively Parallel Optical Interconnects for MicroSatellite Applications.</i>	1.596	0.000
Congressional Add: <i>Center for Solar Electricity and Hydrogen.</i>	3.590	3.983
Congressional Add: <i>Advanced Modular Avionics for Operationally Responsive Space Use/Advanced Modular Avionics for Operationally Responsive Satellite Use.</i>	2.394	2.470
Congressional Add: <i>Center for Space Entrepreneurship.</i>	0.000	1.593
Congressional Add: <i>Mission Design and Analysis Tool.</i>	0.000	1.593
Congressional Add Subtotals for Project: 628809	12.447	9.639
Congressional Add Totals for all Projects	21.823	15.415

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note: In FY 2010, Congress added \$2.48 million for Advanced Modular Avionics for Operationally Responsive Satellite Use, \$4.0 million for the Center for Solar Electricity and Hydrogen, \$1.6 million for the Center for Space Entrepreneurship, \$1.6 million for Mission Design and Analysis Tool, \$5.0 million for AFRL Seismic Research Program, and \$0.8 million for Reconfigurable Electronics and Non-Volatile Memory Research.

C. Performance Metrics.
(U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 621010: <i>Space Survivability & Surveillance</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
621010: <i>Space Survivability & Surveillance</i>	48.855	52.983	48.216	0.000	48.216	46.479	43.864	44.915	45.815	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the technologies to exploit the space environment for warfighter's future capabilities. The project focuses on characterizing and forecasting the battlespace environment for realistic space system design, modeling, and simulation, as well as the battlespace environment's effect on space systems' performance. It includes technologies to specify and forecast the environment from "mud to sun" for planning operations and ensuring uninterrupted system performance, optimize space-based surveillance operations, and allow the opportunity to mitigate or exploit the space environment for both offensive and defensive operations. Finally, this project includes the seismic research program that supports national requirements for monitoring nuclear explosions.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop technologies for specifying, monitoring, predicting, and controlling space environmental conditions hazardous to Department of Defense (DoD) operational space systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Provided scientific and technical support for both optical and radio parts of solar environmental observing network replacement program. Explored techniques for measuring coronal and interplanetary magnetic fields using new wide-field radio arrays. Tested and evaluated empirical flare prediction models based on synoptic data from Air Force and national observatory assets. Coupled radiation belt model to global geospace environment models to increase accuracy and lead time. Utilized three-dimensional global radiation belt diffusion models to simulate global effect of wave-particle interactions from very low frequency (VLF) electromagnetic wave power injected in narrow altitude slices of radiation belts. Validated models for virtual VLF electromagnetic wave generation in the ionosphere and global transport and power distribution.</p>	8.767	8.079	8.800	0.000	8.800

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 621010: <i>Space Survivability & Surveillance</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>feasibility of HT applications for technical intelligence from ground, air, and space-based platforms. Defined the requirements and configuration of a space-based HT sensor. Developed end-to-end simulation capability, based on the sensor performance models, to assist acquisition community and space operator community in trade space analyses of sensors or sensor suites. The emphasis was on the capabilities to derive information and intelligence about space objects with signals in all bands and all temporal regimes. Investigated spectral applications for material identification in support of military chemical/biological weapons detection and identification in the thermal infrared and other bands. Completed transition of spectral image processing and exploitation algorithms and related signature databases to government users. Completed analysis and documentation of military utility of planned space demonstrations of spectral theater surveillance and area search missions. Completed validation of hyperspectral models.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate aircraft-based detection of large booster missile launch through optically thick sunlit clouds using existing HT image processing. Start focused effort on thermal atmospheric model validation and inversion. Initiate the development of sensor system to characterize space object orbital maneuver based on propulsion signatures. With trade space analyses, downselect and develop technical specification of space-based multi-phenomenology Space Situational Awareness (SSA) sensor payload. Document final results from space experiments in reflective spectral tests. Initiate thermal infrared (IR) imaging spectrometer feasibility for space missions. Employ and refine existing spectral radiative transfer models to evaluate requirements of space-based thermal IR imaging spectrometer to meet anticipated mission needs.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Prepare to demonstrate space-based detection of large booster missile launch through optically thick sunlit clouds using existing satellite asset and HT imaging processing. Conduct critical test of maneuver characterization sensor system with go-no-go decision point. Initiate the development of multi-phenomenology SSA sensor system for space-based SSA. Continue study of</p>					

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 621010: <i>Space Survivability & Surveillance</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued research to characterize wave-particle interactions and wave amplification effects in space and their potential application to mitigate charged particle effects on space systems and operations.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Enhance wave-particle interactions and amplification research their application to mitigate charged particle effects on space systems and operations with coordinated Demonstration and Science Experiment (DSX) satellite studies and feedback from physical models.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Initiate research programs to develop controlled processes of triggered optical and infrared emissions and radio scintillation for potential DoD applications. Develop experiment using Demonstration and Science Experiment satellite and HAARP based on studies and feedback from physical models.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>						
<p>MAJOR THRUST: Develop seismic technologies to support national requirements for monitoring nuclear explosions with special focus on regional distances less than 2,000 kilometers from the sensors.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed different techniques for automated processing of increasing numbers of seismic events. Conducted detailed research on causes of challenges in high-frequency regional discrimination. Continued efforts on seismic calibration; seismic detection, location, and discrimination; and observational studies of seismic wave propagation, including propagation in Eurasia. Conducted detailed studies of particular challenge areas in local seismic monitoring. Conducted design and conducted theoretical, laboratory, and field studies to support local monitoring.</p>		6.689	5.957	6.388	0.000	6.388

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>		PROJECT 621010: <i>Space Survivability & Surveillance</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Refine and expand the applicability of different techniques for automated processing of increasing numbers of seismic events. Continue to conduct detailed research on causes of challenges in high-frequency regional discrimination. Integrate results of seismic calibration and observational studies of seismic wave propagation, including propagation in Eurasia, into a unified model. Continue to conduct detailed studies of particular challenge areas in local seismic monitoring. Continue to conduct theoretical, laboratory, and field studies to support local monitoring of new targets. Continue to study improvements in seismic detection, location, and discrimination.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Test and implement refined techniques for automated processing of increasing numbers of seismic events. Evaluate causes of challenges in high-frequency regional discrimination. Test and refine unified model results of seismic calibration and observational studies of seismic wave propagation, including propagation in Eurasia. Continue to conduct detailed studies of particular challenge areas in local seismic monitoring. Continue to conduct theoretical, laboratory, and field studies to support local monitoring of developing targets. Continue to study improvements in seismic detection, location, and discrimination.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				46.860	48.004	48.216	0.000	48.216
				FY 2009	FY 2010			
Congressional Add: Nuclear Test Seismic Research/AFRL Seismic Research Program.				1.995	4.979			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Nuclear Test Seismic Research.		
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for AFRL Seismic Research Program.		
Congressional Adds Subtotals	1.995	4.979

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0305111F: <i>Weather Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0305160F: <i>Defense Meteorological Satellite Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603401F: <i>Advanced Spacecraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 624846: <i>Spacecraft Payload Technologies</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624846: <i>Spacecraft Payload Technologies</i>	26.837	15.797	20.299	0.000	20.299	20.251	19.990	20.188	18.343	Continuing	Continuing

Note

Note: In FY 2011, increases in funding are due the movement of technologies from PE 0603401F, Advanced Spacecraft Technology, to this PE in order to better align the technology readiness levels of these efforts.

A. Mission Description and Budget Item Justification

This project develops advanced technologies that enhance spacecraft payload operations by improving component and subsystem capabilities. The project focuses on four primary areas: (1) development of advanced, space-qualified, survivable electronics, and electronics packaging technologies; (2) development of advanced space data generation and exploitation technologies, including infrared, Fourier transform hyperspectral imaging, polarimetric sensing, and satellite antenna subsystem technologies; (3) development of high-fidelity space simulation models that support space-based surveillance and space asset protection research and development for the warfighter; and (4) development of advanced networking, radio frequency, and laser communications technologies to support next generation satellite communication systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop advanced infrared device technologies that enable hardened space detector arrays with improved detection to perform acquisition, tracking, and discrimination of space objects.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Investigated spectral agility. Demonstrated tuning from 8 to 12 microns in 1 micron increments. Investigated field enhancement technologies. Demonstrated optical amplification using quantum interference and demonstrated enhancement using plasmons. Investigated the single pixel polarimeter. Demonstrated improved long-wave infrared (LWIR) superlattice detector and assessed very long-wave infrared feasibility.</p>	4.961	3.140	4.207	0.000	4.207

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals	20.254	15.000	20.299	0.000	20.299

	FY 2009	FY 2010
Congressional Add: Field Programmable Gate Arrays/ Field Programmable Gate Arrays Mission Assurance Center. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Field Programmable Gate Arrays Mission Assurance Center. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	2.992	0.000
Congressional Add: Radiation Hardened Non-Volatile Memory Technology. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Radiation Hardened Non-Volatile Memory Technology. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.596	0.000
Congressional Add: Reconfigurable Electronic and Non-Volatile Memory Research.	1.995	0.797

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Reconfigurable Electronic and Non-Volatile Memory Research.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Reconfigurable Electronic and Non-Volatile Memory Research.</p>		
Congressional Adds Subtotals	6.583	0.797

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603401F: <i>Advanced Spacecraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 625018: <i>Spacecraft Protection Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625018: <i>Spacecraft Protection Technology</i>	6.687	7.992	7.556	0.000	7.556	9.006	13.287	13.338	13.156	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the technologies for protecting U.S. space assets in potential hostile environments to assure continued space system operation without performance loss in support of warfighter requirements. The project focuses on identifying and assessing spacecraft system vulnerabilities, developing threat warning technologies, and developing technologies to mitigate the effects of both intentional and unintentional threats.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop satellite threat warning technologies and tools for space defense. Exploit on-board inherent satellite resources, satellite-as-a-sensor, and self-aware satellite technologies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed an active and/or passive threat warning sensor for detection of a direct ascent or co-orbital vehicle and transitioned these engineering designs. Identified potential technology options that could provide defensive capability for incorporation into geosynchronous orbit/low earth orbit satellites and completed engineering designs.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Explore capabilities of potential defensive subsystems through laboratory testing. Identify likely transition opportunities and prepare engineering models to assess performance. Develop techniques to exploit existing satellite sensors for defense.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete laboratory testing of potential defensive subsystems. Develop performance goals using engineering models. Transition dual usage sensor technology to multiple satellite</p>	5.889	7.992	7.556	0.000	7.556

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
systems. Identify emerging opportunities to develop/expand defensive subsystems for additional users. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	5.889	7.992	7.556	0.000	7.556

	FY 2009	FY 2010
Congressional Add: Defensive Counterspace Testbed. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Defensive Counterspace Testbed. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.798	0.000
Congressional Adds Subtotals	0.798	0.000

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603401F: <i>Advanced Spacecraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 628809: <i>Spacecraft Vehicle Technologies</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
628809: <i>Spacecraft Vehicle Technologies</i>	53.693	42.353	35.786	0.000	35.786	41.502	40.241	43.702	51.300	Continuing	Continuing
Note Note: In FY 2011, increases in funding are due to realignment of technologies from PE 0603401F, Advanced Spacecraft Technology, to this PE in order to better align the technology readiness levels of these efforts.											
A. Mission Description and Budget Item Justification This project focuses on three major space technology areas: spacecraft platforms (e.g., structures, controls, power, and thermal management); satellite control (e.g., signal processing and control); and space experiments of maturing technologies for space qualification.											
B. Accomplishments/Planned Program (\$ in Millions)											
						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	
MAJOR THRUST: Develop technologies for advanced space platform subsystems such as cryocoolers, compact, high efficiency solar power cells and arrays, and innovative power generation concepts. <i>FY 2009 Accomplishments:</i> In FY 2009: Refined and validated cryocooler component and system models with experimental data. Investigated thermodynamic loss mechanisms in regenerative cycle cryocoolers through computational fluid dynamics models. Completed design work for improved short-wavelength infrared/medium-wavelength infrared (SWIR/MWIR) cryocooler application for missile launch detection and technical intelligence mission systems. Completed engineering demonstration of advanced array for thin-film solar cells scaleable to greater than 100 kilowatts (kw). <i>FY 2010 Plans:</i> In FY 2010: Continue to refine and validate cryocooler component and system models with experimental data. Complete models/validation of pulse tube and start models/validation of inertance						4.164	4.743	4.792	0.000	4.792	

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued ground-based experiments supporting the Demonstration and Science Experiments (DSX) satellite. Delivered host DSX spacecraft bus. Began integration and test of DSX payloads. Continued development of ground support equipment and software.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue ground-based experiments. Begin DSX system-level integration and test. Complete DSX payload system-level functional and environmental tests. Continue development of ground support equipment and software.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue ground-based experiments in support of radiation belt remediation technologies. Complete DSX and payload integration and functional/environmental testing for radiation belt remediation payload. Complete development of ground support equipment and software.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	41.246	32.714	35.786	0.000	35.786

	FY 2009	FY 2010
<p>Congressional Add: Multicontinuum Technology for Space Structures.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Multicontinuum Technology for Space Structures.</p>	2.872	0.000

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Shielding Rocket Payloads. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Shielding Rocket Payloads. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.399	0.000
Congressional Add: Center for Responsive Space Systems. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Center for Responsive Space Systems. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.798	0.000
Congressional Add: Lightweight, High-Efficiency Solar Cells for Spacecraft. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Lightweight, High-Efficiency Solar Cells for Spacecraft. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	0.798	0.000
	1.596	0.000

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
Congressional Add: Massively Parallel Optical Interconnects for MicroSatellite Applications. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Massively Parallel Optical Interconnects for MicroSatellite Applications. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Center for Solar Electricity and Hydrogen. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Center for Solar Electricity and Hydrogen. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Center for Solar Electricity and Hydrogen.	3.590	3.983
Congressional Add: Advanced Modular Avionics for Operationally Responsive Space Use/Advanced Modular Avionics for Operationally Responsive Satellite Use. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advanced Modular Avionics for Operationally Responsive Space Use. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Modular Avionics for Operationally Responsive Satellite Use.	2.394	2.470
Congressional Add: Center for Space Entrepreneurship.	0.000	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force										DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 628809: <i>Spacecraft Vehicle Technologies</i>				
B. Accomplishments/Planned Program (\$ in Millions)											
										FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.											
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Center for Space Entrepreneurship.											
Congressional Add: Mission Design and Analysis Tool.										0.000	1.593
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.											
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Mission Design and Analysis Tool.											
Congressional Adds Subtotals										12.447	9.639
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603401F: <i>Advanced Spacecraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D. Acquisition Strategy Not Applicable.											

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 628809: <i>Spacecraft Vehicle Technologies</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	56.596	58.044	61.330	0.000	61.330	60.765	64.988	66.974	64.813	Continuing	Continuing
622068: <i>Advanced Guidance Technology</i>	17.473	17.758	20.039	0.000	20.039	21.133	22.472	23.035	22.540	Continuing	Continuing
622502: <i>Ordnance Technology</i>	39.123	40.286	41.291	0.000	41.291	39.632	42.516	43.939	42.273	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and establishes the technical feasibility and military utility of advanced guidance and ordnance technologies for conventional air-launched munitions. Programs support core technical competencies of target identification and tracking, guidance navigation and control, munition systems, explosives, fuzes, and warheads/damage mechanisms. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	57.407	58.289	0.000	0.000	0.000
Current President's Budget	56.596	58.044	61.330	0.000	61.330
Total Adjustments	-0.811	-0.245	61.330	0.000	61.330
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.245			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.811	0.000	61.330	0.000	61.330

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 622502: *Ordnance Technology*

	FY 2009	FY 2010

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Advanced Nanotube Micro-Munition Weapon Technology Initiative.*

Congressional Add Subtotals for Project: 622502

Congressional Add Totals for all Projects

FY 2009	FY 2010
1.596	0.000
1.596	0.000
1.596	0.000

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
(U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>				PROJECT 622068: <i>Advanced Guidance Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622068: <i>Advanced Guidance Technology</i>	17.473	17.758	20.039	0.000	20.039	21.133	22.472	23.035	22.540	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional munitions advanced guidance technologies to establish technical feasibility and military utility. This project includes development of advanced guidance including terminal seekers, navigation and control, signal and processing algorithms, and guidance and control simulations. Project payoffs include: adverse-weather and autonomous precision guidance capability; increased number of kills per sortie; increased aerospace vehicle survivability; improved reliability and affordability; and improved survivability and effectiveness of conventional weapons.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Investigate and develop advanced guidance component technologies for seekers to increase air-delivered weapon kill probability, reduce pilot workload, and enhance sortie effectiveness.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued laboratory demonstration of test components for laser ranging seeker to profile "single shot" images of targets. Tested and demonstrated an optical seeker that used multi-discriminate signatures to improve targeting obscured targets. Refined Synthetic Aperture Radar system simulation. Began developing a multimode seeker that provided improved performance in two wavelength bands.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue laboratory demonstration of test components for laser ranging seeker to profile "single shot" images of targets. Complete demonstration of optical seeker that uses multi-discriminate signatures to improve targeting obscure targets. Continue development of multimode seeker that provides improved performance using two complimentary wavelength bands. Develop algorithms to use wide field of view optical imager data to augment map-matching techniques, enabling navigation</p>	4.950	9.825	11.504	0.000	11.504

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622068: <i>Advanced Guidance Technology</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603601F: <i>Conventional Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>				PROJECT 622502: <i>Ordnance Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
622502: <i>Ordnance Technology</i>	39.123	40.286	41.291	0.000	41.291	39.632	42.516	43.939	42.273	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional ordnance technologies to establish technical feasibility and military utility to include technologies for advanced conventional weapon dispensers, submunitions, safe and arm devices, fuzes, explosives, warheads, and weapon airframe and carriage technology. The project also assesses the lethality and effectiveness of current and planned conventional weapons technology programs and assesses target vulnerability. The payoffs include: improved storage capability and transportation safety of fully assembled weapons; improved warhead and fuze effectiveness; improved submunition dispensing; low-cost airframe/subsystem components and structures; and reduced aerospace vehicle and weapon drag.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Investigate and develop high fidelity analytical tools for predicting weapons' effects and assessing target vulnerability to reduce development costs and provide maximum lethality.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Modeled damage to buildings caused by direct weapon effects. Continued developing capability to apply first principles computational tools to design and evaluation of new munitions concepts. Continued to identify high payoff technologies for defeating mobile targets. Applied system level analysis tools to identify promising high payoff technologies for defeating mobile targets.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p>	8.400	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622502: <i>Ordnance Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for the Advanced Nanotube Micro-Munitions Technology Initiative.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
Congressional Adds Subtotals	1.596	0.000

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603601F: <i>Conventional Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	60.233	105.231	103.596	0.000	103.596	112.629	119.405	123.200	126.394	Continuing	Continuing
624866: <i>Lasers & Imaging Technology</i>	35.680	73.826	77.821	0.000	77.821	85.420	89.125	92.029	94.793	Continuing	Continuing
624867: <i>Advanced Weapons & Survivability Technology</i>	18.682	31.405	25.775	0.000	25.775	27.209	30.280	31.171	31.601	Continuing	Continuing
6255SP: <i>Laser and Imaging Space Tech</i>	5.871	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program covers research in directed energy technologies, primarily lasers and high power microwaves. In lasers, this research includes moderate to high power laser devices (electric and chemical) and associated optical components and techniques. In imaging, this research includes long-range optical imaging for space situational awareness. In advanced weapons, this program examines technologies such as narrowband and wideband high power microwave devices and antennas. Vulnerability/lethality assessments of representative systems are done for both areas. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	62.701	105.677	0.000	0.000	0.000
Current President's Budget	60.233	105.231	103.596	0.000	103.596
Total Adjustments	-2.468	-0.446	103.596	0.000	103.596
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.446			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-2.468	0.000	103.596	0.000	103.596

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>
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Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

In FY 2010, funds from Project 55SP, Laser and Imaging Space Technology, are being moved to Project 4866, Lasers & Imaging Technology, to better align efforts. Also in FY 2010, significant funding for electric laser, relay mirror, and space situational awareness (SSA) efforts in PE 0603605F, Advanced Weapons Technology, have been moved into this PE to better reflect the actual technology readiness level of the efforts.

Note: In FY 2010, Congress added \$0.8 million for Hybrid Nanoparticle-based Coolant Technology Development and Manufacturing that has been moved to PE 0602102F, Materials, Project 624347, for execution.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>				PROJECT 624866: <i>Lasers & Imaging Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624866: <i>Lasers & Imaging Technology</i>	35.680	73.826	77.821	0.000	77.821	85.420	89.125	92.029	94.793	Continuing	Continuing

Note

Note: In FY 2010, the efforts that had been in Project 55SP, Laser and Imaging Space Technology, have been moved to this project to allow better integration of directed energy efforts. Also in FY 2010 several electric laser, relay mirror, and space situational awareness efforts in PE 0603605F, Advanced Weapons Technology, have been moved into this project to better reflect the actual technology readiness level of the efforts.

A. Mission Description and Budget Item Justification

This project explores the technical feasibility of moderate to high power lasers, including beam control, for applications such as aircraft protection, force protection, and precision engagement. It also explores the technical feasibility of long-range optical imaging for space situational awareness. New technologies will be developed and physics based modeling will be conducted that will enable: (1) compact, reliable, and affordable laser systems with good beam quality, scalability to high power, and high potential military utility; (2) optical and beam control systems to enhance space surveillance applications, laser beam propagation, and optical pointing and tracking. System concept assessment tools will be developed and used.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop electric laser technologies for airborne tactical applications. Technologies include fiber, bulk solid state, semiconductor, and other electrically powered lasers.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Improved design of laser sources for aircraft self-protection. Demonstrated system-level beam control solutions to aero-optical issues of tactical laser weapons applications on airborne platforms. Continued to assess the effectiveness of various laser concepts in relevant scenarios. Continued to scale electric lasers up to the weapons class power level. Developed architectures that are suitable in terms of size, weight, efficiency, affordability, reliability, maintainability, supportability, environmental acceptability, and ruggedness for the next-generation applications. Performed damage/</p>	16.200	28.132	33.241	0.000	33.241

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624866: <i>Lasers & Imaging Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
avoidance, and space situational awareness and space protection concepts and operational techniques by updating and transitioning databases and assessment and analysis capabilities. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	35.680	73.826	77.821	0.000	77.821

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0601108F: <i>High Energy Laser Research Initiatives.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602890F: <i>High Energy Laser Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603444F: <i>Maui Space Surveillance System.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603924F: <i>High Energy Laser Advanced Technology Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602624A: <i>Weapons and Munitions Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624866: <i>Lasers & Imaging Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0603004A: <i>Weapons and Munitions Advanced Technology.</i>											
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702E: <i>Tactical Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: <i>Ballistic Missile Defense Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C: <i>Ballistic Missile Defense Boost Phase Segment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603651M: <i>Joint Non-Lethal Weapons Technology Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>				PROJECT 624867: <i>Advanced Weapons & Survivability Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624867: <i>Advanced Weapons & Survivability Technology</i>	18.682	31.405	25.775	0.000	25.775	27.209	30.280	31.171	31.601	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project explores high power microwave (HPM) and other unconventional weapon concepts using innovative technologies. Research is conducted that support a wide range of Air Force missions such as the disruption and degradation of an adversary's electronic infrastructure and military capability. This research will allow the effect to be applied covertly and with no collateral structural or human damage. This project also provides for vulnerability assessments of representative U.S. strategic and tactical systems to HPM weapons, HPM weapon technology assessment for specific Air Force missions, and HPM weapon lethality assessments against foreign targets. Active Denial technologies are also developed and assessed for Air Force non-lethal force protection applications.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Investigate technologies for HPM components for applications such as disruption of electronic systems. Investigate other unconventional weapon concepts using innovative technologies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Enhanced the compact repetitively pulsed gigawatt-class HPM testbed. Integrated and demonstrated a conforal antenna and command and control system for the compact HPM testbed. Designed and developed narrowband HPM components that will be integrated into a demonstration aerial platform. Demonstrated mature HPM source materials and continued assessing the applicability of solid state subsystem designs supporting ruggedized high power airborne systems. Improved the wideband antenna and high voltage switch and demonstrated improved effectiveness during field tests. Developed apparatus capable of correctly delivering gas into interaction region of HPM tubes. Investigated HPM concepts related to cyber warfare and studied the possibility of developing new HPM waveforms for a counter-electronics application. Implemented the enhanced options for high power subsystem components based on the results of the HPM system source code. Designed/developed state-of-the-art energy storage power components.</p>	11.201	15.499	10.922	0.000	10.922

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624867: <i>Advanced Weapons & Survivability Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
evaluation of source and thermal subsystem options for next-generation non-lethal systems. Begin harmonic source development. <i>FY 2011 Base Plans:</i> In FY 2011: Continue working towards an FY 2013 ground demonstration of key Airborne Active Denial Technology (AADT) components. Perform full-powered, long-pulse, high duty-cycle testing of the Airborne Active Denial 2.5 megawatt gyrotron source. Continue to improve fidelity of airborne gyrotron source computer model. Continue development of AADT prime power and power conditioning approaches, as well as antenna and beam conditioning systems, including air breakdown mitigation techniques. Perform computer modeling and simulation of a next-generation Active Denial source. Perform engagement modeling and simulation of an Active Denial System. Continue to research and develop alternative use applications for Active Denial. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	18.682	31.405	25.775	0.000	25.775

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602202F: <i>Human Systems Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602624A: <i>Weapons and Munitions Technology</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624867: <i>Advanced Weapons & Survivability Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602114N: <i>Power Projection</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M-A: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603851M: <i>Nonlethal Weapons</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>				PROJECT 6255SP: <i>Laser and Imaging Space Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6255SP: <i>Laser and Imaging Space Tech</i>	5.871	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, the efforts in this project are being moved to Project 4866, Lasers & Imaging Technology to better align efforts.

A. Mission Description and Budget Item Justification

Develop advanced, long-range, optical technologies such as advanced beam control; beam acquisition, tracking, and pointing; adaptive optics; dual line-of-sight pointing; large, lightweight optics; and optical coatings that support future space-object imaging systems. Assess the vulnerability of satellites to the effects of high-energy laser weapons and update catalogued satellites.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop advanced, long-range, optical technologies that support future space-object imaging systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Tested electrostatic deformable mirror technologies to determine maturity and utility for Air Force applications. Developed and demonstrated a high energy fiber laser phased array transceiver system level brassboard concept that includes high resolution pupil plane imaging, coherent beam combining, shared transmit/receive sub-apertures, and initial acquisition, pointing, and tracking investigation.</p> <p><i>FY 2010 Plans:</i> In FY 2010: This thrust has been moved to Project 4866, Laser and Imaging Technology, in order to better align efforts.</p>	2.444	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 6255SP: <i>Laser and Imaging Space Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)					
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals	5.871	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0603444F: <i>Maui Space Surveillance Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0601108F: <i>High Energy Laser Research Initiatives.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602890F: <i>High Energy Laser Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603924F: <i>High Energy Laser Advanced Technology Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C-A: <i>Ballistic Missile Defense Boost Phase Segment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602624A: <i>Weapons and Munitions Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603004A: <i>Weapons and Munitions Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 6255SP: <i>Laser and Imaging Space Tech</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602702E: <i>Tactical Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: <i>Ballistic Missile Defense Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C-B: <i>Ballistic Missile Defense Boost Phase Segment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M-B: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M-C: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	114.510	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
624519: <i>Communications Technology</i>	35.871	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
624594: <i>Information Technology</i>	30.804	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
625581: <i>Command and Control (C2) Technology</i>	38.385	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
6266SP: <i>Space Optical Network Tech</i>	9.450	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note
Note: In FY 2010, efforts in this PE moved to PE 0602788F, Dominant Information Technology.

A. Mission Description and Budget Item Justification

This program develops technology for Air Force Command, Control, and Communications (C3). Advances in C3 are required to increase warfighter readiness and effectiveness by providing the right information, at the right time, in the right format, anytime, anywhere in the world. The program has four projects. The Communication Technology project develops assured and secure communications technology and the capability to attack and exploit adversarial information and information systems. The Information Technology project develops improved and automated capabilities to generate, process, fuse, exploit, interpret, and disseminate timely and accurate information. The Command and Control Technology project investigates and develops planning, assessment, and knowledge base technologies to allow the warfighter to plan, assess, execute, monitor, and re-plan on the complex, compressed time scales required for tomorrow's conflicts. The Space Optical Networking Technology project develops the technology base for the next generation of ultra-wide-bandwidth, multi-channeled, air and space-based communications networks on and between platforms. This program is Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	115.559	0.000	0.000	0.000	0.000
Current President's Budget	114.510	0.000	0.000	0.000	0.000
Total Adjustments	-1.049	0.000	0.000	0.000	0.000
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-1.049	0.000	0.000	0.000	0.000

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 624519: *Communications Technology*

Congressional Add: *Space Qualification of the Common Data Link.*

Congressional Add Subtotals for Project: 624519

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	1.596	0.000
	1.596	0.000
	1.596	0.000

Change Summary Explanation

Note: In FY 2010, Congress added \$2.0 million for Efficient Utilization of Transmission Hyperspace. These efforts were transferred to PE 0602788F, Dominant Information Technology, via Form 1414. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>				PROJECT 624519: <i>Communications Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624519: <i>Communications Technology</i>	35.871	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, this effort moves to PE 0602788F, Project 5315, Connectivity and Protection Tech.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that enable assured, worldwide/theater, high capacity, communications and networking for Air Force Task Forces. These communication and networking technologies will provide capabilities for en-route and deployed distributed collaborative command, control, surveillance, reconnaissance, and exploitation. A rapidly deployed force requires assured connectivity with reliable, responsive, affordable information exchange via all available communications media. This project provides the technologies for multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques; lightweight, phased array antennas; and modular, programmable, low-cost software radios. It includes technologies for advanced processors and devices, advanced network protocols and services, intelligent communications management and control, advanced communications algorithms, and enabling communication signal processing techniques.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop assured and survivable information and networking technologies enabling worldwide command, control, surveillance, reconnaissance, and exploitation operations.	9.698	0.000	0.000	0.000	0.000
<i>FY 2009 Accomplishments:</i> In FY 2009: Completed development of airborne CBDN, synergistic with the Joint Tactical Radio System Wideband Networking Waveform's Network Service Layer and applies to extremely dynamic airborne nets. Designed and developed airborne network modeling and simulation technology. Developed cognitive networking technology that senses operating environment, learns application requirements, and adapts network protocols. Completed development of policy-based network management technologies for real-time network response to changes in INFOCON levels. Designed					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>		PROJECT 624519: <i>Communications Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>								
<p>MAJOR THRUST: Develop cyber operations technologies for enabling worldwide command, control, communications, and intelligence.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Initiated work in Cyber Command and Control for defensive cyber operations to achieve cyber awareness and understanding. Developed defensive techniques for wireless, mobile, and embedded systems. Conducted assured end-to-end Quality of Service and Quality of Assurance integration to the information system enterprise doing malicious and non-malicious faults. Initiated work in autonomic defensive response to rapidly recover from adversary cyber attacks. Developed information system access methods. Initiated efforts to propagate through adversary networks. Developed stealth and persistence technologies enabling network discovery, propagation to new locations, and data exfiltration/infiltration. Conducted cyber intelligence gathering efforts to achieve cyber situational awareness and understanding. Conducted cyber and traditional kinetic weapon integration technology development and initiated efforts for cyber delivery to influence operations effects. Conducted the Congressionally-directed Cyber Attack Mitigation Lab effort.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>				16.831	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals				34.275	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>	PROJECT 624519: <i>Communications Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Space Qualification of the Common Data Link. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted the Congressionally-directed Space Qualification of the Common Data Link. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.596	0.000
Congressional Adds Subtotals	1.596	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (13327): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>				PROJECT 624594: <i>Information Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624594: <i>Information Technology</i>	30.804	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, these efforts move to PE 0602788, Project 5318, Operational Awareness Tech and Project 5317, Information Decision Making Tech.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that improve and automate their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This project improves global awareness at all levels, enabling warfighters to understand relevant military situations on a consistent basis with the timeliness and precision needed to accomplish their missions. Global awareness is achieved by exploiting information provided by the Air Force, other government agencies, and open source information. The information is fused to support the dynamic planning, assessment, and execution cycles via the global information enterprise. Knowledge, information, and data are all archived in the global information base for continued use and historical analysis. The information technologies required to achieve this capability are developed under this project in an affordable manner and include appropriate access mechanisms for our coalition partners. This project develops high-payoff embedded information systems technologies for the next generation of distributed information integration architectures to enable global information dominance and air and space superiority. The embedded information systems technologies provide affordable, innovative, secure, net-enabled embedded information systems to the warfighter.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop innovative multi-sensor collaborative fusion technologies in a fully distributed air and space environment.	6.485	0.000	0.000	0.000	0.000
<i>FY 2009 Accomplishments:</i> In FY 2009: Evaluated fusion management and advance the state-of-the-art in track-to-track fusion techniques. Completed the process of probabilistic identification through the use of multi-source fusion. Increased probabilistic confidence through the inclusion of higher-level fusion techniques in the situational assessment and process refinement area. Completed the development of techniques to dynamically update advanced reasoning fusion engines to adapt to changing threat conditions.					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>		PROJECT 624594: <i>Information Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>								
<p>MAJOR THRUST/CONGRESSIONAL ADD: Develop digital information exploitation technologies for electronic communications and special signals intelligence, imagery, and measurement signatures.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed the multi-intelligence processing, exploitation, and dissemination of actionable intelligence. Completed the development of more effective multi-sensor signature exploitation algorithms to enhance detection (by 50%), identification (by 25%), and assessment (10X reduction in analyst time) of difficult targets; taking into account the complementary signature features (e.g., geo-physical, materials) that can be derived from multiple MASINT sensors. Completed the development to automatically detect and identify audio protection and channelization effects in modern modulated personal communications systems with the goal of providing analysts the capability to automatically detect speech privacy and identify methods and means used. Initiated development of methods and mechanisms to achieve robust/tamper-proof self-authenticating, self-regenerating code/data and detection and eradication systems for polymorphic malware. Research included the detection and prevention of embedded malicious software (malware), system self-optimization/diagnosis/recovery, and the development of self-correcting watermarked code and data for trusted and optimized computing.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				5.018	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>	PROJECT 624594: <i>Information Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.					
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.					
Accomplishments/Planned Programs Subtotals	30.804	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (13550): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy
Not Applicable.

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>				PROJECT 625581: <i>Command and Control (C2) Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625581: <i>Command and Control (C2) Technology</i>	38.385	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, this effort moves to PE 0602788F, Project 5316, Info Mgmt and Computational Tech.

A. Mission Description and Budget Item Justification

The Air Force requires command and control technologies that will provide the next generation of weapon systems with improved processing and presentation of information for real-time, distributed battle management and control. Technologies in this project must be capable of taking advantage of future net-centric environments including new structured and ad hoc processes in response to rapidly changing warfare challenges. Technologies being developed will increase capability, quality, and information interoperability, while reducing the cost of C2 systems and infrastructure. Technology development in this project focuses on planning and assessing techniques knowledge bases, distributed information systems, and information management and distribution services. Advances in planning and assessment technologies will vastly improve the military decision making process within C2 systems. Advances in the ability to rapidly detect, classify, identify, and continuously track objects and events will improve the awareness and understanding and prediction of adversarial intentions, allowing the development of various courses of action to counter their intentions. Advances in the development of very large comprehensive knowledge bases to rapidly formulate and create new knowledge are needed by the Expeditionary Aerospace Force. Advances in distributed intelligent information systems will allow automatic rapid reconfiguration of C2 centers to respond to varying crisis levels, as required, by a Net-Centric Aerospace Force. Advances in robust information management and dissemination technologies will ensure the delivery of high-quality, timely, secure information to the warfighter.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed foundations, technology, and tools to enable effective, practical automated reasoning of the scale and complexity required for computers to perform complex tasks in the real-	5.177	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>		PROJECT 625581: <i>Command and Control (C2) Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>(analytical reasoning). Developed dynamic workflow and workload management capabilities to manage the command and control constellation of resources.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>								
<p>MAJOR THRUST: Investigate and develop technologies to securely share information via publish, subscribe, and query with coalition partners as part of the Global Information Grid.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed cross-domain information sharing research and development to include collaborative monitoring and management of multi-national enterprise resources. Developed techniques and tools that will ensure availability, integrity, and survivability of information within a coalition net-centric environment. Investigated technologies, which can determine the pedigree of information in a coalition environment and assess the trustworthiness of the marked up information to be shared throughout the coalition. Investigated and prototyped the application of information fusion and information management technologies such as fuselets to extend composite views of events across a multi-domain enterprise into fused events. Developed publish/subscribe/query technologies for application to a CBDN system for intelligent network management of user information.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				7.036	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>		PROJECT 625581: <i>Command and Control (C2) Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>								
<p>MAJOR THRUST: Develop next generation monitoring, planning, execution, and assessment technologies and tools.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Investigated application of decision support sciences and advanced decision-making concepts to C2 activities within a coalition AOC. Developed intelligent information systems capable of supporting joint/coalition C2 for various missions in a dynamically changing environment. Developed tools to increase situational awareness and understanding through intelligent information processing. Conducted the application of system-of-systems and federation-of-systems engineering in the creation of joint C2 capabilities. Explored the application of intelligent software agents as virtual battle staff members to enhance various C2 processes. Developed capability for a full-spectrum analysis for effects attainment at all levels of a campaign, linking leading indicators to desired and undesirable effects. The capability utilizes causal reasoning, linking effects to actions to desired end-state, develops non-deterministic, non-linear causal linkages, and is capable of reasoning through uncertainty and ambiguity.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p>				7.132	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>	PROJECT 625581: <i>Command and Control (C2) Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed development of advanced information technologies for collaborative decision-making and knowledge management in support of capability-based planning and next generation planning, execution, and assessment environments. Completed prototyping distributed collaborative environment technologies for advanced decision support for high-profile system concepts, such as the Global Strike Concept of Operations and operations other than war. Studied collaboration services on demand that will exploit dynamic information services matching end user devices (laptops, cell phones, etc.) with appropriate information formats. Supported context aware collaborative user interfaces and semantic interoperability.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>					
Accomplishments/Planned Programs Subtotals	38.385	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (13773): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603617F: <i>C3 Applications.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>	PROJECT 625581: <i>Command and Control (C2) Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0303401F: <i>Communications-Computer Systems (C-CS) Security RDT&E.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>				PROJECT 6266SP: <i>Space Optical Network Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6266SP: <i>Space Optical Network Tech</i>	9.450	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note
Note: In FY 2010, this effort moves to PE 0602788, Project 5315, Connectivity and Protection Tech.

A. Mission Description and Budget Item Justification

This project develops the technology base for the next generation of ultra-wide bandwidth, multi-channelled, air- and space-based communications networks on and between platforms. As the application of laser-based, point-to-point communications between satellites emerges, air- and space-based optical networks, whose communications capacities are thousands of times greater than current communications satellites, become a realistic possibility. This project will assess and adapt the emerging communication and information technologies for applications in air and space. This project will explore technologies for implementing photonic chip scale optical Code Division Multiple Access (CDMA) and Wavelength Division Multiplexed (WDM) transceivers and prototype networks, built to demonstrate the benefits associated with the advanced fiber optic, wireless, platform, and satellite networks that can be built from them. This project will develop and demonstrate technology to integrate current Radio Frequency (RF) with high data rate optical laser communications, along with network management techniques, tools, and software to support them. These technologies have potential applications in specific military systems including reliable, high bandwidth, jam-resistant communications at the theater level, and multiplexing of multiple DoD users onto a common networking infrastructure for reduced manning and logistics.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and assess optical network technologies for application in the space environment. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed 40 channel multi wavelength optical network for on-board air and space applications.	2.815	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>		PROJECT 6266SP: <i>Space Optical Network Tech</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>								
<p>MAJOR THRUST: Develop and assess existing and emerging Optical CDMA and WDM modulation schemes and protocols for use in space-based optical networks.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Initiated flight demonstration of multi-gigabit, multi-wavelength optical communications bus interface chip for space and air platforms.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>				1.705	0.000	0.000	0.000	0.000
<p>MAJOR THRUST: Develop and demonstrate heterogeneous, seamless, secure, self-configuring high capacity air/space/surface wireless networks.</p>				4.930	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602702F: <i>Command Control and Communications</i>	PROJECT 6266SP: <i>Space Optical Network Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed the development and start the characterization of higher throughput RF waveform data link technology for operation under adverse weather conditions. Initiated the design of an integrated RF/laser communications airborne qualifiable brassboard.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>					
Accomplishments/Planned Programs Subtotals	9.450	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (13930): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	0.000	116.785	117.283	0.000	117.283	129.320	131.538	134.298	136.922	Continuing	Continuing
625315: <i>Connectivity and Protection Tech</i>	0.000	46.429	46.780	0.000	46.780	53.093	53.432	54.110	54.869	Continuing	Continuing
625316: <i>Info Mgt and Computational Tech</i>	0.000	33.674	30.804	0.000	30.804	32.506	32.266	34.769	35.617	Continuing	Continuing
625317: <i>Information Decision Making Tech</i>	0.000	16.869	18.835	0.000	18.835	17.962	18.696	20.325	20.394	Continuing	Continuing
625318: <i>Operational Awareness Tech</i>	0.000	19.813	20.864	0.000	20.864	25.759	27.144	25.094	26.042	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communication.

A. Mission Description and Budget Item Justification

This program develops enterprise-centric information technology for the Air Force. Advances in enterprise-centric information technologies are required to increase warfighter readiness and effectiveness by providing the right information, at the right time, in the right format, anytime, anywhere in the world. The program has four projects. The Connectivity and Protection Tech project provides the technologies for: multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques, as well as technologies that successfully deter any adversary from attacking computer systems anytime, anywhere while allowing access to, presence on, manipulation of, and operational effects of adversary computer systems. In addition, this project develops the technology base for the next generation of ultra-wide-bandwidth, multi-channeled, air and space-based communications networks on and between platforms. The Info Mgmt and Computational Tech project will provide advances in robust information management and dissemination technologies to ensure the delivery of high-quality, timely, secure information to the warfighter and develop technologies to produce both advanced on-demand computational processing and computer architectures with greater capacity and sophistication for addressing dynamic mission objectives under constraints imposed by AF systems. The Information Decision Making Tech project develops the technology necessary to support the commander and staff's ability to command all viable options to achieve desired effects across the full spectrum of operations. The Operational Awareness Tech project develops technologies that improve and automate their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This program is in Budget Activity 2, since it develops and demonstrates the technical feasibility and military utility of evolutionary and revolutionary technologies

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	0.000	115.278	0.000	0.000	0.000
Current President's Budget	0.000	116.785	117.283	0.000	117.283
Total Adjustments	0.000	1.507	117.283	0.000	117.283
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.493			
• Congressional Adds		2.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	117.283	0.000	117.283

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 625315: *Connectivity and Protection Tech*

Congressional Add: *Efficient Utilization of Transmission Hyperspace.*

Congressional Add Subtotals for Project: 625315

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	0.000	1.992
	0.000	1.992
	0.000	1.992

Change Summary Explanation

Note: In FY 2010, Congress added \$2.0 million for Efficient Utilization of Transmission Hyperspace. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>				PROJECT 625315: <i>Connectivity and Protection Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625315: <i>Connectivity and Protection Tech</i>	0.000	46.429	46.780	0.000	46.780	53.093	53.432	54.110	54.869	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Projects 4519 and 66SP.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that enable assured, worldwide communications for an agile Expeditionary Aerospace Force (EAF). These communication technologies will provide en-route and deployed reachback communications for distributed collaborative military operations. A rapidly deployed EAF requires assured connectivity with reliable, responsive, and affordable information exchange via all available communications media and across all domains - air, space, and cyber. This project provides the technologies for secure, self-configuring, self-healing, seamless networks; advanced communications processors; anti-jam and low probability of intercept communications techniques; agile, dynamic policy based network management capabilities; and modular, programmable, low-cost software radios. This project also develops both the technology base for the next generation of ultra-wide bandwidth, multi-channeled air and space-based communications networks on and between platforms using the technologies for implementing photonic chip scale optical Code Division Multiple Access (CDMA) and Wavelength Division Multiplexed (WDM) transceivers and prototype networks associated with advanced fiber optics and the technology to integrate current Radio Frequency (RF) with high data rate Optical Laser communications, along with network management techniques, tools, and software to support them. In addition, the Air Force requires technologies to deliver a full range of options in cyberspace at par with air and space dominance in each of the areas of cyber attack, cyber defense, and cyber support to achieve the strategic capability of cyber dominance. This project provides the technologies required to successfully deter any adversary from attacking computer systems anytime, anywhere by ensuring the Air Force's ability to: 1) access, maintain presence on, and deliver effects to adversary systems; 2) detect, defend, and respond to attacks on friendly computer systems as well as provide forensic analysis concerning those attack attempts; and 3) provide cyber situational awareness to Air Force commanders.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop assured and survivable information and networking technologies enabling worldwide command, control, surveillance, reconnaissance, and exploitation operations.	0.000	6.983	10.473	0.000	10.473

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010						
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>		PROJECT 625315: <i>Connectivity and Protection Tech</i>						
B. Accomplishments/Planned Program (\$ in Millions)										
<p>MAJOR THRUST: Develop cyber defense and supporting technologies to detect, defend, and respond to attacks on computer systems as well as provide forensic analysis concerning the attacks.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue to develop defensive techniques for wireless, mobile, and embedded systems. Initiate vulnerability analysis and threat identification for emerging commercial wireless standards. Complete investigation of fusion of cyber intelligence (CybINT) with traditional intelligence methods (INTs) and use of CybINT collection technologies to increase situational awareness of enterprise systems and malicious activities occurring therein. Continue development of technology demonstration plans for cyber situational awareness and understanding using an autonomous set of cooperative agents under positive control to defend mission critical AF assets. Initiate development of technology demonstration plans for active intelligence, surveillance, and reconnaissance (ISR) defense on wired networks to perform an adaptive response to multiple, coordinated, and sustained attacks.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue to develop defensive techniques for wireless, mobile, and embedded systems. Initiate vulnerability analysis and threat identification for emerging commercial wireless standards. Continue development of technology demonstration plans for implementing enhanced cyber security technologies to provide improved security of operating systems against cyber attacks against mission critical AF assets. Develop root of trust techniques for the protection of digital devices and data both laterally within a network and vertically within a network enclave. Develop hardware and software techniques to enhance the security of traditional operating systems in order to be invisible to potential cyber attacks and effectively implement cyber rules of engagement (ROE). Develop formal models for cyber defense policies with the ability to deconflict policies generated by a diverse set of stakeholders and conforming to command intent for</p>						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>		PROJECT 625315: <i>Connectivity and Protection Tech</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Continue development of information system access methods and development of propagation techniques. Continue development of stealth and persistence technologies. Continue development of the capability to exfiltrate information from adversary information systems for generation of actionable CybINT. Continue technology development for preparation of the battlefield and increased situational awareness and understanding. Continue development of technology to deliver D5 effects. Continue development of autonomic technologies for operating within adversary information systems. Continue development of techniques for covert communication among agents operating within adversary information systems. Continue analysis of proprietary hardware and software systems to identify viable means of access and sustained operations within the same. Continue development of a publish/subscribe architecture for exchange and exfiltration of information while operating within adversary information systems. Initiate development of techniques to deliver PsyOps via cyber channels. Develop deception techniques to allow misdirection and confusion of adversary attempts to probe and infiltrate AF systems.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Investigate the range of cyber technologies as needed to achieve information and cyber dominance.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Initiate development of technologies to support a polymorphic cyber infrastructure that avoids exposure to threats and can proactively escape from incoming threats before they affect friendly information systems. Initiate development of techniques to support evasion and escape maneuvers in cyberspace. Initiate development of technology to provide a trusted verification of</p>				0.000	5.159	3.681	0.000	3.681

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625315: <i>Connectivity and Protection Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	44.437	46.780	0.000	46.780

	FY 2009	FY 2010
Congressional Add: Efficient Utilization of Transmission Hyperspace. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Efficient Utilization of Transmission Hyperspace.	0.000	1.992
Congressional Adds Subtotals	0.000	1.992

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (14332): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625315: <i>Connectivity and Protection Tech</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>				PROJECT 625316: <i>Info Mgt and Computational Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625316: <i>Info Mgt and Computational Tech</i>	0.000	33.674	30.804	0.000	30.804	32.506	32.266	34.769	35.617	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Projects 4519 and 5581.

A. Mission Description and Budget Item Justification

The Air Force requires the capability to maximize the value, sharing, management, and use of its information and information assets in achieving its mission objectives as the importance of information grows in the current net centric environment. Technology development in this project must be capable of taking advantage of future net-centric environments including new structured and ad hoc processes in response to rapidly changing warfare challenges. Advances in robust information management focus on quality of service and flow of information within the enterprise, information transformation and brokering, secure information sharing across and among domains, and collaboration of workflow within the enterprise. Technologies addressed in this project include the ability to globally share, discover, and access information across organizational, functional, and coalition boundaries and between and among domains, the timely delivery of information to tactical assets, the tailoring and prioritization of information based on mission needs and importance, and the scaling, robustness, and collaboration features required of the Air Force net-centric information management environment. In addition, the Air Force requires the development of superior, intelligent, on-demand computing to enable information superiority. Technology development in this project focuses on producing: 1) computer architectures with greater capacity and sophistication for addressing constrained, dynamic mission objectives, 2) "game-changing" computing power to the warfighter, 3) disruptive computing technology power at the edge and the power behind grid services, and 4) interactive and real-time computing improving the usability of high performance computing to the Air Force. It includes technologies in computational sciences and engineering, computer architectures, and software intensive systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Investigate and develop technologies to securely share information via publish, subscribe, and query with coalition partners as part of the Global Information Grid (GIG). <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	10.433	8.670	0.000	8.670

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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop service components that provide information management sharing mechanisms as infrastructure components within a service oriented architecture (SOA). Collections of the service components may be assembled to establish a robust and reliable information sharing substrate, eliminating application complexity and management responsibility. Develop mechanisms to federate and share information across disbursed locations and establish the means to maintain provenance and authoritative control over the information. Develop information sharing mechanisms to efficiently share and synchronize dynamic information sources where information changes are in the seconds and require secure disperse dissemination. Develop prioritized queuing mechanisms to maximize value of delivered information based upon its context. Demonstrate decentralized information management through advanced infospherics research. Initiate development of tactical information dominance capabilities that include unmanned aerial systems (UAS), "wide-body" assets and high-altitude platforms.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop service components that provide information management sharing mechanisms as infrastructure components within a SOA. Expand on the SOA techniques so they can be applied to tactical airborne operations. Continue development of the mechanisms to share information in a decentralized manner between peers with any centralized policy management operating through the distributed entities transparent and non-dependent on any individual entity. Continue development of SOA substrate that will provide guaranteed levels of information dissemination to specific user applications based on mission based operational context and derived policy. Complete research into dynamic information management system infrastructure. Initiate nano-computer technology development to provide high performance, secure, scalable, and survivable information dissemination.</p>								

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>		PROJECT 625316: <i>Info Mgt and Computational Tech</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>Initiate quantum information sciences technology to provide enhanced computing applications. Develop information management capabilities in support of force protection.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Develop collaborative services technologies and virtual environments to facilitate the development and fielding of next generation decision support systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Based on study results, begin development of an information service orchestration framework that leverages open system standards and technologies to implement workflow capabilities that can adapt the execution of information services to the changing requirements of dynamic military environments.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. Effort eliminated due to higher Air Force priorities.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>				0.000	0.657	0.000	0.000	0.000
<p>MAJOR THRUST: Develop automatic and dynamically reconfigurable, affordable, scalable, distributed petaflop processing technologies for real-time global information systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p>				0.000	4.082	6.707	0.000	6.707

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625316: <i>Info Mgt and Computational Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Initiate development and design of a modular trusted computing base architecture composed of the foundational hardware and software necessary to ensure overall system security. Enhance system performance of multi-core and multi-threaded microprocessors through resiliency mechanisms.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete prototype design and demonstrate functionality of a modular trusted computing base architecture. Develop trusted, automated cyber defense capability to reduce response time down to milli-seconds vice hours . Develop methods to use emerging commercial high assurance processors, virtualization, secure system development, self-protecting data for the hardening of commercial off-the-shelf products.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	0.000	33.674	30.804	0.000	30.804

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (14555): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625316: <i>Info Mgt and Computational Tech</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>				PROJECT 625317: <i>Information Decision Making Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625317: <i>Information Decision Making Tech</i>	0.000	16.869	18.835	0.000	18.835	17.962	18.696	20.325	20.394	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Project 5581.

A. Mission Description and Budget Item Justification

The Air Force requires advances in technologies enabling the effective execution of military objectives that will vastly improve the ability to support the commander and staff's ability to command all viable options to achieve desired effects across the full spectrum of operations (air, space, and cyberspace) at all levels of war (strategic, operational, and tactical) and during all phases of conflict (pre-conflict, conflict through stability operations). Technology development in this project addressing this requirement include anticipatory decision support and course of action development, planning, scheduling and assessment, and the real time effective portrayal of complex data sets.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop next generation monitoring, planning, and assessment technologies enabling aerospace commanders to develop effects based campaigns.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue development of decision support sciences applications and advanced decision-making concepts for activities focused on integrated command and control (C2). Demonstrate intelligent information systems capable of supporting joint/coalition C2 associated with a specific mission in a dynamically changing environment. Continue to develop tools to increase situational awareness and understanding of the air, space, and cyberspace domains through intelligent</p>	0.000	3.698	5.683	0.000	5.683

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625317: <i>Information Decision Making Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Investigate processes and technologies and recommend solutions to enable the Air and Space Operations Center (AOC) to conduct kinetic/non-kinetic Monitor, Assess, Plan, and Execute (MAPE) while under degraded conditions due to cyber attacks. Design and develop an experimentation environment and conduct scenario-based integrated C2 studies. Develop and evaluate measures of effectiveness (MOEs) and measures of performance (MOPs) for key attributes associated with integrated C2. Investigate methods to seamlessly move between geospatial and non-geospatial data to enhance situational awareness and enable integrated decisions over the air, space, and cyber domains. Develop applications for visualizing and exploring remotely accessed heterogeneous data in to a common operating picture of the battlespace. Initiate an effort to develop an integrated task order synchronizing air, space, and cyberspace capabilities to achieve desired effect.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete the investigation of processes and technologies and recommend solutions to enable the AOC to conduct kinetic/non-kinetic MAPE procedures while under degraded conditions due to cyber attacks. Complete development of an experimentation environment and conduct scenario based integrated C2 studies. Complete development and evaluation of MOEs and MOPs for key attributes associated with integrated C2. Complete investigation of methods to seamlessly move between geospatial and non-geospatial data to enhance situational awareness and enable integrated decisions over the air, space, and cyberspace domains. Complete development of applications for visualizing and exploring remotely accessed heterogeneous data into a common operational picture of the battlespace. Complete development of an integrated task order capability synchronizing air, space, and cyberspace capabilities to achieve desired effect. Develop the capability to rapidly integrate and analyze C2 systems within a developmental environment. Develop technologies to provide dynamic</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625317: <i>Information Decision Making Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
reconfigurable boundary conditions with the goal of forcing an adversary to continually re-plan their missions. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	16.869	18.835	0.000	18.835

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (14688): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>				PROJECT 625318: <i>Operational Awareness Tech</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625318: <i>Operational Awareness Tech</i>	0.000	19.813	20.864	0.000	20.864	25.759	27.144	25.094	26.042	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Project 4594.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that improve and automate their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This project provides not only a network-centric, collaborative intelligence analysis capability that enables the fusion of multi-intelligence and sensor sources to provide timely situation awareness, understanding, and anticipation of the threats in the battle space, but also the advanced, novel exploitation technologies needed to intercept, collect, locate, and process both covert and overt raw data from intelligence and sensor sources. It leads the research, discovery, and development of technology that enables the fusion of multi-intelligence sources to provide accurate object tracking and ID, situational awareness, understanding, and anticipation of the threats in the battlespace (air, ground, space, and cyber). It also leads in the development of advanced exploitation technologies to maximize the intelligence gained from our adversaries in the areas of spectral detection and geolocation, signal recognition and analysis, and the data tagging, tracking, and tracing via the insertion of secure, imperceptible signal embedding for future fusion and understanding of the information.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop innovative multi-sensor collaborative fusion technologies in a fully distributed environment. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Extend and mature models to reflect real Multi-INT data effects. Demonstrate capability on real data sets. Complete Hybrid Multi-INT association algorithms based on contextual knowledge/	0.000	5.991	4.938	0.000	4.938

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625318: <i>Operational Awareness Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals	0.000	19.813	20.864	0.000	20.864

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (14881): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			PE 0602890F: <i>High Energy Laser Research</i>								
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	47.939	53.229	53.384	0.000	53.384	54.059	52.297	54.174	55.038	Continuing	Continuing
625096: <i>High Energy Laser Research</i>	47.939	53.229	53.384	0.000	53.384	54.059	52.297	54.174	55.038	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense (DoD) high energy laser (HEL) applied research through the HEL Joint Technology Office (JTO). HEL weapon systems have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HELs have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase; defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles; and the ultra-precision negation of targets in urban environments with no/little collateral damage. This program is part of an overall DoD HEL Science and Technology program. In general, efforts funded under this program are chosen for their potential to have an impact on multiple HEL systems and multiple Service missions while complimenting Service/Agency programs that are directed at specific Service needs. A broad range of technologies are addressed in key areas such as chemical lasers, solid state lasers, free electron lasers, laser beam control, and laser lethality mechanisms. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	49.268	52.754	0.000	0.000	0.000
Current President's Budget	47.939	53.229	53.384	0.000	53.384
Total Adjustments	-1.329	0.475	53.384	0.000	53.384
• Congressional General Reductions		-6.100			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.225			
• Congressional Adds		6.800			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-1.329	0.000	53.384	0.000	53.384

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 625096: *High Energy Laser Research*

Congressional Add: *Advanced Deformable Mirrors for High Energy Laser Weapons.*

Congressional Add: *High Bandwidth, High Energy Storage, Exawatt Laser Glass Development.*

Congressional Add: *Planar Lightwave Circuit Development for High Power Military Laser Applications.*

Congressional Add Subtotals for Project: 625096

Congressional Add Totals for all Projects

	FY 2009	FY 2010
	0.000	1.593
	0.000	2.788
	0.000	2.390
	0.000	6.771
	0.000	6.771

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note: In FY 2010, Congress added \$1.6 million for Advanced Deformable Mirrors for High Energy Laser Weapons, \$2.8 million for High Bandwidth, High Energy Storage, Exawatt Laser Glass Development, and \$2.4 million for Planar Lightwave Circuit Development for High Power Military Laser Applications.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>				PROJECT 625096: <i>High Energy Laser Research</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625096: <i>High Energy Laser Research</i>	47.939	53.229	53.384	0.000	53.384	54.059	52.297	54.174	55.038	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense (DoD) high energy laser (HEL) applied research through the HEL Joint Technology Office (JTO). HEL weapon systems have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HELs have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase; defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles; and the ultra-precision negation of targets in urban environments with no/little collateral damage. This program is part of an overall DoD HEL Science and Technology program. In general, efforts funded under this program are chosen for their potential to have an impact on multiple HEL systems and multiple Service missions while complimenting Service/Agency programs that are directed at specific Service needs. A broad range of technologies are addressed in key areas such as chemical lasers, solid state lasers, free electron lasers, laser beam control, and laser lethality mechanisms. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Advance solid-state laser development. <i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated over 100 kilowatts (kW) from the Joint High Power Solid State Laser (JHPSSL) laboratory. Verified performance through independent government-sponsored measurements. Initiated a joint-high power electric laser product improvement program that emphasizes efficiency, affordability, and ruggedization. <i>FY 2010 Plans:</i> In FY 2010: Conduct a joint-high power electric laser product improvement program. Begin translation of efficiency improvements into size, weight and packing reductions.	8.000	12.605	13.764	0.000	13.764

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>		PROJECT 625096: <i>High Energy Laser Research</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Conduct a joint-high power electric laser product improvement program. Prepare for government-sponsored measurements to validate performance.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Mature solid state laser device technologies that will provide improve system level performance.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed power scaling architecture with good beam quality and reduced size and weight. Improved the efficiency and reliability of diode pump sources. Continued testing laser module combination concepts on testbed. Conducted Service and Agency proposal call for FY 2009.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Combine high performance single modules in optimum module combination schemes to demonstrate the path to weapons-class scaling. Continue development of high reliability diode pump sources and fiber laser components. Investigate eye-safer laser technologies and high efficiency architectures. Conduct an industry proposal call for FY 2010.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate building block for highly efficient, compact, modular laser system with weapons-class applications. Demonstrate high reliability of diode pump sources. Scale eye-safer laser technologies to higher powers. Conduct Service and Agency proposal call for FY 2011.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>				8.708	9.479	9.830	0.000	9.830
<p>MAJOR THRUST: Investigate new technologies that have revolutionary potential for HEL applications.</p>				4.520	4.601	7.790	0.000	7.790

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>	PROJECT 625096: <i>High Energy Laser Research</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A						
<p>MAJOR THRUST: Develop technology to support high performance beam control systems and integrated demonstrations.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed/provided beam control technology options for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems). Investigated technologies to compensate for negative effects of atmosphere and platform vibration. Conducted a Service and Agency proposal call for FY 2009, awarded ten new efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate advanced component and control techniques for difficult environments, such as high speed flight, high turbulence, and extended ranges. Conduct an industry proposal call for FY 2010.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Implement beam control technology options for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Conduct a Service and Agency proposal call for FY 2011.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>		9.490	9.626	9.980	0.000	9.980
MAJOR THRUST: Conduct laser vulnerability experiments on materials, components, and targets. Develop a lethality database, and integrate into a systems-level architecture plan and lethality models.		3.851	4.053	4.640	0.000	4.640

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>		PROJECT 625096: <i>High Energy Laser Research</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Provide maintenance, verification, validation, and accreditation for updated system level HEL models. Conduct mission-level HEL engagement scenarios and wargame HEL concepts.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				47.939	46.458	53.384	0.000	53.384
				FY 2009	FY 2010			
<p>Congressional Add: Advanced Deformable Mirrors for High Energy Laser Weapons.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Deformable Mirrors for High Energy Laser Weapons.</p>				0.000	1.593			
<p>Congressional Add: High Bandwidth, High Energy Storage, Exawatt Laser Glass Development.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for High Bandwidth, High Energy Storage, Exawatt Laser Glass Development.</p>				0.000	2.788			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>	PROJECT 625096: <i>High Energy Laser Research</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Planar Lightwave Circuit Development for High Power Military Laser Applications. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Planar Lightwave Circuit Development for High Power Military Laser Applications.	0.000	2.390
Congressional Adds Subtotals	0.000	6.771

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0601108F: <i>High Energy Laser Research Initiatives.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603444F: <i>Maui Space Surveillance System.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603924F: <i>High Energy Laser Advanced Technology Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C: <i>Ballistic Missile Defense Boost Phase Segment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>	PROJECT 625096: <i>High Energy Laser Research</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603004A: <i>Weapons and Munitions Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702E: <i>Tactical Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: <i>Ballistic Missile Defense Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603651M: <i>Joint Non-Lethal Weapons Technology Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	62.070	67.856	33.414	0.000	33.414	40.341	42.098	44.191	43.239	Continuing	Continuing
632100: <i>Laser Hardened Materials</i>	22.377	24.177	19.853	0.000	19.853	23.399	22.714	24.228	25.617	Continuing	Continuing
633153: <i>Non-Destructive Inspection Development</i>	8.081	4.038	2.260	0.000	2.260	5.379	7.509	7.580	5.444	Continuing	Continuing
633946: <i>Materials Transition</i>	16.412	28.502	9.039	0.000	9.039	9.167	8.945	9.331	9.612	Continuing	Continuing
634918: <i>Deployed Air Base Demonstrations</i>	11.232	11.139	2.262	0.000	2.262	2.396	2.930	3.052	2.566	Continuing	Continuing
6377SP: <i>Advanced Space Materials</i>	3.968	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note
Note: In FY 2010, funds from Project 77SP have been moved to Project 2100 within this Program Element to more accurately align efforts. In FY 2011, funds moved from Project 2100 to Project 4348 to increase emphasis in applied research.

A. Mission Description and Budget Item Justification
This program develops and demonstrates materials technology for transition into Air Force systems. The program has five projects which develop: (1) hardened materials technologies for the protection of aircrews and sensors; (2) non-destructive inspection and evaluation technologies; (3) transition data on structural and non-structural materials for aerospace applications; (4) airbase operations technologies including deployable base infrastructure, force protection, and fire fighting capabilities; and (5) advanced materials for space applications. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	62.676	37.901	0.000	0.000	0.000
Current President's Budget	62.070	67.856	33.414	0.000	33.414
Total Adjustments	-0.606	29.955	33.414	0.000	33.414
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.285			
• Congressional Adds		30.240			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.606	0.000	33.414	0.000	33.414

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 633153: *Non-Destructive Inspection Development*

Congressional Add: *Materials Integrity Management Research for Air Force Systems.*

Congressional Add: *Sonic Infrared Imaging Technology Development.*

Congressional Add: *Aircraft Evaluation Readiness Initiative (AERI).*

Congressional Add Subtotals for Project: 633153

Project: 633946: *Materials Transition*

Congressional Add: *Metals Affordability Initiative.*

Congressional Add: *EMI Grid Fabrication Technology.*

Congressional Add: *Silicon Carbide Electronics Material Producibility Initiative.*

Congressional Add: *SiC-RF Power for Avionics Systems.*

Congressional Add Subtotals for Project: 633946

	<u>FY 2009</u>	<u>FY 2010</u>
	0.798	0.000
	0.798	0.000
	2.394	2.390
	3.990	2.390
	3.989	9.958
	2.713	2.390
	4.787	5.019
	0.000	1.593
	11.489	18.960

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R-1 Line Item #15

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 634918: *Deployed Air Base Demonstrations*

Congressional Add: *Body Armor Improved Ballistic Protection.*

Congressional Add: *Strategic Biofuels Supply System.*

Congressional Add: *Sewage-Derived Biofuels Program.*

Congressional Add: *Military Waste-to-Energy Project Using the Hydro-Thermal Energy Conversion (Hy-TEC) Process.*

Congressional Add Subtotals for Project: 634918

Congressional Add Totals for all Projects

	FY 2009	FY 2010
	1.995	1.753
	0.997	1.593
	2.393	3.824
	0.000	1.593
Congressional Add Subtotals for Project: 634918	5.385	8.763
Congressional Add Totals for all Projects	20.864	30.113

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

In FY 2010, Congress added \$2.4 million for Aircraft Evaluation Readiness Initiative, \$1.76 million for Body Armor Improved Ballistic Protection, Research and Development, \$2.4 million for EMI Grid Fabrication Technology, \$10.0 million for Metals Affordability Initiative, \$1.6 million for Military Waste-to-Energy Project Using the Hydro-Thermal Energy Conversion (Hy-TEC) Process, \$3.84 million for Sewage-Derived Biofuels Program, \$1.6 million for SiC-RF Power for Avionics Systems, \$5.04 million for Silicon Carbide Electronics Material Producibility Initiative, and \$1.6 million for Strategic Biofuels Supply System.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 632100: <i>Laser Hardened Materials</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
632100: <i>Laser Hardened Materials</i>	22.377	24.177	19.853	0.000	19.853	23.399	22.714	24.228	25.617	Continuing	Continuing

Note
Note: Funds from Project 77SP have been moved to Project 2100 within this Program Element to more accurately align efforts. Note: Beginning in FY 2011, funds from Project 2100 have been moved to Program Element 0602102F BPAC 4348 to increase emphasis on applied research.

A. Mission Description and Budget Item Justification
This project develops and demonstrates advanced materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrews to perform required missions in threat environments. Advanced materials technologies are also developed and demonstrated to enhance protection for Air Force sensor systems to ensure safety, survivability, and operability in threat environments.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Major Thrust: Develop and demonstrate materials technologies that enhance hardening for sensors, avionics, and components to increase survivability and mission effectiveness of aerospace systems. <i>FY 2009 Accomplishments:</i> In FY 2009: Transitioned mature hardening materials technology for an Air Force tactical system. Demonstrated performance of dual band limiter materials in tactical systems. <i>FY 2010 Plans:</i> In FY 2010: Investigate performance of dual band limiter materials in tactical systems. Demonstrate protection strategies for large format multi-chip CCDs. Fabricate and demonstrate solid state limiter and filter technology for protection of space systems. Evaluate materials survivability for space environments. Analyze the effect of laser energy on optical materials and electro-optical sensors and space structural materials.	16.568	20.010	16.792	0.000	16.792

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 632100: <i>Laser Hardened Materials</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Evaluate hardening performance of current materials and technologies to threats. Demonstrate detector hardening for next generation USAF targeting platforms. Develop new persistent surveillance detectors with increased survivability. Design more robust Vis/NIR detectors. Incorporate materials in optical test bed configuration and test performance in relevant environments. Demonstrate optimized nonlinear optical limiter materials for damage protection. Demonstrate semiconductor optical limiter materials performance for damage protection. Verify performance of hardening SWIR sensor systems. Evaluate materials survivability for relevant environments. Develop advanced thin film concepts for enhanced fixed filter performance.</p> <p><i>FY 2011 OCO Plans:</i> In FY2011 OCO: N/A.</p>						
<p>Major Thrust: Develop and demonstrate materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrew to perform required missions in a threat environment.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Transitioned advanced agile filters and optical power limiters technologies in a system configuration. Demonstrated agile filter and optical limiter devices for Air Force applications.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Integrate fixed optical coatings within visor applications for demonstration.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Investigate susceptibility of candidate detectors for HMD systems. Demonstrate enhanced photorefractive hybrid materials concepts for Air Force passive protection applications. Identify personnel protection technologies for the visible and SWIR. Evaluate performance of optical coatings within visor applications.</p>		5.809	4.167	3.061	0.000	3.061

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 632100: <i>Laser Hardened Materials</i>
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B. Accomplishments/Planned Program (\$ in Millions)					
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans: In FY2011 OCO: N/A.</i>					
Accomplishments/Planned Programs Subtotals	22.377	24.177	19.853	0.000	19.853

C. Other Program Funding Summary (\$ in Millions)											
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604706F: <i>Life Support Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE					PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603112F: <i>Advanced Materials for Weapon Systems</i>					633153: <i>Non-Destructive Inspection Development</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633153: <i>Non-Destructive Inspection Development</i>	8.081	4.038	2.260	0.000	2.260	5.379	7.509	7.580	5.444	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced nondestructive inspection/evaluation (NDI/E) technologies to monitor performance integrity and to detect failure causing conditions in weapon systems components and materials. NDI/E capabilities greatly influence and/or limit many design, manufacturing, and maintenance practices. This project provides technology to satisfy Air Force requirements to extend the lifetime of current systems through increased reliability and cost-effectiveness at field and depot maintenance levels. Equally important is assuring manufacturing quality, integrity, and safety requirements.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop and demonstrate advanced technologies to improve capabilities to inspect for cracks and other damage to extend the total safe life of turbine engines.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated NDI/E approaches to extend the life of fracture-critical gas turbine engine components.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Validate NDI/E approaches to extend the life of fracture-critical gas turbine engine components.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Transition NDI/E approaches to extend the life of fracture-critical gas turbine engine components.</p>	0.527	0.200	0.650	0.000	0.650

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633153: <i>Non-Destructive Inspection Development</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.						
<p>MAJOR THRUST: Develop and demonstrate advanced inspection technologies supporting low-observable (LO) systems to enhance affordability and ensure full performance and survivability.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed and demonstrated a multiuse, multiplatform LO NDI/E hand tool that meets user requirements.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Transition a common, multiuse, multiplatform, handheld LO NDI/E point inspection tool/ sensor system.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop inspection methods and sensor technology for signature and material integrity of next generation LO material systems.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>		0.339	0.779	0.351	0.000	0.351
<p>MAJOR THRUST: Develop and demonstrate technologies for improved capabilities in corrosion, fatigue monitoring, and testing of aircraft to reduce operations, maintenance costs.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Transitioned application-focused NDI/E technologies to meet emerging inspection requirements for aging aircraft.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		1.645	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>		PROJECT 633153: <i>Non-Destructive Inspection Development</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals				4.091	1.648	2.260	0.000	2.260
				FY 2009	FY 2010			
Congressional Add: Materials Integrity Management Research for Air Force Systems. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Materials Integrity Management Research for Air Force Systems. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				0.798	0.000			
Congressional Add: Sonic Infrared Imaging Technology Development. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Sonic Infrared Imaging Technology Development. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				0.798	0.000			
Congressional Add: Aircraft Evaluation Readiness Initiative (AERI). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for AERI.				2.394	2.390			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633153: <i>Non-Destructive Inspection Development</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for AERI.		
Congressional Adds Subtotals	3.990	2.390

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>				PROJECT 633946: <i>Materials Transition</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633946: <i>Materials Transition</i>	16.412	28.502	9.039	0.000	9.039	9.167	8.945	9.331	9.612	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced materials and processing technologies for fielded and planned Air Force weapon, airframe, and propulsion applications. Advanced materials and processes that have matured beyond applied research are characterized, critical data are collected, and critical evaluations in the proposed operating environment are performed. These design and scale-up data improve the overall affordability of promising materials and processing technologies, providing needed initial incentives for their industrial development.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop & demonstrate M&P technologies for air vehicle & subsystems to enhance lift, propulsion, low-observable performance, power generation management, & affordability of air vehicles.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Validated materials-damage predictive approaches for engine health determination and life extension capability. Transitioned advanced materials and processing technologies to fielded and planned Air Force weapon, airframe, and propulsion applications as well as support systems including AFMC center infrastructure. Evaluated domestic lithium ion precursor materials, active materials, associated testing, and battery-cell manufacturing for acceleration of industrial development.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Refine processes for producing large area, high-quality diamond windows for airborne high power microwave directed energy weapons. Initially develop nanostructured materials using multiple approaches for high energy density capacitors for pulsed power applications. Transition and validate the methodology to characterize LO materials during production for process control and process validation.</p>	3.692	3.140	4.254	0.000	4.254

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>		PROJECT 633946: <i>Materials Transition</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY2011 OCO: N/A.								
MAJOR THRUST: Develop & demonstrate affordable, novel high temperature materials/structures and thermal management concepts to enable future defense capabilities for prompt global strike concepts. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Identify key issues and structural concepts for hot structure and thermal protection systems to be fabricated from advanced ceramics, ceramic matrix composites, hybrids, and advanced metals and intermetallics. <i>FY 2011 Base Plans:</i> In FY 2011: Explore fabrication techniques for hot structure and thermal protection systems from advanced ceramics, CMCs, hybrids and advanced metals and intermetallics. <i>FY 2011 OCO Plans:</i> In FY2011 OCO: N/A.				0.000	2.000	4.074	0.000	4.074
Accomplishments/Planned Programs Subtotals				4.923	9.542	9.039	0.000	9.039
				FY 2009	FY 2010			
Congressional Add: Metals Affordability Initiative. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Metals Affordability Initiative.				3.989	9.958			

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633946: <i>Materials Transition</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Metals Affordability Initiative.		
Congressional Add: EMI Grid Fabrication Technology. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for EMI Grid Fabrication Technology. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for EMI Grid Fabrication Technology.	2.713	2.390
Congressional Add: Silicon Carbide Electronics Material Producibility Initiative. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Silicon Carbide Electronics Material Producibility Initiative. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Silicon Carbide Electronics Material Producibility Initiative.	4.787	5.019
Congressional Add: SiC-RF Power for Avionics Systems. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for SiC-RF Power for Avionics Systems.	0.000	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633946: <i>Materials Transition</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Adds Subtotals	11.489	18.960

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Technology Dev/Demo.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603216F: <i>Aerospace Propulsion and Power Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>				PROJECT 634918: <i>Deployed Air Base Demonstrations</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634918: <i>Deployed Air Base Demonstrations</i>	11.232	11.139	2.262	0.000	2.262	2.396	2.930	3.052	2.566	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced, rapidly deployable airbase technologies that reduce airlift and manpower requirements, setup times, and sustainment costs, and improve protection and survivability of deployed Air Expeditionary Force (AEF) warfighters. Affordable, efficient technologies are developed and demonstrated to provide deployable infrastructure, advanced weapon system support, force protection, and fire fighting capability for deployed AEF operations.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Demonstrate & transition deployable infrastructure airbase technologies, to reduce airlift & manpower requirements, setup time, & sustainment costs in support of AEF operations.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed best methods for integration of advanced power generation and distribution. Characterized and made ensure processes for innovative technologies. Began development and demonstration of airfield damage repair and matting technologies that address field critical conditions, represented by key performance parameters, including issues like reduced weight and ease of installation and repair in the field.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate and transition methods for integrated, advanced power generation and distribution. Demonstrate methods and technologies for performing aircraft operating surface evaluations for ability to sustain aircraft operations. Demonstrate and analyze rapid temporary and permanent high temperature operating surface repairs.</p>	4.338	1.157	1.074	0.000	1.074

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>		PROJECT 634918: <i>Deployed Air Base Demonstrations</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate and transition agile, lightweight adaptive blast suppression materials in representative structures. Demonstrate and optimize candidate fire fighter safety technologies against representative environments and threats. Demonstrate and transition candidate ultrahigh pressure, nozzles, and other technologies in fire safety systems. Develop and demonstrate reactive and responsive materials for platforms, expeditionary structures and personnel protection.</p> <p><i>FY 2011 OCO Plans:</i> IN FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				5.847	2.376	2.262	0.000	2.262
				FY 2009	FY 2010			
Congressional Add: Body Armor Improved Ballistic Protection.				1.995	1.753			
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Body Armor Improved Ballistic Protection.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Body Armor Improved Ballistic Protection.</p>								
Congressional Add: Strategic Biofuels Supply System.				0.997	1.593			
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Strategic Biofuels Supply System.</p>								

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 634918: <i>Deployed Air Base Demonstrations</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Strategic Biofuels Supply System.		
Congressional Add: Sewage-Derived Biofuels Program. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Sewage-Derived Biofuels Program. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Sewage-Derived Biofuels Program.	2.393	3.824
Congressional Add: Military Waste-to-Energy Project Using the Hydro-Thermal Energy Conversion (Hy-TEC) Process. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Military Waste-to-Energy Project Using the Hydro-Thermal Energy Conversion (Hy-TEC) Process.	0.000	1.593
Congressional Adds Subtotals	5.385	8.763

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>						
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603287F: <i>Physical Security Equipment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 634918: <i>Deployed Air Base Demonstrations</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0604617F: <i>Agile Combat Support.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>				PROJECT 6377SP: <i>Advanced Space Materials</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6377SP: <i>Advanced Space Materials</i>	3.968	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: Funds from Project 77SP have been moved to Project 2100 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates materials and processing technologies for transition into Air Force space systems. Materials and processes development is scaled up to the appropriate level to demonstrate materials capability in the relative environment. Sub-scale components and nonstructural material components are developed and demonstrated to validate expected materials characteristics. Critical data on both structural and nonstructural materials is developed and provided for engineering and system design decisions. Laser hardened materials technologies are developed, demonstrated, and transitioned for the broadband protection of space sensors from a variety of laser threats. Reducing risk in materials technology improves the affordability, reliability, survivability, and operational performance of current and future space systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop & demonstrate advanced M&P technologies to enable revolutionary improvements in the performance of air-breathing and rocket-based aerospace vehicles and weapons.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Utilized newly developed materials approaches, fabricate thermal protection system sub-components for high temperature testing. Developed a sub-component cryogenic tank article and demonstrate the integration of ceramic, metallic, and carbon-carbon thermal protection system components.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.853	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE	PROJECT
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	6377SP: <i>Advanced Space Materials</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (1248): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	0.000	2.943	2.935	0.000	2.935	5.876	6.858	9.746	9.715	Continuing	Continuing
635351: <i>Technology Sustainment</i>	0.000	2.943	2.935	0.000	2.935	5.876	6.858	9.746	9.715	Continuing	Continuing

Note

Note: This program represents increased emphasis on sustainment technologies previously addressed within the individual S&T programs and is not a new start.

A. Mission Description and Budget Item Justification

This program develops and demonstrates sustainment technologies for transition into Air Force systems to increase readiness and reduce life cycle costs. Technologies matured and demonstrated in this program impact affordability and availability of fielded and future aerospace weapon systems by extending service life, ensuring flight safety, reducing sustainment costs, and ensuring mission readiness and capability. This program develops and demonstrates technologies that can be implemented to address operational sustainment issues on existing systems as well as supports new system sustainability through demonstration of technologies related to robust life cycle management, system design, fleet management decision making, and mission capability. Studies are conducted to identify and analyze design methodologies that focus on "building" in sustainability into future applications.

This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for sustainment of existing and future aerospace vehicle system upgrades and/or new system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	0.000	2.955	0.000	0.000	0.000
Current President's Budget	0.000	2.943	2.935	0.000	2.935
Total Adjustments	0.000	-0.012	2.935	0.000	2.935
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.012			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	2.935	0.000	2.935

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

(U) C. Performance Metrics Under Development

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>				PROJECT 635351: <i>Technology Sustainment</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635351: <i>Technology Sustainment</i>	0.000	2.943	2.935	0.000	2.935	5.876	6.858	9.746	9.715	Continuing	Continuing

Note

Note: This program represents increased emphasis on sustainment technologies previously addressed within the individual S&T programs and is not a new start.

A. Mission Description and Budget Item Justification

This program develops and demonstrates sustainment technologies for transition into Air Force systems to increase readiness and reduce life cycle costs. Technologies matured and demonstrated in this program impact affordability and availability of fielded and future aerospace weapon systems by extending service life, ensuring flight safety, reducing sustainment costs, and ensuring mission readiness and capability. This program develops and demonstrates technologies that can be implemented to address operational sustainment issues on existing systems as well as supports new system sustainability through demonstration of technologies related to robust life cycle management, system design, fleet management decision making, and mission capability. Studies are conducted to identify and analyze design methodologies that focus on "building" in sustainability into future applications.

This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for sustainment of existing and future aerospace vehicle system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop, demonstrate, and transition system health prediction technologies. Conduct studies and analyses to "design" in sustainability into future applications. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Develop and demonstrate fatigue/corrosion diagnostics sensors and algorithms for interpreting sensor data. Verify capability of state of the art reasoners to assess component	0.000	1.473	1.475	0.000	1.475

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>	PROJECT 635351: <i>Technology Sustainment</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
and reduce the cost of system management and operational sustainment. Demonstrate high reliability maintenance free repair technologies. Demonstrate improved maintenance and repair data base systems. Demonstrate technology solutions for future and existing system maintenance issues. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	2.943	2.935	0.000	2.935

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602201F: <i>Aerospace Vehicle Technologies</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603211F: <i>Aerospace Technology Dev/Demo</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	69.902	52.786	44.677	0.000	44.677	50.650	48.614	50.969	53.337	Continuing	Continuing
63665A: <i>Advanced Aerospace Sensors Technology</i>	19.832	27.175	22.996	0.000	22.996	24.446	22.571	23.656	24.755	Continuing	Continuing
6369DF: <i>Target Attack and Recognition Technology</i>	40.422	25.611	21.681	0.000	21.681	26.204	26.043	27.313	28.582	Continuing	Continuing
6388SP: <i>Advanced Space Sensors</i>	9.648	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Divided into three broad project areas, this program develops technologies to enable the continued superiority of sensors from aerospace platforms. The first project develops and demonstrates advanced technologies for electro-optical sensors, radar sensors and electronic counter-countermeasures, and components and algorithms. The second project develops and demonstrates radio frequency and electro-optical sensors for detecting, locating, and targeting airborne, fixed, and time-critical mobile ground targets obscured by natural or man-made means. The third project develops and demonstrates space sensor technologies including radio-frequency sensors; intelligence, surveillance, and reconnaissance sensors; electro-optical sensors; laser warning sensors; targeting and attack radar sensors; and electronic counter-countermeasures and communications. Together, the projects in this program develop the means to find, fix, target, track, and engage air and ground targets anytime, anywhere, and in any weather. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new sensor and electronic combat system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
3600: <i>Research, Development, Test & Evaluation, Air Force</i>	PE 0603203F: <i>Advanced Aerospace Sensors</i>
BA 3: <i>Advanced Technology Development (ATD)</i>	

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	65.115	51.482	0.000	0.000	0.000
Current President's Budget	69.902	52.786	44.677	0.000	44.677
Total Adjustments	4.787	1.304	44.677	0.000	44.677
• Congressional General Reductions		-0.075			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.221			
• Congressional Adds		1.600			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	4.787	0.000	44.677	0.000	44.677

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 63665A: *Advanced Aerospace Sensors Technology*

Congressional Add: *Moving Target Strike.*

Congressional Add: *Precision Image Tracking and Registration.*

Congressional Add Subtotals for Project: 63665A

Project: 6369DF: *Target Attack and Recognition Technology*

Congressional Add: *Active Unmanned Air Vehicle (UAV) Phenomenology (AUP) & ART Technology Transition.*

Congressional Add: *Automated Sensor-Communication Response Technology.*

Congressional Add: *Reconfigurable Secure Computing Technologies.*

Congressional Add Subtotals for Project: 6369DF

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	1.995	0.000
	1.596	0.000
	3.591	0.000
	1.995	0.000
	1.596	0.000
	1.197	1.593
	4.788	1.593
	8.379	1.593

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force

DATE: February 2010

APPROPRIATION/BUDGET ACTIVITY

3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603203F: *Advanced Aerospace Sensors*

Change Summary Explanation

Note: In FY 2010, Congress added \$1.6 million for Reconfigurable Secure Computing Technologies. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>				PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63665A: <i>Advanced Aerospace Sensors Technology</i>	19.832	27.175	22.996	0.000	22.996	24.446	22.571	23.656	24.755	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates aerospace sensor and processing technologies for intelligence, surveillance, reconnaissance, target, and attack radar applications in both manned and unmanned platforms, including electro-optical sensors and electronic counter-countermeasures for radars. It provides aerospace platforms with the capability to precisely detect, track, and target both airborne (conventional and low radar cross-section) and ground-based, high-value, time-critical targets in adverse clutter and jamming environments. Project activities include developing multi-function radio-frequency systems including radar and electronic warfare technology. Desired warfighting capabilities include the ability to detect concealed targets in difficult background conditions.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop electro-optical sensor technology to detect, locate, and identify air and ground targets at long ranges, including those that are low-observable, or use deception or camouflage.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted airborne experiments with a multi-function active/passive electro-optical/infrared demonstration system to detect, locate, and identify difficult targets in both obscured and urban environments for intelligence, surveillance, and reconnaissance applications. Characterized end-to-end performance of high-resolution, three-dimensional laser radar for high confidence target identification coupled with passive spectral imaging for low false alarm rate detection utilizing advanced change detection and spatial-spectral discrimination techniques. Completed development of multispectral/polarimetric focal plane array device for enhanced low contrast target discrimination, and designed airborne sensor module for enhancement of multi-function demonstration system.</p>	4.259	3.979	1.317	0.000	1.317

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>		PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Initiate concept demonstration experiments, beginning with ground-based experiments, for exploiting novel temporal, spectral, and polarimetric discrimination based on infrared sensors to rapidly detect, locate, identify, and characterize battlefield targets and events in urban areas. Leverage large format, infrared focal plane array technology developed under other component development projects and assess utility for high altitude and space platforms.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
<p>MAJOR THRUST: Reduce technology risk for space sensor platform payload components and exploitation of infrastructure integration.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop Mission Design Tool kit and experimental hardware for class III (scalable payloads) sensors. Begin to address PnP (Plug and Play) concepts for large satellite systems.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. Effort eliminated due to higher Air Force priorities.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>				0.000	1.659	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals				16.241	27.175	22.996	0.000	22.996

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Moving Target Strike. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Moving Target Strike. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.995	0.000
Congressional Add: Precision Image Tracking and Registration. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Precision Image Tracking and Registration. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.596	0.000
Congressional Adds Subtotals	3.591	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (1862): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603205F: <i>Flight Vehicle Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603707F: <i>Weather Systems Advanced Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603500F: <i>Multi-Disciplinary Advanced Development Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602111N: <i>Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602232N: <i>Space and Electronic Warfare (SEW) Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604249F: <i>LANTIRN Night Precision Attack.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603270F: <i>Electronic Combat Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>				PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6369DF: <i>Target Attack and Recognition Technology</i>	40.422	25.611	21.681	0.000	21.681	26.204	26.043	27.313	28.582	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced technologies for attack management, fire control, and target identification and recognition. This includes developing and demonstrating integrated and cooperative fire control techniques to provide for adverse-weather precision air strikes against multiple targets per pass and at maximum weapon launch ranges. Specific fire control technologies under development include attack management, sensor fusion, automated decision aids, advanced tracking for low radar cross section threats, and targeting using both on-board and off-board sensor information. This project also evaluates targeting techniques to support theater missile defense efforts in surveillance and attack. These fire control technologies will provide force multiplication and reduce warfighter exposure to hostile fire. This project also develops and demonstrates target identification and recognition technologies for positive, high confidence cueing, recognition, and identification of airborne and ground-based, high-value, time-critical targets at longer ranges than are currently possible. The goal is to apply these technologies to tactical air-to-air and air-to-surface weapon systems so they are able to operate in all weather conditions, during day or night, and in high-threat, multiple target environments. Model-based vision algorithms and target signature development techniques are the key to target identification and recognition. This project is maturing these technologies in partnership with the Defense Advanced Research Projects Agency and evaluating the techniques to support theater missile defense efforts in surveillance and attack. Fire control and recognition technologies developed and demonstrated in this project are high leverage efforts, providing for significant advancements in operational capabilities largely through software improvements readily transitionable to new and existing weapon systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and test an automatic target recognition system for tracking and identifying moving and stationary ground targets for use in strike and reconnaissance platforms. <i>FY 2009 Accomplishments:</i> In FY 2009: Provided support to the transition of the moving target algorithm technology to operational strike and reconnaissance platforms.	0.945	0.098	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>		PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Complete the transition of moving target algorithm technology to operational strike and reconnaissance platforms.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
<p>MAJOR THRUST: Develop and assess multi-sensor automatic target recognition for intelligence, surveillance, reconnaissance, strike, and weapon systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted spiral development and assessment of multi-sensor automatic target recognition fusion algorithms. Conducted assessment of technology supporting intelligence, surveillance, reconnaissance, strike, and weapon systems using the Air Force automatic target recognition test and evaluation facility. Conducted spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Developed automatic target recognition fusion sensor data exploitation capability utilizing analysis and experimentation of data independence and interdependence of features to support development of an optimum data fusion exploitation capability. Enhanced the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced automatic target recognition fusion capabilities. Determined technology shortfalls and developed automatic target recognition fusion technologies to overcome these shortfalls.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue spiral development and assessment of multi-sensor automatic target recognition fusion algorithms. Continue assessment of technology supporting intelligence, surveillance,</p>				2.478	1.950	3.077	0.000	3.077

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>		PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>																			
B. Accomplishments/Planned Program (\$ in Millions)																							
<table border="1"> <thead> <tr> <th></th> <th>FY 2009</th> <th>FY 2010</th> <th>FY 2011 Base</th> <th>FY 2011 OCO</th> <th>FY 2011 Total</th> </tr> </thead> <tbody> <tr> <td> <p>of the Air Force interest item to develop electro-optical, infrared, and synthetic aperture radar staring-sensor technologies and algorithms.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop, integrate, and test the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the individual component stage. Integrate, demonstrate, and test the enhanced, spiral two, wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses in the Air Force automatic target recognition test and evaluation facility. Continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter. Demonstrate in a militarily significant scenario, evaluate results and plan for transition.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop, integrate and test to technology readiness level (TRL) 5, the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the previous demonstration. Integrate, demonstrate and test the enhanced, TRL level 5, wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses in the Air Force automatic target recognition test and evaluation facility. Continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter. Increase TRL to 5 and demonstrate in a militarily significant scenario, evaluate results and begin transition.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p> </td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td align="right">12.580</td> <td align="right">9.854</td> <td align="right">6.048</td> <td align="right">0.000</td> <td align="right">6.048</td> </tr> </tbody> </table>							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	<p>of the Air Force interest item to develop electro-optical, infrared, and synthetic aperture radar staring-sensor technologies and algorithms.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop, integrate, and test the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the individual component stage. Integrate, demonstrate, and test the enhanced, spiral two, wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses in the Air Force automatic target recognition test and evaluation facility. Continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter. Demonstrate in a militarily significant scenario, evaluate results and plan for transition.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop, integrate and test to technology readiness level (TRL) 5, the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the previous demonstration. Integrate, demonstrate and test the enhanced, TRL level 5, wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses in the Air Force automatic target recognition test and evaluation facility. Continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter. Increase TRL to 5 and demonstrate in a militarily significant scenario, evaluate results and begin transition.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>							12.580	9.854	6.048	0.000	6.048
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total																		
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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>		PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals				35.634	24.018	21.681	0.000	21.681
				FY 2009	FY 2010			
Congressional Add: Active Unmanned Air Vehicle (UAV) Phenomenology (AUP) & ART Technology Transition. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Active Unmanned Air Vehicle (UAV) Phenomenology (AUP) & ART Technology Transition. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				1.995	0.000			
Congressional Add: Automated Sensor-Communication Response Technology. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Automated Sensor-Communication Response Technology. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.				1.596	0.000			
Congressional Add: Reconfigurable Secure Computing Technologies.				1.197	1.593			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Reconfigurable Secure Computing Technologies.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Reconfigurable Secure Computing Technologies.</p>		
Congressional Adds Subtotals	4.788	1.593

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603253F: <i>Advanced Sensor Integration.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603500F: <i>Multi-Disciplinary Advanced Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603762E: <i>Sensor and Guidance Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603270F: <i>Electronic Combat Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE Not Provided (2391): <i>Theater Missile Defense System Program Office.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE Not Provided (2403): <i>Low Altitude Night Targeting and</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
<i>Infrared Navigation (LANTIRN) System Program Office.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>				PROJECT 6388SP: <i>Advanced Space Sensors</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6388SP: <i>Advanced Space Sensors</i>	9.648	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note
Note: In FY 2010, funds from Project 88SP are being moved to Projects 665A and 69DF to better align efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates space sensor technologies, including radio frequency sensors; intelligence, surveillance, and reconnaissance sensors; electro-optical sensors; laser warning sensors; targeting and attack radar sensors; and electronic counter-countermeasures and communications. By developing multi-function radar, laser, electronic combat, and electronic counter-countermeasures technologies for space applications, this project provides space platforms with the capability to precisely detect, track, and target air- and ground-based, high-value, time-critical targets, while remaining invulnerable to hostile and natural threats.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Reduce technology risk for space sensor platform payload components and exploitation of infrastructure integration. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed "plug-and-play" satellite critical experiment, to including full simulation. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.	0.789	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6388SP: <i>Advanced Space Sensors</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.						
<p>MAJOR THRUST: Develop technologies for global positioning system jam resistance, positional and timing accuracy, and exploitation techniques to improve offensive and defensive combat capabilities.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated space-based distributed position, navigation, and timing technologies to achieve optimal sensor fusion for distributed, layered sensing. Demonstrated multi-ship virtual flight test simulation technology to assess world-wide distributed position, navigation, and timing architectures for disparate platforms across distributed, layered sensing.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>		2.065	0.000	0.000	0.000	0.000
<p>MAJOR THRUST: Develop electro-optical sensor component technology to advance multiple space mission areas. Develop new sensor components, topologies and architectures for space.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed experimental space flight of sensor components to test in space environment. Completed data collection, testing, and system evaluation. Initiated lab-based integration testing with embedded satellite components.</p>		1.428	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6388SP: <i>Advanced Space Sensors</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop a geodesic phased array antenna to improve satellite operations over current reflector antennas. Improve operational capacity and efficiency of the satellite control network.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Fully characterized the advanced technology demonstrator sub-sector and demonstrate with operational satellites. This effort completed in FY 2009.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>	0.642	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	9.648	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (2596): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602500F: <i>Multi-Disciplinary Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6388SP: <i>Advanced Space Sensors</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603500F: <i>Multi-Disciplinary Advanced Development Space Technology.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i>			PE 0603211F: <i>Aerospace Technology Dev/Demo</i>								
BA 3: <i>Advanced Technology Development (ATD)</i>											
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	41.748	88.226	53.588	0.000	53.588	56.480	58.124	58.384	60.306	Continuing	Continuing
63486U: <i>Advanced Aerospace Structures</i>	1.197	11.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
634920: <i>Flight Vehicle Tech Integration</i>	40.551	76.526	53.588	0.000	53.588	56.480	58.124	58.384	60.306	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program demonstrates advanced aerospace vehicle technologies. Advanced aerospace structures are demonstrated to sustain and enhance the capability of current and future aerospace vehicles. Aerospace vehicle technology integration is accomplished through integration of various technologies to include avionics, advanced propulsion, and weapon systems for demonstration in near-realistic operational environments.

This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing aerospace vehicle system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	45.990	76.844	0.000	0.000	0.000
Current President's Budget	41.748	88.226	53.588	0.000	53.588
Total Adjustments	-4.242	11.382	53.588	0.000	53.588
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.368			
• Congressional Adds		11.750			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-4.242	0.000	53.588	0.000	53.588

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/Demo</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 63486U: *Advanced Aerospace Structures*

Congressional Add: *Big Antennas Small Structures Efficient Tactical (BASSET) Unmanned Air Vehicles.*

Congressional Add: *3D Bias Woven Preform Development*

Congressional Add: *Long-Loiter, Load Bearing Antenna Platform for Pervasive Airborne Intelligence*

Congressional Add: *Program Increase*

Congressional Add Subtotals for Project: 63486U

Congressional Add Totals for all Projects

	FY 2009	FY 2010
	1.197	1.593
	0.000	2.390
	0.000	3.983
	0.000	3.734
	1.197	11.700
	1.197	11.700

Change Summary Explanation

Note 1: The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note 2: In FY 2010, Congress added \$1.59 million for Big Antennas Small Structures Efficient Tactical Unmanned Air Vehicles, \$2.39 million for 3D Bias Woven Preform Development, \$1.59 million for Long-Loiter, Load Bearing Antenna Platform for Pervasive Airborne Intelligence, and \$3.73 million for Program Increase.

(U) C. Performance Metrics
Under Development

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/ Demo</i>				PROJECT 63486U: <i>Advanced Aerospace Structures</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63486U: <i>Advanced Aerospace Structures</i>	1.197	11.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates affordable aerospace vehicle technologies to sustain the existing fleet, reduce the cost of aircraft ownership, and enhance the capability of current and future aerospace vehicles. Demonstration of these technologies will restore structural integrity, extend structural life, enhance capability, and reduce life cycle costs of fielded aircraft.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Big Antennas Small Structures Efficient Tactical (BASSET) Unmanned Air Vehicles. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally directed effort in big antennas small structures efficient tactical unmanned air vehicles. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in big antennas small structures efficient tactical unmanned air vehicles.	1.197	1.593
Congressional Add: 3D Bias Woven Preform Development <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	2.390

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/ Demo</i>	PROJECT 63486U: <i>Advanced Aerospace Structures</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in 3D bais woven preform development.		
Congressional Add: Long-Loiter, Load Bearing Antenna Platform for Pervasive Airborne Intelligence <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in long-loiter, load bearing antenna platform for pervasive airborne intelligence.	0.000	3.983
Congressional Add: Program Increase <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in program increase.	0.000	3.734
Congressional Adds Subtotals	1.197	11.700

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/ Demo</i>	PROJECT 63486U: <i>Advanced Aerospace Structures</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (2888): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/ Demo</i>				PROJECT 634920: <i>Flight Vehicle Tech Integration</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634920: <i>Flight Vehicle Tech Integration</i>	40.551	76.526	53.588	0.000	53.588	56.480	58.124	58.384	60.306	Continuing	Continuing

Note

Note: Increased funding in FY 2010 is due to FY 2008 emphasis being placed on flight demonstration efforts of an X-type composite cargo aircraft. Decreased funding in FY 2011 is due to higher Air Force priorities.

A. Mission Description and Budget Item Justification

This project integrates and demonstrates advanced flight vehicle technologies that will improve the performance and supportability of existing and future manned and unmanned aerospace vehicles. System level integration brings together aerospace vehicle technologies along with avionics, propulsion, and weapon systems for demonstration in a near-realistic operational environment. Integration and technology demonstrations reduce the risk and time required to transition technologies into operational aircraft. This program provides proven aerospace vehicle technologies for all-weather, day/night operations with improved performance and affordability.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop autonomous flight controls for safe flight and cooperative operations between manned and unmanned air platforms. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted ground demonstrations of situational awareness and control technologies for unmanned air vehicles operating in and around air bases. Developed and demonstrated cooperative teaming of small unmanned air vehicles in complex, low altitude environments. Conducted evaluation of validation and verification tools and process for affordable certification of autonomous unmanned air vehicle flight control software.	6.485	8.573	13.197	0.000	13.197

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/ Demo</i>	PROJECT 634920: <i>Flight Vehicle Tech Integration</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>analogues and apply these methods to understand shape change for high-speed flight test and other prompt global reach concepts under development. Continue risk reduction research in the areas of aeromechanics, propulsion integration, controls and hot structures for a high-speed combined-cycle propulsion demonstration program. Initiate work to develop, demonstrate and validate measurement/prediction methods for hypersonic boundary layer transition and aerodynamic heating for current/future prompt global reach concepts, as well as expendable and reusable hypersonic air-breathing concepts. Conduct hypersonic flight experiments to explore aeromechanics, propulsion, materials/structures, and controls research issues that can only be uniquely resolved through flight testing (boundary layer transition, shock boundary layer interaction, combustor flame holding, lean blowout, etc).</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	40.551	76.526	53.588	0.000	53.588

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602201F: <i>Aerospace Vehicle Technologies.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604015F: <i>Next Generation Bomber.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	175.292	192.241	136.135	0.000	136.135	112.786	115.313	120.264	129.044	Continuing	Continuing
6310SP: <i>Space Rocket Prop Demo</i>	22.724	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
632480: <i>Aerospace Fuels</i>	14.998	26.524	9.393	0.000	9.393	6.882	6.731	7.668	7.965	Continuing	Continuing
633035: <i>Aerospace Power Technology</i>	11.450	14.936	5.556	0.000	5.556	5.842	5.766	8.522	10.224	Continuing	Continuing
634921: <i>Aircraft Propulsion Subsystems Int</i>	44.678	39.592	41.403	0.000	41.403	18.006	18.176	17.867	19.479	Continuing	Continuing
634922: <i>Space & Missile Rocket Propulsion</i>	4.736	29.515	31.840	0.000	31.840	28.059	31.925	39.865	41.610	Continuing	Continuing
635098: <i>Advanced Aerospace Propulsion</i>	28.301	23.832	13.177	0.000	13.177	20.457	17.959	18.617	20.357	Continuing	Continuing
63681B: <i>Advanced Turbine Engine Gas Generator</i>	48.405	57.842	34.766	0.000	34.766	33.540	34.756	27.725	29.409	Continuing	Continuing

Note

Note: In FY 2010, work in PE 0603216F Project 10SP was consolidated into PE 0603216F Project 4922 within this program element to better align work.

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to achieve enabling and revolutionary advances in turbine, advanced cycle, and rocket propulsion, as well as electrical power thermal management, and fuels. The program has seven projects, each focusing on technologies with a high potential to enhance the performance of existing and future Air Force weapons systems. The Aerospace Fuels project develops and demonstrates improved hydrocarbon fuels and advanced propulsion systems for high-speed/hypersonic flight. The Aerospace Power Technologies project develops and demonstrates power and thermal management systems for weapons and aircraft as part of the Integrated Vehicle Energy Technology (INVENT) program. The Advanced Turbine Engine Gas Generator (ATEGG) project develops and demonstrates core turbine engine technologies for current and future aircraft propulsion systems. The Aerospace Propulsion Subsystem Integration (APSI) project integrates the engine cores demonstrated in the ATEGG project with low-pressure components into demonstrator engines. Turbine engine

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>
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propulsion projects within this program are part of the Versatile Affordable Advanced Turbine Engine (VAATE) program. A portion of the Fuels, ATEGG, and APSI projects supports adaptive cycle technology demonstrations which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs. The Advanced Aerospace Propulsion project develops the scramjet propulsion cycle to a technology readiness level appropriate for in-flight demonstration and for full integration with other engine cycles (including turbine and rocket based). The Space and Missile Rocket Propulsion project develops and demonstrates innovative rocket propulsion technologies, propellants, manufacturing techniques. Rocket propulsion projects within this program are part of the Integrated High Payoff Rocket Propulsion Technology (IHRPT) program, which includes the area of Technology for the Sustainment of Strategic Systems.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	180.554	175.676	0.000	0.000	0.000
Current President's Budget	175.292	192.241	136.135	0.000	136.135
Total Adjustments	-5.262	16.565	136.135	0.000	136.135
• Congressional General Reductions		-6.055			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.800			
• Congressional Adds		23.420			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-5.262	0.000	136.135	0.000	136.135

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 6310SP: *Space Rocket Prop Demo*

 Congressional Add: *Hybrid Sounding Rocket Propulsion.*

Congressional Add Subtotals for Project: 6310SP

Project: 632480: *Aerospace Fuels*

 Congressional Add: *Assured Aerospace Fuels Research.*

 Congressional Add: *Bio-JP8 Fuel Development.*

	<u>FY 2009</u>	<u>FY 2010</u>
	0.798	0.000
	0.798	0.000
	1.596	0.000
	0.798	3.983

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	
<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>		FY 2009	FY 2010
Congressional Add: <i>Renewable Hydrocarbon Fuels for Military Applications.</i>		1.995	1.992
Congressional Add: <i>Algal Biofuels for Aviation.</i>		0.000	2.390
Congressional Add: <i>Algal-Derived Jet Fuel for Air Force Applications.</i>		0.000	2.689
Congressional Add: <i>Hawaii Microalgae Biofuel Project.</i>		0.000	3.505
Congressional Add Subtotals for Project: 632480		4.389	14.559
Project: 633035: Aerospace Power Technology			
Congressional Add: <i>Silicon Carbide (SiC) Power Electronics for More Electric Aircraft.</i>		3.191	0.000
Congressional Add: <i>Methanol Fuel Cell Development for USAF Battlefield Renewable Integrated Tactical Energy System (BRITES).</i>		0.000	2.390
Congressional Add: <i>Silicon Carbide Power Modules for the F-35 Joint Strike Fighter.</i>		0.000	2.390
Congressional Add: <i>Texas Research Institute for Environmental Studies.</i>		0.000	0.797
Congressional Add Subtotals for Project: 633035		3.191	5.577
Project: 634921: Aircraft Propulsion Subsystems Int			
Congressional Add: <i>Small Adaptive Cycle Turbine Engines.</i>		1.596	0.000
Congressional Add: <i>Small Turbofan Versatile Affordable Advanced Turbine Engine (VAATE) Program.</i>		3.590	3.187
Congressional Add Subtotals for Project: 634921		5.186	3.187
Congressional Add Totals for all Projects		13.564	23.323
<u>Change Summary Explanation</u>			
The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force

DATE: February 2010

APPROPRIATION/BUDGET ACTIVITY

3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603216F: *Aerospace Propulsion and Power Technology*

In FY 2010, Congress added \$2.4 million for Algal Biofuels for Aviation, \$2.7 million for Algal-Derived Jet Fuel for Air Force Applications, \$4.0 million for Bio-JP8 Fuel Development, \$3.52 million for Hawaii Microalgae Biofuel Project, \$2.4 million for Methanol Fuel Cell Development for USAF Battlefield Renewable Integrated Tactical Energy System (BRITES), \$2.0 million for Renewable Hydrocarbon Fuels for Military Applications, \$2.4 million for Silicon Carbide Power Modules for the F-35 Joint Strike Fighter, \$3.2 million for Small Turbofan Versatile Affordable Advanced Turbine Engine Program, and \$0.8 million for Texas Research Institute for Environmental Studies.

C. Performance Metrics
(U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 6310SP: <i>Space Rocket Prop Demo</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6310SP: <i>Space Rocket Prop Demo</i>	22.724	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note

Note: In FY 2010 and beyond, this work was moved to Project 4922 within this Program Element to better align efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced and innovative low-cost rocket turbo-machinery and components, low-cost space launch propulsion technologies, and advanced propellants for launch and orbit transfer propulsion. Additionally, this project develops technologies for the Technology for Sustainment of Strategic Systems Phase 1. Characteristics such as environmental acceptability, affordability, reliability, responsiveness, reduced weight, and reduced operation and launch costs are emphasized. Increased life and performance of propulsion systems are key goals. This project also develops chemical, electrical, and solar rocket propulsion technologies for station-keeping and on-orbit maneuvering applications. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion technologies, higher efficiency energy conversion systems (derived from an improved understanding of combustion fundamentals), and high-energy propellants. Technological advances developed in this program could improve the performance of expendable payload capabilities by approximately 20 percent and reduce launch, operations, and support costs by approximately 30 percent. Responsiveness and operability of propulsion systems will be enhanced for reusable launch systems. Technology advances could also lead to a seven-year increase in satellite on-orbit time, a 50 percent increase in satellite maneuvering capability, a 25 percent reduction in orbit transfer operational costs, and a 15 percent increase in satellite payload. The efforts in this project contribute to the IHPRPT program, a joint Department of Defense, National Aeronautics and Space Administration, and industry effort to focus rocket propulsion technology on national space launch needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop liquid rocket propulsion technology for current and future space launch vehicles. <i>FY 2009 Accomplishments:</i> In FY 2009: Completed advanced cryogenic upper stage hardware fabrication and begin testing components to validate and verify modeling and simulation tools developed. Developed hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept	15.769	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 6310SP: <i>Space Rocket Prop Demo</i>																			
B. Accomplishments/Planned Program (\$ in Millions)																							
<table border="1"> <thead> <tr> <th></th> <th>FY 2009</th> <th>FY 2010</th> <th>FY 2011 Base</th> <th>FY 2011 OCO</th> <th>FY 2011 Total</th> </tr> </thead> <tbody> <tr> <td> for future reusable launch vehicles. Continued material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Continued advanced hydrocarbon fuel/additive scale-up and proof efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A. </td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td> MAJOR THRUST: Develop solar electric propulsion technologies for satellites, upper stages, orbit transfer vehicles, and satellite formation flying, station keeping, and repositioning. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed electric propulsion systems for orbit-transfer by developing high-power hall thrusters capable of low earth orbit to geosynchronous orbit transfer. Conducted and completed testing of the high-power hall thruster demonstration. Continued hardware scale-up for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Continued demonstration of advanced chemical propulsion system for satellites. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. </td> <td align="center">0.220</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> </tr> </tbody> </table>							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	for future reusable launch vehicles. Continued material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Continued advanced hydrocarbon fuel/additive scale-up and proof efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.						MAJOR THRUST: Develop solar electric propulsion technologies for satellites, upper stages, orbit transfer vehicles, and satellite formation flying, station keeping, and repositioning. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed electric propulsion systems for orbit-transfer by developing high-power hall thrusters capable of low earth orbit to geosynchronous orbit transfer. Conducted and completed testing of the high-power hall thruster demonstration. Continued hardware scale-up for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Continued demonstration of advanced chemical propulsion system for satellites. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.	0.220	0.000	0.000	0.000	0.000
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total																		
for future reusable launch vehicles. Continued material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Continued advanced hydrocarbon fuel/additive scale-up and proof efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.																							
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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 6310SP: <i>Space Rocket Prop Demo</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.						
MAJOR THRUST: Develop electric and advanced chemical based monopropellant propulsion technologies for future satellite propulsion systems. Phases are referring to IHRPRT program phases. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued development of advanced IHRPRT Phase III monopropellant thruster technologies. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.		5.937	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals		21.926	0.000	0.000	0.000	0.000
		FY 2009	FY 2010			
Congressional Add: Hybrid Sounding Rocket Propulsion. <i>FY 2009 Accomplishments:</i> In FY 2009: Matured hybrid rocket propulsion technologies.		0.798	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 6310SP: <i>Space Rocket Prop Demo</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Adds Subtotals	0.798	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (3423): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 632480: <i>Aerospace Fuels</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
632480: <i>Aerospace Fuels</i>	14.998	26.524	9.393	0.000	9.393	6.882	6.731	7.668	7.965	Continuing	Continuing

Note

Note: The funding in this project has decreases in FY 2011 and beyond due to planned taper of turbine engine technologies.

A. Mission Description and Budget Item Justification

This project evaluates and demonstrates improved hydrocarbon fuels, unique/alternate fuels and advanced, novel aerospace propulsion technologies for Air Force applications; including high-speed/hypersonic flight and technologies to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The advanced fuel emphasis is on demonstrating new thermally stable, high-heat sink, and controlled chemically reacting fuels for a conventional turbine engine, turbine-based combined cycle engines, and other advanced propulsion systems. The project also evaluates and demonstrates fuel system components that minimize cost, reduce maintenance, and improve performance of future aerospace systems. The advanced propulsion emphasis is on demonstrating concepts for combined cycle, ramjet, and scramjet engines. This project is integrated into the Versatile Affordable Advanced Turbine Engine (VAATE) program. A portion of this project supports the demonstration of adaptive cycle technologies. This project develops component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Demonstrate thermally stable fuels and fuel system hardware concepts to enhance cooling capacity (performance), minimize fuel coking, and reduce fuel system maintenance.	1.869	3.000	2.866	0.000	2.866
<i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated engine and airframe durability and performance benefits from the use of alternative fuels. Developed knowledge base needed for Air Force-wide certification of alternative fuels, especially biofuels. Demonstrated cooling air systems and other advanced aircraft thermal management systems. Determined fuel structure changes required to increase specific gravity to 0.775. Determined elastomer swell agents capable of increasing swell to typical JP-8 levels. Began determination of new specification requirements for biomass-derived alternative fuels. Developed key					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 632480: <i>Aerospace Fuels</i>																			
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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 632480: <i>Aerospace Fuels</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p>Congressional Add: Assured Aerospace Fuels Research.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Created sufficient alternative (non-petroleum) jet fuel to enable fuel composition-versus-properties studies. The facility is also used for collaborative studies with fuel manufacturers on technology to produce suitable jet fuels for AF use.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	1.596	0.000
<p>Congressional Add: Bio-JP8 Fuel Development.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Evaluated an alternative biofuel production pathway with hydrotreated fats and oils as the initial "biokerosene" jet fuels to be evaluated.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Bio-JP8 Fuel Development.</p>	0.798	3.983
<p>Congressional Add: Renewable Hydrocarbon Fuels for Military Applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted research to identify the most promising types of algae for use in military applications.</p>	1.995	1.992

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B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Renewable Hydrocarbon Fuels for Military Applications.		
Congressional Add: Algal Biofuels for Aviation. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Algal Biofuels for Aviation.	0.000	2.390
Congressional Add: Algal-Derived Jet Fuel for Air Force Applications. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Algal-Derived Jet Fuel for Air Force applications.	0.000	2.689
Congressional Add: Hawaii Microalgae Biofuel Project. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in the Hawaii Microalgae Biofuel Project.	0.000	3.505

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Adds Subtotals	4.389	14.559

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603112F: <i>Advanced Materials for Weapons Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 633035: <i>Aerospace Power Technology</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633035: <i>Aerospace Power Technology</i>	11.450	14.936	5.556	0.000	5.556	5.842	5.766	8.522	10.224	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates electrical power, thermal management, and distribution for aerospace applications. This technology enhances reliability and survivability, and reduces vulnerability, weight, and life cycle costs for manned and unmanned aerospace vehicles. The electrical power system components developed are projected to provide a two- to five-fold improvement in aircraft reliability and maintainability, and a 20 percent reduction in power system weight. This project is integrated into the Integrated Vehicle Energy Technology (INVENT) and power and thermal programs. This project also develops and demonstrates electrical power and thermal management technologies to enable solid state high power density sources for directed energy weapons.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop electrical power and thermal management component subsystem technologies for integration with directed energy weapons (DEW) to deliver high power for DEW operation.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed analysis of high power megawatt class generator test results.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Initiate development of high energy laser flight demonstration power and thermal management systems.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Initiate development of energy storage, power conditioning, and thermal management subsystems to support flight demonstration of a high energy laser.</p>	0.396	0.207	0.250	0.000	0.250

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
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B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.						
<p>MAJOR THRUST: Develop power generation/conditioning/distribution component, energy storage, and thermal management components and subsystem technologies for integration into high power aircraft.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Designed high temperature demonstrator and fabricated key components.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Complete detailed design of high temperature, energy optimized demonstrator and initiate fabrication of power and thermal management components.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Integrate, fabricate, and modify high temperature, energy optimized power and thermal management components. Note: In FY 2011, decrease in funding in is due to the movement of technologies to PE 0602203F, Aerospace Propulsion, to better reflect the actual technology readiness level of this effort.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>		3.191	3.992	1.939	0.000	1.939
<p>MAJOR THRUST: Develop power and thermal management components and subsystems technologies for fielded and future high power aircraft to enable efficient power acquisition, storage, and transport.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Investigated, designed, and developed efficient, lightweight, wide temperature range, rugged/robust power electronics, motor controls, actuators, heat exchangers, and thermal management components and subsystems.</p>		4.672	4.814	2.883	0.000	2.883

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010			
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B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>FY 2009. In FY 2010, efforts were broken out the clearly show application of these technologies to unmanned aerial systems (UAS).</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Develop and fabricate energy optimized, lightweight, hybrid electrical power and thermal management subsystems for increased endurance UAS and ground based special purpose applications.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>						
Accomplishments/Planned Programs Subtotals		8.259	9.359	5.556	0.000	5.556
		FY 2009	FY 2010			
<p>Congressional Add: Silicon Carbide (SiC) Power Electronics for More Electric Aircraft.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed reliable, high voltage (600-1200V), high current (50-100A/die) enhancement mode vertical junction field effect transistors and Schottky diodes, manufacturing yield limiter evaluation and enhancement, applications engineering, and reliability testing.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		3.191	0.000			
<p>Congressional Add: Methanol Fuel Cell Development for USAF Battlefield Renewable Integrated Tactical Energy System (BRITES).</p>		0.000	2.390			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 633035: <i>Aerospace Power Technology</i>	
B. Accomplishments/Planned Program (\$ in Millions)			
		FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Methanol Fuel Cell Development for USAF Battlefield Integrated Tactical Energy System (BRITES).</p>			
<p>Congressional Add: Silicon Carbide Power Modules for the F-35 Joint Strike Fighter.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in Silicon Carbide Power Modules for the F-35 Joint Strike Fighter.</p>		0.000	2.390
<p>Congressional Add: Texas Research Institute for Environmental Studies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort at the Texas Research Institute for Environmental Studies.</p>		0.000	0.797
Congressional Adds Subtotals		3.191	5.577

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 633035: <i>Aerospace Power Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 634921: <i>Aircraft Propulsion Subsystems Int</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634921: <i>Aircraft Propulsion Subsystems Int</i>	44.678	39.592	41.403	0.000	41.403	18.006	18.176	17.867	19.479	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. This project includes the Aerospace Propulsion Subsystems Integration (APSI) program, which includes demonstrator engines such as the Joint Technology Demonstrator Engine for manned systems and the Joint Expendable Turbine Engine Concept for unmanned air vehicle and cruise missile applications. The demonstrator engines integrate the core (high-pressure spool) technology developed under the Advanced Turbine Engine Gas Generator project with the engine (low-pressure spool) technology such as fans, turbines, engine controls, mechanical systems, exhaust nozzles, and augmentors. Additionally, these efforts include activities under the national Propulsion Safety and Readiness program. This project also focuses on integration of inlets, nozzles, engine/airframe compatibility, and power and thermal management subsystems technologies. APSI provides aircraft with potential for longer range and higher cruise speeds with lower specific fuel consumption, surge power for successful engagements, high sortie rates with reduced maintenance, reduced life cycle cost, and improved survivability, resulting in increased mission effectiveness. Technologies developed are applicable to sustained high-speed vehicles and responsive space launch. APSI supports the goals of the national Versatile Affordable Advanced Turbine Engine (VAATE) program, which is focused on improving propulsion capabilities while at the same time reducing the cost of ownership. Anticipated technology advances include turbine engine improvements providing approximately twice the range for a sustained supersonic combat aircraft, doubling the time on station with 10 times the power output for surveillance aircraft and propulsion for a high speed supersonic missile with double the range for time sensitive targets. The VAATE program provides continuous technology transition for military turbine engine upgrades and derivatives and has the added dual-use benefit of enhancing the United States turbine engine industry's international competitiveness. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Design, fabricate, and demonstrate durability and integration technologies for turbofan/turbojet engines to improve durability, supportability, and affordability of AF aircraft.	1.621	2.625	7.267	0.000	7.267

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
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B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Finished testing of advanced components for technologies for engine testing to include an advanced light weight fan/compressor, turbines with new advanced cooling approaches, oil-less bearings and high through flow combustors for high mach missile applications. Initiated design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency improving range. Initiated design of low spool components for fuel efficient subsonic unmanned turbofan engines.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct preliminary design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency improving range. Conduct preliminary design of advanced fan, advanced low spool turbine, and advanced engine components for improved fuel efficient subsonic unmanned turbofan engines. Note: In FY 2010, funding dips due to completion of testing of advanced components.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Conduct detailed design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency improving range. Conduct detailed design of advanced fan, advanced low spool turbine spool, and advanced engine components for fuel efficient subsonic unmanned turbofan engines. Note: In FY 2011, funding is increased due to shift in emphasis from preliminary design to detailed design of expendable turbine engines.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				39.492	36.405	41.403	0.000	41.403
				FY 2009	FY 2010			
				1.596	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 634921: <i>Aircraft Propulsion Subsystems Int</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Small Adaptive Cycle Turbine Engines. <i>FY 2009 Accomplishments:</i> In FY 2009: Performed risk reduction for an advanced cooled metal turbine and for an advanced high temperature rear bearing. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Add: Small Turbofan Versatile Affordable Advanced Turbine Engine (VAATE) Program. <i>FY 2009 Accomplishments:</i> In FY 2009: Supported the on-going engine demonstrator, design and hardware, tip treatments for high pressure compressor, and thermal mechanical fatigue analysis/design for the turbine. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally directed effort in the Small Turbofan Versatile Affordable Advanced Turbine Engine (VAATE) Program.	3.590	3.187
Congressional Adds Subtotals	5.186	3.187

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603003A: <i>Aviation Advanced Technology.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 634922: <i>Space & Missile Rocket Propulsion</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634922: <i>Space & Missile Rocket Propulsion</i>	4.736	29.515	31.840	0.000	31.840	28.059	31.925	39.865	41.610	Continuing	Continuing

Note

Note: In FY 2010, this work was moved from Project 10SP within this Program Element to better align efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced and innovative low-cost rocket turbo-machinery and components, low-cost space launch propulsion technologies, and advanced propellants for launch and orbit transfer propulsion. Additionally, this project develops technologies for the Technology for Sustainment of Strategic Systems (TSSS) Phase II (including solid boost/missile propulsion, post boost control, and aging and surveillance efforts) and tactical rockets. Characteristics such as environmental acceptability, affordability, reliability, responsiveness, reduced weight, and reduced operation and launch costs are emphasized. Increased life and performance of propulsion systems are key goals. This project also develops chemical, electrical, and solar rocket propulsion technologies for station-keeping and on-orbit maneuvering applications. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion technologies, higher efficiency energy conversion systems (derived from an improved understanding of combustion fundamentals), and high-energy propellants. Technological advances developed in this program could improve the performance of expendable payload capabilities by approximately 20-50 percent and reduce launch, operations, and support costs by approximately 30 percent. Responsiveness and operability of propulsion systems will be enhanced for reusable launch systems. Technology advances could also lead to seven-year increase in satellite on-orbit time, a 50 percent increase in satellite maneuvering capability, a 25 percent reduction in orbit transfer operational costs, and a 15 percent increase in satellite payload. Aging and surveillance efforts for solid rocket motors could reduce lifetime prediction uncertainties for individual motors by 50 percent, enabling motor replacement for cause. The efforts in this project contribute to the TSSS program and Integrated High Payoff Rocket Propulsion Technology program (IHRPT), a joint Department of Defense, National Aeronautics and Space Administration, and industry effort to focus rocket propulsion technology on national space launch needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop liquid rocket propulsion technology for current and future space launch vehicles.	0.000	19.707	25.608	0.000	25.608

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 634922: <i>Space & Missile Rocket Propulsion</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate through hot fire testing advanced cryogenic upper stage hardware to validate and verify modeling and simulation tools developed. Continue development of hydrocarbon engine components for integration and demonstration in advanced hydrocarbon engine concepts for future reusable launch vehicles. Initiate sub-scale component testing to demonstrate hydrocarbon boost technologies. Continue material manufacturing scale-up effort to support hydrocarbon boost demonstration program.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete the validation and verification of modeling and simulation tools developed for advanced cryogenic upper stage technologies. Continue development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept for future reusable launch vehicles. Continue sub-scale component testing to demonstrate hydrocarbon boost technologies. Continue material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Initiate component demonstration for advanced hydrocarbon engine technologies using fuels other than kerosene that address IHPRPT Phase III goals. Note: In FY 2011, funding is increased due to initiation of component demonstration for advanced hydrocarbon engine technologies.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
MAJOR THRUST: Develop solar electric, electric, and monopropellant propulsion technologies for existing and future satellites, upper stages, orbit transfer vehicles, and satellite maneuvering.				0.000	1.051	3.196	0.000	3.196

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 634922: <i>Space & Missile Rocket Propulsion</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue integration and full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>					
Accomplishments/Planned Programs Subtotals	4.736	29.515	31.840	0.000	31.840

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Spacecraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603401F: <i>Advanced Spacecraft Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 634922: <i>Space & Missile Rocket Propulsion</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0603500F: <i>Multi-Disciplinary Advanced Development Space Technology.</i>											
• PE 0603853F: <i>Evolved Expendable Launch Vehicle Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603114N: <i>Power Projection Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 635098: <i>Advanced Aerospace Propulsion</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635098: <i>Advanced Aerospace Propulsion</i>	28.301	23.832	13.177	0.000	13.177	20.457	17.959	18.617	20.357	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates, via ground and flight tests, the scramjet propulsion cycle to a technology readiness level appropriate for full integration with other engine cycles (including turbine and rocket-based) to provide the Air Force with transformational military capabilities. The primary focus is on the hydrocarbon-fueled, scramjet engine. Multi-cycle engines will provide the propulsion systems for possible application to support aircraft and weapon platforms operating over the range of Mach 0 to 8+. Efforts include scramjet flow-path optimization to enable operation over the widest possible range of Mach numbers, active combustion control to assure continuous positive thrust (even during mode transition), robust flame-holding to maintain stability through flow distortions, and maximized volume-to-surface area to minimize the thermal load imposed by the high-speed engine. Thermal management plays a vital role in scramjet and combined cycle engines, including considerations for protecting low speed propulsion systems (e.g., turbine engines) during hypersonic flight.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation over a range of Mach 4 to 8. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted integrated air vehicle/propulsion flight tests and conducted post test data reduction and reporting. <i>FY 2010 Plans:</i> In FY 2010: Complete integrated air vehicle/propulsion flight tests; conduct post test data reduction and write X-51A final report. Demonstrate small scale scramjet engine to technology readiness level 6.	28.301	23.832	13.177	0.000	13.177

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 635098: <i>Advanced Aerospace Propulsion</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Develop and demonstrate tactically compliant subsystems, including scramjet engine start system, fuel system, and engine controls. Note: In FY 2011, the efforts in this thrust are reduced due to higher AF priorities.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2001 OCO: N/A.</p>					
Accomplishments/Planned Programs Subtotals	28.301	23.832	13.177	0.000	13.177

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 63681B: <i>Advanced Turbine Engine Gas Generator</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63681B: <i>Advanced Turbine Engine Gas Generator</i>	48.405	57.842	34.766	0.000	34.766	33.540	34.756	27.725	29.409	Continuing	Continuing

Note

Note: The funding in this project decreases in FY 2011 due to planned taper of turbine engine technologies.

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The objective is to provide the continued evolution of technologies into an advanced gas generator in which the performance, cost, durability, reparability, and maintainability can be assessed in a realistic engine environment. The gas generator, or core, is the basic building block of the engine and nominally consists of a compressor, a combustor, a high-pressure turbine, mechanical systems, and core subsystems. Experimental core engine demonstration validates engineering design tools and enhances rapid, low-risk transition of key engine technologies into engineering development, where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, missiles, land combat vehicles, ships, and responsive space launch. Component technologies are demonstrated in a core (sub-engine). This project also assesses the impact of low spool components (such as inlet systems, fans, low pressure turbines, and exhaust systems) and system level technologies (such as integrated power generators and thermal management systems) on core engine performance and durability in "core-centric engine" demonstration. The core performances of this project are validated on demonstrator engines in Project 4921 of this PE. Efforts are part of the Versatile Affordable Advanced Turbine Engines (VAATE) program. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan/turbojet engines.	37.681	46.648	21.410	0.000	21.410

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 63681B: <i>Advanced Turbine Engine Gas Generator</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>advanced mechanical systems. Complete hardware fabrication, and continue selective risk reduction experimental demonstrations of UAS small versatile affordable advanced core engine technologies including a high heat release combustor, durable high performance turbine, and systems for thermal management and advanced power extraction. Complete preliminary design and initiate long lead fabrication of efficient small engine component technologies for use in UAS applications.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Conduct detailed design of core for highly efficient core engine concept with advanced core technologies including high efficiency, high pressure ratio, high temperature capability compressor, high efficiency, high heat release combustor, and high work, high cooling effectiveness turbine with an integrated thermal management system and advanced mechanical systems. Continue selective risk reduction experimental demonstrations of UAS small versatile affordable advanced core engine. Complete detailed design and initiate fabrication of efficient small engine component technologies including high efficiency, high pressure ratio, high temperature capability compressor, high efficiency, high heat release combustor, and high work, high cooling effectiveness or uncooled turbine for use in UAS applications.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>					
Accomplishments/Planned Programs Subtotals	48.405	57.842	34.766	0.000	34.766

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602201F: <i>Aerospace Flight Dynamics.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 63681B: <i>Advanced Turbine Engine Gas Generator</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603003A: <i>Aviation Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	35.742	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
632830: <i>Decision Effectiveness Technology</i>	25.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
634924: <i>Warfighter Readiness Technology</i>	7.830	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
635020: <i>Bioeffects & Protection Technology</i>	2.848	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note
 Note: In FY 2010, Decision Effectiveness Technology efforts will move from PE 0603231F, Project 2830 to PE 0603456F, Project 5324, Project 5326, and Project 5327; Warfighter Readiness Technology efforts will move from PE 0603231F, Project 4924 to PE 0603456F, Project 5325; and Bioeffects & Protection Technology efforts will move from PE 0603231F, Project 5020 to PE 0603456F, Project 5323 and Project 5326 to better align efforts. Funds for the FY 2008 Congressionally-directed Virtual Medical Trainer in the amount of \$2.4 million are in the process of being moved to the Defense Health Program from PE 0603231F, Crew Systems and Personnel Protection Technology, for execution.

A. Mission Description and Budget Item Justification
 This program develops and demonstrates technologies to enhance human performance and effectiveness and to enable the aerospace force. State-of-the-art advances are made to train personnel, protect and sustain warfighters, and improve human interfaces with weapon systems. The Decision Effectiveness Technology project develops and demonstrates warfighter capability enhancing technologies that promote effective decision-making, control, and mission execution in the emerging network-enabled operational environments. The Warfighter Readiness Technology project develops and demonstrates advanced training, simulation, and mission rehearsal technologies. The Bioeffects and Protection Technology project develops and demonstrates advanced technologies to provide laser eye protection, assure the safety of personnel involved with test, deployment, and operation of high-energy laser weapons, enhance capabilities for sustained operations in extreme environments, and deliver novel, tailored bio-taggant and identification/neutralization capabilities to meet specific AF special operations needs. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	36.411	0.000	0.000	0.000	0.000
Current President's Budget	35.742	0.000	0.000	0.000	0.000
Total Adjustments	-0.669	0.000	0.000	0.000	0.000
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.669	0.000	0.000	0.000	0.000

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 632830: *Decision Effectiveness Technology*

Congressional Add: *Air Purification with Carbon Nanotube Nanostructured Material.*

Congressional Add: *PhasorBIRD Helmet Tracker.*

Congressional Add Subtotals for Project: 632830

Project: 634924: *Warfighter Readiness Technology*

Congressional Add: *Joint Theater Air Ground Simulation System.*

Congressional Add Subtotals for Project: 634924

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	4.986	0.000
	2.473	0.000
	7.459	0.000
	2.393	0.000
	2.393	0.000
	9.852	0.000

Change Summary Explanation

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>				PROJECT 632830: <i>Decision Effectiveness Technology</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
632830: <i>Decision Effectiveness Technology</i>	25.064	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, Decision Effectiveness Technology efforts will move from PE 0603231F, Project 2830 to PE 0603456F, Project 5324, Project 5326, and Project 5327 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates warfighter capability enhancing technologies and information operations technologies that promote effective decision-making, control, and mission execution in the emerging network-enabled operational environment. Included are advanced technologies that improve the ability of battlefield Airmen to rapidly assimilate critical information and make timely and correct decisions, display technologies and decision aids that enhance time-critical strikes, and warfighter interface technologies that simplify and speed critical operations in air operation centers and battle management platforms. The project also develops technologies that enhance logistics functions, improve the fidelity and accuracy of large-scale military simulations, protect deployed personnel, improve human effectiveness during aerospace and cyber operations, support development of novel, tailored bio-taggant and identification/neutralization capabilities, develop aircrew system technologies to support long duration missions, and improve the manhunt capabilities of AF special operations. The ultimate goal is to assure warfighter decision effectiveness in AF operations.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop/demonstrate human-centered tools for the AF Information Operations (IO) and Intelligence, Surveillance and Reconnaissance (ISR) communities. <i>FY 2009 Accomplishments:</i> In FY 2009: Designed advanced IO/ISR/Cyber technologies and demonstrated next-generation IO/ISR/Cyber operator workstation capabilities to operationally integrate/normalize AF non-kinetic capabilities with kinetic operations. Developed operator-aiding and training tools for IO/ISR/Cyber	2.591	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>		PROJECT 632830: <i>Decision Effectiveness Technology</i>																			
B. Accomplishments/Planned Program (\$ in Millions)																							
<table border="1"> <thead> <tr> <th></th> <th>FY 2009</th> <th>FY 2010</th> <th>FY 2011 Base</th> <th>FY 2011 OCO</th> <th>FY 2011 Total</th> </tr> </thead> <tbody> <tr> <td> <p>operators. Initiated advanced Cyber influence development. NOTE: In FY 2010, this major thrust will move to PE 0603456F, Project 5324 to better align efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p> </td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td> <p>MAJOR THRUST: Develop/demonstrate human effectiveness technologies to improve combat effectiveness reporting, situation assessment, and decision support for Combined Air/Space Operation Center (CAOC).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Integrated visualization tools with other collaborative tools to create a seamless flow of operational assessment data into strategy planning data. Demonstrated a final visually-oriented, unified strategy planning and assessment support tool in a simulated CAOC. NOTE: In FY 2010, this major thrust will move to PE 0603456F, Project 5324 to better align efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p> </td> <td align="center">1.825</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> </tr> </tbody> </table>							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	<p>operators. Initiated advanced Cyber influence development. NOTE: In FY 2010, this major thrust will move to PE 0603456F, Project 5324 to better align efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>						<p>MAJOR THRUST: Develop/demonstrate human effectiveness technologies to improve combat effectiveness reporting, situation assessment, and decision support for Combined Air/Space Operation Center (CAOC).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Integrated visualization tools with other collaborative tools to create a seamless flow of operational assessment data into strategy planning data. Demonstrated a final visually-oriented, unified strategy planning and assessment support tool in a simulated CAOC. NOTE: In FY 2010, this major thrust will move to PE 0603456F, Project 5324 to better align efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>	1.825	0.000	0.000	0.000	0.000
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total																		
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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>	PROJECT 632830: <i>Decision Effectiveness Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop/demonstrate technologies to interface between ground controllers and multiple machine components through unified visual and auditory displays.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed and demonstrated human systems integration concepts for ground controllers and other battlefield Airmen. Demonstrated technologies for three-dimensional audio navigation in visually obscured environments while improving team situational awareness by geo-location of voice communications. Incorporated a geo-located survival guide into a wearable computer and demonstrated its value in an operationally relevant environment. Developed and incorporated an advanced battlefield air traffic control capability in the combat controller's software suite. Incorporated intelligent agent technology to improve battlefield Airmen situational awareness in a dynamic wartime scenario. Completed hardware and software implementation of a supervisory control station technology baseline and a next-generation supervisory control station. Planned a technology demonstration program using real-time system simulation and field testing in spiral demonstration phases. Established the scope of simulation and test activities, selected experimental variables, determined key performance measures, and commenced the assessment. NOTE: In FY 2010, this major thrust will move to PE 0603456F, Project 5327 to better align efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>		3.748	0.000	0.000	0.000	0.000
<p>MAJOR THRUST: Develop/demonstrate decision-aiding technologies to rapidly assess battlefield situations, predict most likely adversary behaviors, and select/prioritize appropriate courses of action.</p>		2.147	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>	PROJECT 632830: <i>Decision Effectiveness Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Air Purification with Carbon Nanotube Nanostructured Material. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Air Purification with Carbon Nanotube Nanostructured Material. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	4.986	0.000
Congressional Add: PhasorBIRD Helmet Tracker. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for PhasorBIRD Helmet Tracker. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	2.473	0.000
Congressional Adds Subtotals	7.459	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>						
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>	PROJECT 632830: <i>Decision Effectiveness Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0604706F: <i>Life Support Systems.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>				PROJECT 634924: <i>Warfighter Readiness Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634924: <i>Warfighter Readiness Technology</i>	7.830	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, Warfighter Readiness Technology efforts will move from PE 0603231F, Project 4924 to PE 0603456F, Project 5325 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced training, simulation, and mission rehearsal technologies that will improve warfighter capabilities and mission readiness by enhancing operator and team performance skills. This effort includes the development of technologies that enable integration of computer models, live weapon systems, and weapon system simulators to portray the global battlespace, including all-weather, day/night flight operations, C2, force protection, and aerospace operations. This project develops and demonstrates advanced training and simulation technologies that will improve warfighter readiness by enhancing mission training and mission rehearsal capabilities. Development and effective use of the global battlespace requires advances in training systems and in interconnection, information, visual, and representation technologies. The resulting mission training and rehearsal capabilities will enhance the mission essential competencies of combat and combat support individuals and teams that comprise the aerospace force.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Advance aerospace/organizational behavior models for integrated warfighter training and rehearsal. Adds realism operations, C2, force protection, and air base defense warfighters.	2.426	0.000	0.000	0.000	0.000
<i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated adaptive training within Distributed Mission Operations (DMO) using embedded knowledge and skills assessment. Developed common tools for mission planning, briefing, and after action review that function across air combat, ground operations, and combat operations and planning in an Air and Space Operations Center (AOC). Completed integration and evaluation of joint close air support (JCAS) environment for schoolhouse training. Demonstrated and validated technology alternatives for in-garrison and field deployable JCAS training and rehearsal system.					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>	PROJECT 634924: <i>Warfighter Readiness Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals	5.437	0.000	0.000	0.000	0.000

	FY 2009	FY 2010
Congressional Add: Joint Theater Air Ground Simulation System. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Joint Theater Air Ground Simulation System. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	2.393	0.000
Congressional Adds Subtotals	2.393	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604227F: <i>Distributed Mission Training.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>	PROJECT 634924: <i>Warfighter Readiness Technology</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>				PROJECT 635020: <i>Bioeffects & Protection Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635020: <i>Bioeffects & Protection Technology</i>	2.848	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, Bioeffects & Protection Technology efforts will move from PE 0603231F, Project 5020 to PE 0603456F, Project 5323 and Project 5326 to better align efforts.

A. Mission Description and Budget Item Justification

This project integrates and demonstrates technologies to provide protection against directed energy threats and hazards, without compromising performance, vigilance, or mission effectiveness, and man-portable technologies for the neutralization of threats. Development and demonstration efforts focus on advanced technologies for laser eye protection (LEP), preventing injurious exposures of personnel involved with test and evaluation of high power microwave or high-energy laser weapons, and enabling operational employment of these systems. It also develops tools and guidelines for testing and deploying high power microwave and high-energy laser systems and technologies to enhance personnel safety and effectiveness in aerospace operations. Biobehavioral performance capabilities are developed and demonstrated to enable sustained and enhanced operations in extreme environments to include surge, night, global, information warfare, C2, and other operations.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate technologies that permit safe testing, deployment, and use of high energy laser weapons and systems.	1.093	0.000	0.000	0.000	0.000
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed validation, verification, and accreditation package for laser range safety tool. Released collateral hazard assessment software tool to enable analysis of tactical uses for high-energy laser systems. NOTE: In FY 2010, this major thrust will move to PE 0603456F, Project 5323 to better align efforts.</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>	PROJECT 635020: <i>Bioeffects & Protection Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop and demonstrate ability to support testing of counterforce technologies and to enable man-portable threat neutralization capabilities.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed technologies that will provide the capability to neutralize threats without evidence for special applications. Improved technologies to enable safe return and avoid contaminating aircraft or other equipment. NOTE: In FY 2010, this major thrust will move to PE 0603456F, Project 5326 to better align efforts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	2.848	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603112F: <i>Advanced Materials for Weapon Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603319F: <i>Airborne Laser Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603231F: <i>Crew Systems and Personnel Protection Technology</i>	PROJECT 635020: <i>Bioeffects & Protection Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603456F: <i>Human Effectiveness Adv Tech Dev.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604706F: <i>Life Support Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	29.364	32.056	16.992	0.000	16.992	22.636	23.719	24.367	24.018	Continuing	Continuing
632432: <i>Defensive System Fusion Technology</i>	11.622	4.543	4.707	0.000	4.707	6.292	6.358	6.142	5.926	Continuing	Continuing
63431G: <i>RF Warning & Countermeasures Tech</i>	9.609	21.250	4.142	0.000	4.142	5.502	6.854	7.190	7.028	Continuing	Continuing
63691X: <i>EO/IR Warning & Countermeasures Tech</i>	8.133	6.263	8.143	0.000	8.143	10.842	10.507	11.035	11.064	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to support Air Force electronic combat warfighting capabilities. The program focuses on developing components, subsystems, and technologies with potential aerospace combat, special operations, and airlift electronic combat applications in three project areas. The first project develops and demonstrates technologies for integrating electronic combat sensors and systems into a fused and seamless whole. The second project develops and demonstrates advanced technologies for radio-frequency electronic combat suites. The third project develops and demonstrates advanced warning and countermeasure technologies to defeat electro-optical, infrared, and laser threats to aerospace platforms. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new sensor and electronic combat system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	30.241	31.021	0.000	0.000	0.000
Current President's Budget	29.364	32.056	16.992	0.000	16.992
Total Adjustments	-0.877	1.035	16.992	0.000	16.992
• Congressional General Reductions		-0.031			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.134			
• Congressional Adds		1.200			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.877	0.000	16.992	0.000	16.992

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 632432: *Defensive System Fusion Technology*

Congressional Add: *Advanced Threat Alert Advanced Technology Demonstration.*

Congressional Add: *Commercial-Off-the-Shelf (COTS) Analysis Tools for Navigational Warfare.*

Congressional Add Subtotals for Project: 632432

Project: 63431G: *RF Warning & Countermeasures Tech*

Congressional Add: *Advanced Electromagnetic Location of IEDs Defeat System.*

Congressional Add: *New Electronic Warfare Specialists Through Advanced Research by Students.*

Congressional Add Subtotals for Project: 63431G

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	4.867	0.000
	1.197	0.000
	6.064	0.000
	1.596	1.195
	1.596	0.000
	3.192	1.195
	9.256	1.195

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force

DATE: February 2010

APPROPRIATION/BUDGET ACTIVITY

3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603270F: *Electronic Combat Technology*

Change Summary Explanation

Note: In FY 2010, Congress added \$1.2 million for Advanced Electromagnetic Location of IEDs Defeat System. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>				PROJECT 632432: <i>Defensive System Fusion Technology</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
632432: <i>Defensive System Fusion Technology</i>	11.622	4.543	4.707	0.000	4.707	6.292	6.358	6.142	5.926	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technologies for integrating electronic combat sensors and electronic combat system fusion. It develops advanced algorithms and assessment techniques needed to evaluate and enable combat aircraft operations in multi-spectral threat and countermeasure environments. It also matures technologies required for command-and-control warfare, standoff jamming, and electronic support measures for the denial, disruption, and suppression of adversary air defense operations. Technologies include: advanced components and techniques needed to jam enemy radars; advanced standoff jammer technologies; and electronic collection methods to inform field commanders of changes in the electronic environment.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop affordable radio-frequency and electro-optical emitter warning and electronic warfare battle (EW) management technologies, integrating EW and information operations.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted analyses and initial demonstrations of electronic warfare battle management strategies in the Air Force Integrated Demonstrations and Applications Laboratory and Virtual Combat Laboratory simulation facilities. Developed and demonstrated technical protocols for the integration of electronic warfare, command-and-control warfare, and information operations against an integrated air defense system. Developed and matured key technologies essential for Airborne Electronic Attack risk reduction.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue research into electronic warfare battle management techniques and protocols in the Virtual Combat Environment for Electronic Conflict. Investigate and demonstrate electronic attack techniques from multiple nodes. Initiate a project to demonstrate a distributed (multi-node) electronic</p>	5.558	4.543	4.707	0.000	4.707

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>		PROJECT 632432: <i>Defensive System Fusion Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>support/electronic attack architecture. Continue research into integration of electronic attack and information operations to defeat an adversary integrated air defense system.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Initiate a critical experiment to demonstrate synergistic electronic warfare (EW) and information operations (IO) techniques against a representative integrated air defense system. Initiate an effort to develop a virtual EW/IO battlespace environment for future project demonstrations, experiments, and assessments. Conduct a demonstration of electronic warfare battle management techniques and algorithms. Continue with the development of a distributed (multi-node) electronic support/electronic attack architecture.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				5.558	4.543	4.707	0.000	4.707
				FY 2009	FY 2010			
<p>Congressional Add: Advanced Threat Alert Advanced Technology Demonstration.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advanced Threat Alert Advanced Technology Demonstration.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>				4.867	0.000			
<p>Congressional Add: Commercial-Off-the-Shelf (COTS) Analysis Tools for Navigational Warfare.</p>				1.197	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 632432: <i>Defensive System Fusion Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for COTS Analysis Tools for Navigational Warfare.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
Congressional Adds Subtotals	6.064	0.000

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (6105): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603500F: <i>Multi-disciplinary Advanced Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>				PROJECT 63431G: <i>RF Warning & Countermeasures Tech</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63431G: <i>RF Warning & Countermeasures Tech</i>	9.609	21.250	4.142	0.000	4.142	5.502	6.854	7.190	7.028	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced technologies for radio-frequency electronic combat suites to enhance the survivability of aerospace vehicles and to provide crew situational awareness. One major area addresses technologies for missile/threat warning, radio-frequency receivers, electronic combat pre-processors, advanced sorting/pre-processing algorithms, and expert software for applications on existing and future electronic combat systems. Another major technology area focuses on the development and demonstration of subsystems and components for generating on-board/off-board radio-frequency countermeasure techniques. This includes the development of electronic countermeasures techniques as well as advanced electronic countermeasures technologies such as antennas, power amplifiers, and preamplifiers.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop aerospace platform jamming technologies and techniques to counter advanced radio-frequency threats associated with current and future aerospace weapon systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Provided hardware simulation and analysis support to multi-intelligence sensor needs for accurate and timely electronic surveillance information. Developed advanced radar jamming engineering models including technique generators, wide band amplifier modules and apertures, needed to conduct network enabled research and evaluation of countermeasure techniques. Developed advanced simulation capabilities to support network enabled jamming of adversary early warning and surveillance networks. Developed and evaluated integrated digital receiver/jammer brassboard architectures that leverage real-time electronic surveillance signal processing to enhance electronic attack effectiveness.</p>	6.417	20.055	4.142	0.000	4.142

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force							DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>				PROJECT 63431G: <i>RF Warning & Countermeasures Tech</i>				
B. Accomplishments/Planned Program (\$ in Millions)											
							FY 2009	FY 2010			
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Electromagnetic Location of IEDs Defeat System.											
Congressional Add: New Electronic Warfare Specialists Through Advanced Research by Students. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for New Electronic Warfare Specialists Through Advanced Research by Students. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.							1.596	0.000			
Congressional Adds Subtotals							3.192	1.195			
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (6274): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604270F: <i>Electronic Warfare (EW) Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603500F: <i>Multi-disciplinary Advanced Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D. Acquisition Strategy											
Not Applicable.											

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 63431G: <i>RF Warning & Countermeasures Tech</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603270F: <i>Electronic Combat Technology</i>				63691X: <i>EO/IR Warning & Countermeasures Tech</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63691X: <i>EO/IR Warning & Countermeasures Tech</i>	8.133	6.263	8.143	0.000	8.143	10.842	10.507	11.035	11.064	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates the advanced warning and countermeasure technologies required to negate electro-optical, infrared, and laser threats to aerospace platforms. Off-board (decoys and expendables) and on-board countermeasure technologies developed for aircraft self-protection will provide robust, affordable solutions for protection against infrared missiles with autonomous seekers, multi-spectral threats, laser-guided weapons, and electro-optical and infrared tracking systems used to direct electro-optical, infrared, and radar-guided missiles.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Analyze the vulnerabilities of current infrared missile systems and future imaging infrared sensors.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Performed laboratory analyses on future infrared guided missile capabilities. Assessed effectiveness of current and planned techniques against new threat trends and direction of future countermeasure technique requirements. Conducted digital simulations to assess effectiveness of expendable and laser countermeasure techniques.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue to perform laboratory analyses and assessments on infrared guided missiles and future imaging systems. Investigate countermeasures techniques that include laser jamming and jamming, expendables combinations. Conduct digital, injection, hardware-in-loop simulation to develop and assess countermeasures (CM) effectiveness. Obtain imaging threat to enable evaluation of postulated CM concepts. Support major advanced technology demonstrations through developmental test and evaluation.</p>	4.424	1.654	2.987	0.000	2.987

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 63691X: <i>EO/IR Warning & Countermeasures Tech</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals	8.133	6.263	8.143	0.000	8.143

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (6503): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602204F: <i>Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604270F: <i>Electronic Warfare (EW) Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603500F: <i>Multi-disciplinary Advanced Development Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604270N: <i>EW Development.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	97.834	98.708	83.705	0.000	83.705	75.985	77.194	78.925	78.744	Continuing	Continuing
632181: <i>Spacecraft Payloads</i>	33.821	33.691	20.548	0.000	20.548	17.853	17.019	18.987	17.712	Continuing	Continuing
633834: <i>Integrated Space Technology Demonstrations</i>	37.531	28.996	41.188	0.000	41.188	36.082	33.481	32.396	33.148	Continuing	Continuing
634400: <i>Space Systems Protection</i>	5.892	8.070	5.316	0.000	5.316	6.042	9.711	10.308	10.764	Continuing	Continuing
635021: <i>Space Systems Survivability</i>	4.123	4.842	3.845	0.000	3.845	3.336	3.367	3.540	3.689	Continuing	Continuing
635083: <i>Ballistic Missiles Technology</i>	5.195	11.921	5.256	0.000	5.256	5.036	5.039	5.259	6.141	Continuing	Continuing
63682J: <i>Spacecraft Vehicles</i>	11.272	11.188	7.552	0.000	7.552	7.636	8.577	8.435	7.290	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops, integrates, and demonstrates space technologies in the areas of spacecraft payloads, spacecraft protection, spacecraft and launch vehicles, ballistic missiles, space systems survivability, and development of advanced laser communications technologies to support next generation satellite communication systems. The integrated space technologies are demonstrated by component or system level tests on the ground or in flight. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing space system upgrades and/or new space system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	97.469	83.909	0.000	0.000	0.000
Current President's Budget	97.834	98.708	83.705	0.000	83.705
Total Adjustments	0.365	14.799	83.705	0.000	83.705
• Congressional General Reductions		-0.148			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.413			
• Congressional Adds		15.360			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.365	0.000	83.705	0.000	83.705

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 632181: *Spacecraft Payloads*

Congressional Add: *Satellite Coherent Optical Receiver (SCORE).*

Congressional Add: *Integrated Spacecraft Engineering Tool (ISET).*

Congressional Add: *Operational Responsive Space Architecture for Dual Use Applications.*

Congressional Add: *Semiconductor Optical Amplifier for Responsive Space MPOI.*

Congressional Add: *Ultra Low Power Electronics.*

Congressional Add: *Micromachined Switches for Next-Generation Modular Satellites.*

Congressional Add: *Domestic Manufacturing of 45nm Electronics.*

Congressional Add: *Integrated Passive Electronic Components.*

Congressional Add Subtotals for Project: 632181

	<u>FY 2009</u>	<u>FY 2010</u>
	1.745	0.000
	1.596	0.000
	1.269	0.000
	2.194	0.000
	3.191	0.000
	2.394	2.390
	0.000	3.187
	0.000	1.354
	12.389	6.931

Project: 635083: *Ballistic Missiles Technology*

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Ballistic Missile Technology.*

Congressional Add: *Florida National Guard Total Force Integration.*

Congressional Add: *P-Net Ballistic Missile Technology.*

Congressional Add Subtotals for Project: 635083

Project: 63682J: *Spacecraft Vehicles*

Congressional Add: *Small Low-Cost Reconnaissance Spacecraft Components/Small Responsive Spacecraft at Low-Cost.*

Congressional Add: *Thin Film Amorphous Solar Arrays.*

Congressional Add: *Space Situational Awareness.*

Congressional Add Subtotals for Project: 63682J

Congressional Add Totals for all Projects

	FY 2009	FY 2010
	0.000	1.593
	0.000	2.390
	0.000	1.992
	0.000	5.975
	1.596	2.390
	1.596	0.000
	1.197	0.000
	4.389	2.390
	16.778	15.296

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note: In FY 2010, Congress added \$1.6 million for Ballistic Missile Technology, \$3.2million for Domestic Manufacturing of 45nm Electronics, \$2.4 million for Florida National Guard Total Force Integration, \$1.36 million for Integrated Passive Electronic Components, \$2.4 million for Micromachined Switches for Next Generation Modular Satellites, \$2.4 million for Small Responsive Spacecraft at Low-Cost, and \$2.0 million for P-Net Ballistic Missile Technology.

C. Performance Metrics
(U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>				PROJECT 632181: <i>Spacecraft Payloads</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
632181: <i>Spacecraft Payloads</i>	33.821	33.691	20.548	0.000	20.548	17.853	17.019	18.987	17.712	Continuing	Continuing

Note

Note: In FY 2011, some of the technology efforts are being moved from this PE to PE 0602601F, Space Technology, to better reflect the actual technology readiness levels of those efforts.

A. Mission Description and Budget Item Justification

This project funds the development, demonstration, and evaluation of radiation-hardened space electronic hardware, satellite control hardware, and software for advanced satellite surveillance operations and development of advanced laser communications technologies to support next-generation satellite communications systems. Improved space-qualifiable electronics and software for data and signal processing will be more interchangeable, interoperable, and standardized. In the near-term, this project's work concentrates on converting (i.e., radiation-hardening) commercial data and signal processor technologies for use in Air Force space systems. For mid-term applications, merge advanced, radiation-hardened space processor, memory, and interconnect technologies with commercially-derived, open system architectures to develop and demonstrate robust, on-board processing capabilities for 21st century Department of Defense satellites. In the long-term, this project area focuses on developing low-cost, easily modifiable software and hardware architectures for fully autonomous constellations of intelligent satellites capable of performing all mission related functions without operator intervention.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop microelectronic devices, including radiation-hardened data processors and high-density hardened memories, advanced packaging technology, and MEMS components and applications. <i>FY 2009 Accomplishments:</i> In FY 2009: Incorporated new Satellite Design Automation software capabilities and demonstrated a logical sequence "push-button toolflow" satellite builder. Integrated high-fidelity radiation-hardened space sensor interface modules using standardized sensor data protocols and demonstrated enhanced device control of sensors and actuators in relevant satellite sub-systems.	7.467	8.479	6.431	0.000	6.431

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 632181: <i>Spacecraft Payloads</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A						
Accomplishments/Planned Programs Subtotals		21.432	26.760	20.548	0.000	20.548
		FY 2009	FY 2010			
Congressional Add: Satellite Coherent Optical Receiver (SCORE). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Satellite Coherent Optical Receiver (SCORE). <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		1.745	0.000			
Congressional Add: Integrated Spacecraft Engineering Tool (ISET). <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Integrated Spacecraft Engineering Tool (ISET). <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		1.596	0.000			
Congressional Add: Operational Responsive Space Architecture for Dual Use Applications.		1.269	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 632181: <i>Spacecraft Payloads</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Operational Responsive Space Architecture for Dual Use Applications.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Semiconductor Optical Amplifier for Responsive Space MPOI.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Semiconductor Optical Amplifier for Responsive Space MPOI.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	2.194	0.000
<p>Congressional Add: Ultra Low Power Electronics.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Ultra Low Power Electronics.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	3.191	0.000
<p>Congressional Add: Micromachined Switches for Next-Generation Modular Satellites.</p>	2.394	2.390

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 632181: <i>Spacecraft Payloads</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Micromachined Switches for Next-Generation Modular Satellites.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Micromachined Switches for Next-Generation Modular Satellites.</p>		
<p>Congressional Add: Domestic Manufacturing of 45nm Electronics.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Domestic Manufacturing of 45nm Electronics.</p>	0.000	3.187
<p>Congressional Add: Integrated Passive Electronic Components.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Integrated Passive Electronic Components.</p>	0.000	1.354
Congressional Adds Subtotals	12.389	6.931

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 632181: <i>Spacecraft Payloads</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0303601F: <i>MILSTAR Satellite Communications System.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0305160F: <i>Defense Meteorological Satellite Program (DMSP).</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603215C: <i>Limited Defense System.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603218C: <i>Research and Support.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603226E: <i>Experimental Evaluation of Major Innovative Technologies.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604609F: <i>Reliability and Maintainability Technology Insertion Program (RAMTIP).</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>				PROJECT 633834: <i>Integrated Space Technology Demonstrations</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633834: <i>Integrated Space Technology Demonstrations</i>	37.531	28.996	41.188	0.000	41.188	36.082	33.481	32.396	33.148	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project is a series of advanced technology demonstrations designed to address mission needs by applying emerging technologies from the Air Force Research Laboratory, other U.S. Government laboratories, and industry. These technologies are integrated into system-level demonstrations that are used to test, evaluate, and validate the technologies in a relevant environment.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop microsatellite technologies for integrated, robust, flexible, microsatellite demonstrations building on previous work and leveraging investments by other organizations.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Launched and completed autonomous flight demonstration for Tactical Satellite-3. Developed next in the series of satellite design(s). Initiated procurement of bus and payload hardware.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Complete lightweight visible and infrared sensors development. Complete bus designs and begin integration.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete integration of experimental microsatellite for geosynchronous orbit. Complete design for next generation plug-n-play bus.</p>	37.531	28.996	41.188	0.000	41.188

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 633834: <i>Integrated Space Technology Demonstrations</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	37.531	28.996	41.188	0.000	41.188

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>				PROJECT 634400: <i>Space Systems Protection</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634400: <i>Space Systems Protection</i>	5.892	8.070	5.316	0.000	5.316	6.042	9.711	10.308	10.764	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates tools, instruments, and mitigation techniques required to assure operation of U.S. space assets in potentially hostile warfighting environments. The project performs assessments of critical components and subsystems, and evaluates susceptibility and vulnerability to radio frequency (RF) and laser threats. This project also develops technologies that mitigate identified vulnerabilities. Technologies are developed and demonstrated to support balanced satellite protection strategies for detecting, avoiding, and operating in a hostile space environment.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Multi-threat assessment tools to assess space-based electro-optical, communication, and other responses to various candidate RF and laser countermeasures and directed energy threats.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted demonstrations illustrating effects and meditation analysis. Identified technology transition opportunities and reported findings to major commands.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate additional subsystem performance in laboratory. Identify additional transition opportunities and prepare engineering models to assess performance.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Conduct extensive engineering analysis and down select final systems. Perform subsystem testing of RF and laser countermeasures.</p>	1.415	2.186	2.325	0.000	2.325

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 634400: <i>Space Systems Protection</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Identify technology options that provide passive or active detection of satellites in the RF spectrum. Develop and complete engineering designs for systems used to support active space superiority technologies. Demonstrate subsystems through laboratory testing.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	5.892	8.070	5.316	0.000	5.316

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635021: <i>Space Systems Survivability</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635021: <i>Space Systems Survivability</i>	4.123	4.842	3.845	0.000	3.845	3.336	3.367	3.540	3.689	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technologies to improve space system survivability and reliability of current and future Department of Defense space systems that must continue operation despite natural space hazards. It develops and demonstrates cost-effective solutions to mitigate hazardous space environmental interactions including electrical charge buildup and electronics failures due to both single radiation events and long-term radiation doses.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop technologies to provide improved space radiation and ionospheric hazard specification and forecasting.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Completed development of miniaturized space weather sensor engineering models. Identified space test opportunity for miniaturized solar hazard sensors. Initiated development of a new standard model of the radiation belts. Co-operatively operated existing first generation heliospheric imagers in coordinated joint-agency campaign exploiting unique three vantage point configuration. Developed and evaluated concepts for second-generation joint-agency heliospheric imager(s).</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue development of new standard model of radiation belts to specify space hazards for spacecraft design. Design second-generation heliospheric imager as joint agency initiative.</p>	3.149	3.916	3.845	0.000	3.845

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635021: <i>Space Systems Survivability</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Complete initial version of new standard model of radiation belts. Begin space test of miniaturized space weather sensors. Complete design and begin construction of second-generation heliospheric imager as joint agency initiative.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>						
<p>MAJOR THRUST: Develop technology to warn of spacecraft radiation, charging, and kinetic impact hazards and to provide space environment situational awareness and anomaly resolution capability.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Constructed hardware for space demonstration of the distributed anomaly resolution sensor. Performed verification and validation of compact environment anomaly sensor for diagnosing severe radiation environment. Began development of new medium earth orbit radiation belt model.</p> <p><i>FY 2010 Plans:</i> FY 2010: Develop engineering model of micrometeoroid impact detector as a component of a spacecraft anomaly resolution system. Initiate development of radiation dosimeter, spacecraft charge sensors, and common satellite interface architecture for spacecraft protection.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: These efforts are moving to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.</p>		0.974	0.926	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals		4.123	4.842	3.845	0.000	3.845

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635021: <i>Space Systems Survivability</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635083: <i>Ballistic Missiles Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635083: <i>Ballistic Missiles Technology</i>	5.195	11.921	5.256	0.000	5.256	5.036	5.039	5.259	6.141	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, integrates, and demonstrates advanced technologies for sustainment and modernization of strategic ballistic missiles. The project focuses on developing robust, low maintenance inertial navigation instruments to sustain current ballistic missile systems, as well as provide new, small, low-powered, high-precision instrumentation for next generation missile systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop, integrate, and demonstrate advanced navigation instrumentation applied to emerging vehicle designs and other technologies that sustain current strategic missile systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued engineering system development design verification and testing to incorporate performance improvements. Conducted flight qualification testing and evaluation of candidate demonstration flight units. Initiated system integration of flight demonstration units with emerging vehicle designs.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue performance verification and integration of demonstration units. Begin advanced navigation instrument engineering model designs with common mission requirements for better accuracy, lower cost, increased robustness, and smaller size. Initiate planning for advanced guidance risk reduction ground and flight demonstrations.</p>	2.598	2.973	2.628	0.000	2.628

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>		PROJECT 635083: <i>Ballistic Missiles Technology</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>safety devices with new vehicle design interfaces. Continue dynamic and hostile environments analysis and testing of common guidance designs. Initiate integration of advanced guidance technologies with common vehicle designs and interfaces focused on lower cost solutions with increased accuracy, flexibility, and robustness.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				5.195	5.946	5.256	0.000	5.256
				FY 2009	FY 2010			
<p>Congressional Add: Ballistic Missile Technology.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Ballistic Missile Technology.</p>				0.000	1.593			
<p>Congressional Add: Florida National Guard Total Force Integration.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Florida National Guard Total Force Integration.</p>				0.000	2.390			

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: P-Net Ballistic Missile Technology. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for P-Net Ballistic Missile Technology.	0.000	1.992
Congressional Adds Subtotals	0.000	5.975

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0601102F: <i>Defense Research Sciences.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603601F: <i>Conventional Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603851F: <i>Intercontinental Ballistic Missile-Dem/Val.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0604851F: <i>Intercontinental Ballistic Missile-EMD.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0605860F: <i>Rocket System Launch Program-Space.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

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E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 63682J: <i>Spacecraft Vehicles</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63682J: <i>Spacecraft Vehicles</i>	11.272	11.188	7.552	0.000	7.552	7.636	8.577	8.435	7.290	Continuing	Continuing

Note
Note: In FY 2011: Changes in funding are due to some technology development efforts being moved to PE 0602601F, Space Technology, in order to better align the technology readiness levels of these efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates compact, low-cost, spacecraft and launch vehicle power generation, storage, distribution, and thermal management technologies, including cryogenic cooling technologies. Power generation activities focus on lightweight, low-cost, low-volume, and survivable solar cell arrays. Energy storage work focuses on lightweight nickel hydrogen and sodium sulfur spacecraft batteries and flywheel energy storage systems for extended (five to ten year) satellite missions. The project's power distribution efforts focus on producing lightweight, high-efficiency, standardized power busses for use on future space systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop power generation space technologies such as multi-junction solar cells, thin-film solar cells, lightweight solar cell arrays, and radiation resistant solar cell modules.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated greater than 14% efficient thin-film solar cells. Explored performance optimization of greater than 40% efficient solar cell concepts.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate large area solar cells based on the inverted metamorphic structure. Develop integration schemes and module technology for inverted metamorphic solar cells. Begin environmental testing of inverted metamorphic solar cells.</p>	1.905	2.621	1.978	0.000	1.978

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 63682J: <i>Spacecraft Vehicles</i>				
B. Accomplishments/Planned Program (\$ in Millions)						
		FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals		6.883	8.798	7.552	0.000	7.552
		FY 2009	FY 2010			
Congressional Add: Small Low-Cost Reconnaissance Spacecraft Components/Small Responsive Spacecraft at Low-Cost. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Small Low-Cost Reconnaissance Spacecraft Components. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Small Responsive Spacecraft at Low-Cost.		1.596	2.390			
Congressional Add: Thin Film Amorphous Solar Arrays. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Thin Film Amorphous Solar Arrays. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		1.596	0.000			
Congressional Add: Space Situational Awareness. <i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Space Situational Awareness.		1.197	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 63682J: <i>Spacecraft Vehicles</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.		
Congressional Adds Subtotals	4.389	2.390

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602203F: <i>Aerospace Propulsion.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602601F: <i>Space Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603218C: <i>Research and Support.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603226E: <i>Experimental Evaluation of Major Innovative Technologies.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	36.093	36.661	5.899	0.000	5.899	5.563	5.522	5.613	5.702	Continuing	Continuing
634868: <i>Maui Space Surveillance System</i>	36.093	36.661	5.899	0.000	5.899	5.563	5.522	5.613	5.702	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds space situational awareness (SSA) technology development and demonstration at the Maui Space Surveillance System (MSSS) in Hawaii, as well as the operation and upgrade of the facility. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	36.339	5.813	0.000	0.000	0.000
Current President's Budget	36.093	36.661	5.899	0.000	5.899
Total Adjustments	-0.246	30.848	5.899	0.000	5.899
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.152			
• Congressional Adds		31.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.246	0.000	5.899	0.000	5.899

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 634868: *Maui Space Surveillance System*

Congressional Add: *Panoramic Survey Telescope And Rapid Response System (Pan-STARRS).*

Congressional Add: *Flash Hyper-Dimensional Imaging System for Space Situational Awareness and Ballistic Missile Defense.*

	FY 2009	FY 2010
	7.978	9.461
	1.596	1.992

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2009	FY 2010
Congressional Add Subtotals for Project: 634868	9.574	11.453
Congressional Add Totals for all Projects	9.574	11.453

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

Note: In FY 2010, Congress added \$2.0 million for FLASH Hyper-Dimensional Imaging for Near Space Surveillance and Ballistic Missile Defense, \$19.5 million for Maui Space Surveillance System Operations and Research, and \$9.5 million for PanSTARRS.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>				PROJECT 634868: <i>Maui Space Surveillance System</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634868: <i>Maui Space Surveillance System</i>	36.093	36.661	5.899	0.000	5.899	5.563	5.522	5.613	5.702	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds space situational awareness (SSA) technology development and demonstration at the Maui Space Surveillance System (MSSS) in Hawaii, as well as the operation and upgrade of the facility. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST/CONGRESSIONAL ADD: Develop, demonstrate, and integrate space situational awareness technology at the Maui Space Surveillance System (MSSS), as well as operate and upgrade the facility.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued MSSS infrastructure contributions in research, development, and operations that support various customers and experimenters. Continued refurbishing and upgrading MSSS to accommodate those missions and maintaining requirements for safety and security in accordance with Air Force regulations. Continued development and implementation of self-sufficiency plan. This effort includes Congressional Add of \$22.0 million in FY 2009.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue MSSS infrastructure contributions in research, development, and operations that support various customers and space situational awareness research and demonstrations. Continue refurbishing and upgrading MSSS to accommodate those missions and maintaining requirements for safety and security in accordance with Air Force regulations. Continue development</p>	26.519	25.208	5.899	0.000	5.899

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>		PROJECT 634868: <i>Maui Space Surveillance System</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
and implementation of self-sufficiency plan. This effort includes Congressional Add of \$19.5 million in FY 2010. <i>FY 2011 Base Plans:</i> In FY 2011: Continue MSSS infrastructure contributions in research, development, and operations that support various customers and space situational awareness research and demonstrations. Continue refurbishing and upgrading MSSS to accommodate those missions and maintaining requirements for safety and security in accordance with Air Force regulations. Continue development and implementation of self-sufficiency plan. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A								
Accomplishments/Planned Programs Subtotals				26.519	25.208	5.899	0.000	5.899
				FY 2009	FY 2010			
Congressional Add: Panoramic Survey Telescope And Rapid Response System (Pan-STARRS). <i>FY 2009 Accomplishments:</i> In FY 2009: Pan-STARRS Prototype on Maui began its three year mission of asteroid hunting and sky mapping. AF used its five percent allocation of telescope time for military utility determination. Procurement for the second telescope has begun. The Environmental Impact Statement for the four telescope system on Mauna Kea has begun. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Pan-STARRS.				7.978	9.461			
				1.596	1.992			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>	PROJECT 634868: <i>Maui Space Surveillance System</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Flash Hyper-Dimensional Imaging System for Space Situational Awareness and Ballistic Missile Defense. <i>FY 2009 Accomplishments:</i> In FY 2009: Provided hyperspectral imaging for missile intercepts and SSA applications, determined temperatures on missile intercept fireballs, preformed debris tracking, and provided hyperspectral information to aid in identifying non-imaging space objects. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Flash Hyper-Dimensional Imaging System for Space Situational Awareness and Ballistic Missile Defense.		
Congressional Adds Subtotals	9.574	11.453

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0601108F: <i>High Energy Laser Research Initiatives.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602890F: <i>High Energy Laser Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603924F: <i>High Energy Laser Advanced Technology Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>	PROJECT 634868: <i>Maui Space Surveillance System</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603883C: <i>Ballistic Missile Defense Boost Phase Segment.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	0.000	27.390	24.814	0.000	24.814	27.874	28.774	30.291	31.812	Continuing	Continuing
635323: <i>Directed Energy Bioeffects Parameters</i>	0.000	1.696	2.270	0.000	2.270	2.520	2.459	2.545	2.643	Continuing	Continuing
635324: <i>Human Dynamics and Terrain Demonstration</i>	0.000	6.233	6.426	0.000	6.426	6.745	6.711	8.897	9.720	Continuing	Continuing
635325: <i>Mission Effective Performance</i>	0.000	4.683	4.530	0.000	4.530	5.676	5.935	5.142	5.392	Continuing	Continuing
635326: <i>Performance Enhancement Demonstration</i>	0.000	7.465	4.377	0.000	4.377	4.572	4.546	4.704	4.941	Continuing	Continuing
635327: <i>Warfighter Interfaces</i>	0.000	7.313	7.211	0.000	7.211	8.361	9.123	9.003	9.116	Continuing	Continuing

Note

Note: In FY 2010, Directed Energy Bioeffects Parameters efforts will move from PE 0603231F, Project 5020 to PE 0603456F, Project 5323; Human Dynamics and Terrain Demonstration efforts will move from PE 0603231F, Project 2830 to PE 0603456F, Project 5324; Mission Effective Performance efforts will move from PE 0603231F, Project 4924 to PE 0603456F, Project 5325; Performance Enhancement Demonstration efforts will move from PE 0603231F, Project 2830 and Project 5020 to PE 0603456F, Project 5326; and Warfighter Interfaces efforts will move from PE 0603231F, Project 2830 to PE 0603456F, Project 5327 to better align efforts.

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to enhance human performance and effectiveness in the aerospace force. State-of-the-science advances are made in warfighter training, warfighter system interfaces, directed energy bioeffects, deployment and sustainment of warfighters in extreme environments, and understanding and shaping adversarial behavior. The Mission Effective Performance project develops, demonstrates, and transitions advanced training, simulation, mission rehearsal, and other performance-aiding methods and technologies to enhance warfighter readiness. The Warfighter Interfaces project develops, demonstrates, and transitions technologies to revolutionize the way human operators synergistically use Air Force systems, including autonomous machines and adaptive teams of humans and machines. The Directed Energy Bioeffects Parameters project develops, demonstrates, and transitions technologies to predict, evaluate, and mitigate the effects of directed energy on personnel and mission performance, and exploits the offensive capabilities of directed energy systems. The Performance Enhancement Demonstration project develops, demonstrates, and transitions technologies to increase survivability and performance of personnel during military operations. The Human Dynamics and Terrain Demonstration project develops, demonstrates, and transitions technologies to anticipate and influence

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>
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adversarial behavior within the air, space, and cyber domains. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	0.000	24.565	0.000	0.000	0.000
Current President's Budget	0.000	27.390	24.814	0.000	24.814
Total Adjustments	0.000	2.825	24.814	0.000	24.814
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.115			
• Congressional Adds		2.940			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	24.814	0.000	24.814

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 635326: *Performance Enhancement Demonstration*

Congressional Add: *Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials.*

Congressional Add Subtotals for Project: 635326

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	0.000	2.928
	0.000	2.928
	0.000	2.928

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

In FY 2010, Congress added \$2.94 million for Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials.

C. Performance Metrics

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force

DATE: February 2010

APPROPRIATION/BUDGET ACTIVITY

3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603456F: *Human Effectiveness Adv Tech Dev*

Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				PROJECT 635323: <i>Directed Energy Bioeffects Parameters</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635323: <i>Directed Energy Bioeffects Parameters</i>	0.000	1.696	2.270	0.000	2.270	2.520	2.459	2.545	2.643	Continuing	Continuing

Note

Note: In FY 2010, Directed Energy Bioeffects Parameters efforts will move from PE 0603231F, Project 5020 to PE 0603456F, Project 5323 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to predict, evaluate, and mitigate the effects of directed energy on personnel and mission performance, and exploits the offensive capabilities of directed energy systems. This project also develops the human-components of the guidelines for testing, deployment, and protection from high power microwave and high-energy laser systems and uses this information to enhance the effectiveness of these weapon systems in air, space, and cyber operations. The optical radiation bioeffects research develops and demonstrates technologies that counter optical threats, while exploiting optical systems for non-lethal applications. Radio frequency radiation bioeffects research develops, demonstrates, and transitions technologies to the warfighters. Biobehavioral systems efforts focus on the design and characterization of scalable non-lethal directed energy and novel effects weapons, including quantification of physiological and psychological effectiveness and risks associated with these weapons.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate protective technologies for aircrew and ground personnel to provide protection against directed energy threats. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Complete validation and verification of human systems integration tool for directed energy protective equipment (optical radiation only). Continue assessment of radio frequency radiation personnel protection technologies. Begin monitoring optical radiation skin protection technologies.	0.000	0.813	0.770	0.000	0.770

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force										DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				PROJECT 635323: <i>Directed Energy Bioeffects Parameters</i>				
B. Accomplishments/Planned Program (\$ in Millions)											
						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	
<i>FY 2011 OCO Plans:</i> <i>In FY 2011 OCO: N/A</i>											
Accomplishments/Planned Programs Subtotals						0.000	1.696	2.270	0.000	2.270	
C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D. Acquisition Strategy Not Applicable.											
E. Performance Metrics Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.											

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				635324: <i>Human Dynamics and Terrain Demonstration</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635324: <i>Human Dynamics and Terrain Demonstration</i>	0.000	6.233	6.426	0.000	6.426	6.745	6.711	8.897	9.720	Continuing	Continuing

Note

Note: In FY 2010, Human Dynamics and Terrain Demonstration efforts will move from PE 0603231F, Project 2830 to PE 0603456F, Project 5324 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to anticipate and influence adversarial behavior within the air, space, and cyber domains. These technologies will enhance Air Force capabilities in intelligence, surveillance, and reconnaissance (ISR), layered sensing, decision aids for computer network attack/defense/support, cyber force development and training, anticipatory command, control, and intelligence (C2I), measures of effectiveness for psychological operations, cross-cultural communication, and human-centric exploitation of measurement and signatures intelligence.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop, mature, and demonstrate technology to provide mission-essential capabilities for AF cyber operator performance enhancement and situational awareness. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Develop technologies to enhance cyber operator situational awareness capabilities. Develop advanced cyber mission/campaign planning tools that optimize blue force readiness and operational effectiveness. Develop, integrate, and assess advanced cyber mission/campaign planning tools that facilitate the operator's ability to anticipate and influence an adversary's behavior.	0.000	2.188	2.365	0.000	2.365

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010						
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>		PROJECT 635324: <i>Human Dynamics and Terrain Demonstration</i>						
B. Accomplishments/Planned Program (\$ in Millions)										
<p>MAJOR THRUST: Develop/demonstrate technology to optimize human operator performance, adversarial modeling techniques, and automated speech translation tools to aid AF information/influence operations.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Identify, integrate, demonstrate, and transition technology that optimizes human operator performance within AF influence operations. Illustrate adversarial cultural modeling techniques used to gauge adversarial threats. Mature and transition research into influence operations human performance training effectiveness, mission rehearsal, simulations, and combat readiness. Mature quantitative measures of effectiveness for psychological operations and selected influence operations capabilities. Develop and demonstrate next-generation information operations and cyber influence capabilities yielding non-kinetic warfighting options. Demonstrate and transition advanced speech-to-speech translation tools which support automated, cross-cultural communications.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate and determine the suitability, maturity, and readiness of next-generation information operations and cyber influence capabilities which yield non-kinetic warfighting options. Demonstrate and assess the effectiveness of advanced adversarial cultural modeling techniques used to gauge adversarial threats and behavior signatures. Develop, demonstrate, and assess the suitability of technology to transition advanced speech-to-speech translation tools that support automated, cross-cultural communications. Validate and improve models used to demonstrate measures of effectiveness for selected AF influence operations capabilities.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals						0.000	6.233	6.426	0.000	6.426

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635324: <i>Human Dynamics and Terrain Demonstration</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				PROJECT 635325: <i>Mission Effective Performance</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635325: <i>Mission Effective Performance</i>	0.000	4.683	4.530	0.000	4.530	5.676	5.935	5.142	5.392	Continuing	Continuing

Note

Note: In FY 2010, Mission Effective Performance efforts will move from PE 0603231F, Project 4924 to PE 0603456F, Project 5325 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions advanced training, simulation, mission rehearsal, and other performance-aiding methods and technologies to enhance warfighter readiness. This project also develops advanced methods and technologies to enable interactive live, virtual, and constructive (LVC) environments for performance-aiding methods and technologies. Activities include development of computer-generated entities to support training, simulation, and mission rehearsal; integrated high-fidelity weapon-systems training technologies for air, space, and cyber; tailored immersive simulation environments for Airmen at the tactical and operational levels; robust performance assessment and feedback tools; and maturation of game-based technologies for effective and efficient training. These methods and technologies facilitate the development of mission-essential competencies.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Advance aerospace/organizational behavior models for integrated warfighter training and rehearsal. Add realistic operations, command and control, force protection, and air base defense. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Evaluate and validate learning and mission performance impacts associated with common tools for mission planning, briefing, and after action review. Identify specific methods and tools of relevance within and across mission contexts and levels of decision making (e.g., tactical, operational, and strategic). Validate immersive training alternative environments for coalition	0.000	2.339	1.753	0.000	1.753

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635325: <i>Mission Effective Performance</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				635326: <i>Performance Enhancement Demonstration</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635326: <i>Performance Enhancement Demonstration</i>	0.000	7.465	4.377	0.000	4.377	4.572	4.546	4.704	4.941	Continuing	Continuing

Note

Note: In FY 2010, Performance Enhancement Demonstration efforts will move from PE 0603231F, Project 2830 and Project 5020 to PE 0603456F, Project 5326 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to increase survivability and performance of personnel during military operations. Bioscience efforts develop advanced biotechnology, nanotechnology, and neuroscience solutions for the protection and enhanced effectiveness of battlefield Airmen. Counterproliferation efforts develop biotechnology and bio-tagants to advance the ability to detect, identify, monitor, and neutralize biological threat agents. The counterproliferation effort also demonstrates and transitions modeling and simulation techniques for operational assessment of pre- and post-bio-agent attack. Biobehavioral and biomechanics focus areas develop aircrew support technologies that enhance warfighter protection and improve performance during long-duration missions. The biomechanics focus area also develops technology to rapidly integrate multi-sensor data with automated dynamic human modeling to anticipate and identify human adversarial threats.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop/demonstrate tailored bio-taggant and identification/neutralization capabilities to enhance force protection/enable air operations commanders to maintain operations tempo.	0.000	1.702	1.925	0.000	1.925
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.					
<i>FY 2010 Plans:</i> In FY 2010: Optimize the selected bio-taggant technologies and begin the development of platforms to employ the bio-tagants. Optimize the insertion/distribution of bio-tagants in target areas.					

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010							
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>		PROJECT 635326: <i>Performance Enhancement Demonstration</i>							
B. Accomplishments/Planned Program (\$ in Millions)											
<table border="1"> <thead> <tr> <th></th> <th>FY 2009</th> <th>FY 2010</th> <th>FY 2011 Base</th> <th>FY 2011 OCO</th> <th>FY 2011 Total</th> </tr> </thead> </table>							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total						
<p>Evaluate taggant technologies in simulated operational environments. Initiate research to develop capabilities to track biological warfare agents inside buildings and vehicles.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete the development of the rapid, hand-held bio-taggant threat identification platforms and transition to the warfighter. Conduct research to develop capabilities to track biological warfare agents inside buildings and vehicles.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>											
<p>MAJOR THRUST: Develop/demonstrate technologies for improved force protection, maintenance of peak performance in known toxic environments, and identification of difficult-to-detect enemy threats.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop methods to identify key human threat indicators to reduce bandwidth requirements and enable real-time threat assessment from the air. Develop enhanced anthropometric visualization techniques that integrate heterogeneous sensor data of potential adversaries.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate a human morphable digital model that adapts to different sensor input and predicts both threat and the combination of sensing systems needed to increase the precision of predictions. Demonstrate new human threat awareness, visualization, and risk assessment capabilities for the deployed Airmen. Develop techniques to analyze behavioral data and apply the information to relevant AF missions.</p>											
<table border="1"> <tbody> <tr> <td></td> <td align="right">0.000</td> <td align="right">2.835</td> <td align="right">2.452</td> <td align="right">0.000</td> <td align="right">2.452</td> </tr> </tbody> </table>							0.000	2.835	2.452	0.000	2.452
	0.000	2.835	2.452	0.000	2.452						

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635326: <i>Performance Enhancement Demonstration</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	4.537	4.377	0.000	4.377

	FY 2009	FY 2010
Congressional Add: Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials.	0.000	2.928
Congressional Adds Subtotals	0.000	2.928

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635326: <i>Performance Enhancement Demonstration</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				PROJECT 635327: <i>Warfighter Interfaces</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635327: <i>Warfighter Interfaces</i>	0.000	7.313	7.211	0.000	7.211	8.361	9.123	9.003	9.116	Continuing	Continuing

Note

Note: In FY 2010, Warfighter Interfaces efforts will move from PE 0603231F, Project 2830 to PE 0603456F, Project 5327 to better align efforts.

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to revolutionize the way human operators optimize the capabilities of Air Force systems, including autonomous machines and adaptive teams of humans and machines. Improvements in the presentation of operational information to the community of users, from the system operator to the commander, must be developed in step with advancements in the acquisition, storage, and retrieval of information. This project provides the advances in understanding of human cognitive abilities, as well as the utilization of human interfaces, multi-sensory fusion, high-resolution image displays, and three-dimensional audio to customize communications and enhance shared understanding across a diverse user community in air, space, and cyber for maximum situational awareness.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop/demonstrate technologies in a collaborative interface infrastructure to facilitate team building, sensemaking, and workflow in a globally distributed, net-centric C2 environment. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Analyze the hardware and software trade-space options for a future C2 collaborative interface environment. Begin concept development of sensemaking technologies and collaborative decision support tools for the resulting net-centric C2 environment infrastructure.	0.000	0.906	1.550	0.000	1.550

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>		PROJECT 635327: <i>Warfighter Interfaces</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Complete final evaluations of integrated components. Demonstrate the integrated system concept, including advanced audio, speech, and visual interfaces, improved human-centric software applications, wearable power management systems, and ergonomically improved cabling and carriage concepts. Conduct laboratory evaluations to assess effectiveness of integrated system and compare performance to original baseline. Conduct field evaluations of technology components and prepare for transition to operational capability.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Develop/demonstrate supervisory-level interfaces between ground controllers and multiple, highly autonomous UAS that optimize net-centric information flow to system operators.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop warfighter interface control station technologies permitting the effective conduct of cooperative dynamic reconnaissance, surveillance, and target acquisition missions either by a single warfighter or by a two-person crew in the next-generation supervisory control station. Integrate advanced mission and sensor management controls, displays, and decision aids with multi-UAS cooperative control automation for demonstration of the next-generation supervisory control station. Begin to demonstrate and assess system performance and mission effectiveness in high-fidelity virtual simulation and flight test environments.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete the development of advanced multi-UAS control station technology for dynamic reconnaissance, surveillance, and time-critical target acquisition missions. Complete the integration of</p>				0.000	1.386	1.458	0.000	1.458

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>		PROJECT 635327: <i>Warfighter Interfaces</i>																			
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	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total																		
cooperative engagement algorithms and operator interface technologies for technology demonstration. Complete the demonstration and assessment of system performance and mission effectiveness enabled by the next-generation supervisory control station, using high-fidelity virtual simulation and flight test environments. Determine how many vehicles a UAS operator can effectively manage/ supervise. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A																							
MAJOR THRUST: Develop and demonstrate advanced job performance aiding technologies, emphasizing human interaction with complex planning algorithms. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Begin to develop a visual interface concept that planners may use to visualize the primary constraints within capacity-based planning. Include alternative planning algorithms that exploit cognitive engineering and work-centered design principles. Outline a program plan featuring interactive simulations as a way to optimize resource allocation in complex time-sensitive deployments. <i>FY 2011 Base Plans:</i> In FY 2011: Develop visual interface and incorporate advanced algorithms for planning military mobility operations. Demonstrate the ability to exploit automated planning to optimize the use of resources within Joint Deployment and Distribution Enterprise capacity constraints. Provide for real-time operator interaction within the capacity-based planner and begin to quantify the benefits of the human-automation interaction relative to current capabilities.	0.000	0.498	1.112	0.000	1.112																		

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>		PROJECT 635327: <i>Warfighter Interfaces</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Develop/demonstrate cognitive-based analytic/design methods and computer software tools for C2 operations to synchronize personnel in distributed locations.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Begin analysis and refine analytic methods and techniques to support unified action for large, cross-organizational C2 teams and teams-of-teams. Begin concept development of an extensible work-aiding framework that integrates future and current work aids into a coherently unified framework that affords efficient and effective action of large distributed and semi-independent teams and individuals.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate and evaluate a unifying C2 work-aiding framework supporting distributed cross-organizational teams and individuals, including integration of a representative set of existing tools. Examine results and refine work-centered analytic, design, and development methods and techniques as applied to teams.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>				0.000	1.814	1.591	0.000	1.591
Accomplishments/Planned Programs Subtotals				0.000	7.313	7.211	0.000	7.211

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635327: <i>Warfighter Interfaces</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602202F: <i>Human Effectiveness Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603231F: <i>Crew Systems and Personnel Protection Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603601F: <i>Conventional Weapons Technology</i>								
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	16.771	14.296	15.755	0.000	15.755	19.357	20.086	20.337	17.693	Continuing	Continuing
63670A: <i>Conventional Weapons Development</i>	16.771	14.296	15.755	0.000	15.755	19.357	20.086	20.337	17.693	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops, demonstrates, and integrates ordnance and advanced guidance technologies for air-launched conventional weapons. The program includes development of conventional ordnance technologies including warheads, fuzes, and explosives; and development of advanced guidance technologies including seekers, navigation and control, and guidance. This program is in the Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	17.166	14.356	0.000	0.000	0.000
Current President's Budget	16.771	14.296	15.755	0.000	15.755
Total Adjustments	-0.395	-0.060	15.755	0.000	15.755
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.060			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.395	0.000	15.755	0.000	15.755

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 63670A: *Conventional Weapons Development*

Congressional Add: *Energetic Device Quality and Reliability Improvements Using Computer Aided Process Control.*

FY 2009	FY 2010
2.393	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Integrated Targeting Devices.*

Congressional Add Subtotals for Project: 63670A

Congressional Add Totals for all Projects

FY 2009	FY 2010
2.992	0.000
5.385	0.000
5.385	0.000

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
 (U) Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>	PROJECT 63670A: <i>Conventional Weapons Development</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
63670A: <i>Conventional Weapons Development</i>	16.771	14.296	15.755	0.000	15.755	19.357	20.086	20.337	17.693	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and integrates ordnance and affordable, autonomous, and adverse weather resistant guidance technologies for enhancing the effectiveness of air-launched conventional weapons delivered from manned and unmanned aerospace vehicles. The project develops conventional ordnance including warheads, fuzes, explosives, carriage and release, munition integration technologies, terminal seekers, midcourse navigation sensors for stand off delivery weapons, and target detection and identification processing algorithms for reducing target location error to improve target kill probability. This project improves the capability for conventional munitions supporting an Air Expeditionary Force.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop and demonstrate advanced air-delivered munitions fuze and mass-focusing warhead technologies to improve munition effectiveness.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued development of an active imaging target device that can provide warhead aimpoint selection for mass focused warheads.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Complete development of an active imaging target device that can provide warhead aimpoint selection for mass focused warheads.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p>	2.666	3.440	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>		PROJECT 63670A: <i>Conventional Weapons Development</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> In FY 2011: Complete design trades and select an approach to a multispectral autonomous all weather seeker.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>								
<p>MAJOR THRUST: Develop and demonstrate advanced conventional armament navigation and control technologies to improve armament navigation accuracy, stand off range, and weapons control and operation.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop a small guided sub-munition to attack multiple moving targets.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Demonstrate a small guided sub-munition capable of attacking moving targets.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>				0.000	2.714	2.052	0.000	2.052
Accomplishments/Planned Programs Subtotals				11.386	14.296	15.755	0.000	15.755
				FY 2009	FY 2010			
Congressional Add: Energetic Device Quality and Reliability Improvements Using Computer Aided Process Control.				2.393	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>	PROJECT 63670A: <i>Conventional Weapons Development</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009 : Conducted Congressionally-directed effort for Energetic Device Quality and Reliability Improvements Using Computer-Aided Process Control.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Integrated Targeting Devices.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Integrated Targeting Devices.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>	2.992	0.000
Congressional Adds Subtotals	5.385	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602602F: <i>Conventional Munitions.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	61.420	44.794	17.461	0.000	17.461	28.683	32.749	34.542	35.944	Continuing	Continuing
6311SP: <i>Advanced Optics and Laser Space Tech</i>	15.477	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
633150: <i>Advanced Optics Technology</i>	10.970	9.460	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
633151: <i>Lasers and Imaging Development and Integration</i>	26.467	21.965	6.883	0.000	6.883	16.487	21.563	22.887	23.452	Continuing	Continuing
633152: <i>High Power Microwave Development and Integration</i>	8.506	13.369	10.578	0.000	10.578	12.196	11.186	11.655	12.492	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program provides for the development and demonstration of advanced directed energy and optical concepts. In electric lasers, compact, reliable, relatively high power, cost-effective electric laser devices are demonstrated. High power chemical laser enhancements are also developed. Optical imaging/beam control components/techniques are demonstrated. In high power microwaves (HPMs), technologies such as narrowband and wideband devices and antennas are demonstrated. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	56.283	30.056	0.000	0.000	0.000
Current President's Budget	61.420	44.794	17.461	0.000	17.461
Total Adjustments	5.137	14.738	17.461	0.000	17.461
• Congressional General Reductions		-0.015			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.187			
• Congressional Adds		14.940			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	5.137	0.000	17.461	0.000	17.461

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 633150: *Advanced Optics Technology*

- Congressional Add: *Compound Zoom for Airborne Reconnaissance (CZAR).*
- Congressional Add: *Applications of LIDAR to Vehicles with Analysis (ALVA).*
- Congressional Add: *Real-time Optical Surveillance Applications (ROSA).*

Congressional Add Subtotals for Project: 633150

Project: 633151: *Lasers and Imaging Development and Integration*

- Congressional Add: *Advanced Tactical Laser.*
- Congressional Add: *Advanced Fiber Lasers Systems and Components.*

Congressional Add Subtotals for Project: 633151

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	1.197	0.000
	6.981	5.975
	2.792	3.485
	10.970	9.460
	0.000	2.231
	0.957	3.187
	0.957	5.418
	11.927	14.878

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>
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Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

In FY 2010, several electric laser, relay mirror, and space situational awareness efforts have been moved from this PE into PE 0602605F, Directed Energy Technology, to better reflect the actual technology readiness level of the efforts.

Note: In FY 2010, Congress added \$3.2 million for Advanced Fiber Lasers Systems and Components, \$6.0 million for Applications of LIDAR to Vehicles with Analysis, \$3.5 million for Real-time Optical Surveillance Applications, and \$2.24 million for Advanced Tactical Laser.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>				PROJECT 6311SP: <i>Advanced Optics and Laser Space Tech</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6311SP: <i>Advanced Optics and Laser Space Tech</i>	15.477	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, funds from this Project are being moved to Project 3151, Lasers and Imaging Development and Integration, in this PE or Project 4866, Lasers and Imaging Technology, in PE 0602605F, Directed Energy Technology, to better align efforts depending on the technology readiness level of the effort.

A. Mission Description and Budget Item Justification

This project provides for the demonstration and detailed assessment of space unique technologies needed for advanced optical and laser systems. Starting in FY 2010 this project will be combined with other projects to better integrate the directed energy efforts.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop and demonstrate optical technologies for space situational awareness applications.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Integrated high efficiency adaptive optics system on large aperture high resolution telescope. Performed system tests and prepared for demonstrations of high resolution compensated imaging and detection of very dim space objects at visible and infrared wavelengths. Concluded phased array imaging experiments.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p>	4.365	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 6311SP: <i>Advanced Optics and Laser Space Tech</i>

B. Accomplishments/Planned Program (\$ in Millions)					
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
MAJOR THRUST: Develop and demonstrate advanced optical beam control technologies for laser propagation through severe and/or extended atmospheric turbulence. <i>FY 2009 Accomplishments:</i> In FY 2009: Completed design of advanced ground diagnostic system to characterize laser propagation through atmospheric turbulence in a variety of atmospheric conditions. In FY 2010, this thrust has been moved to Project 3151, Lasers and Imaging Development and Integration, to better align efforts. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A	11.112	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	15.477	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602605F: <i>Directed Energy Technology</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 6311SP: <i>Advanced Optics and Laser Space Tech</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0603444F: <i>Maui Space Surveillance System</i>											
• PE 0601108F: <i>High Energy Laser Research Initiatives.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602890F: <i>High Energy Laser Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603924F: <i>High Energy Laser Advanced Technology Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602624A: <i>Weapons and Munitions Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603004A: <i>Weapons and Munitions Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702E: <i>Tactical Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: <i>Ballistic Missile Defense Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C: <i>Ballistic Missile Defense Boost Phase Segment</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 6311SP: <i>Advanced Optics and Laser Space Tech</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603651M: <i>Joint Non-Lethal Weapons Technology Development.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633150: <i>Advanced Optics Technology</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633150: <i>Advanced Optics Technology</i>	10.970	9.460	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: Funding in this project is due to Congressional adds.

A. Mission Description and Budget Item Justification

This project develops advanced optical technologies for various strategic and tactical beam control applications.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
Congressional Add: Compound Zoom for Airborne Reconnaissance (CZAR). <i>FY 2009 Accomplishments:</i> In FY 2009: Completed critical design review of optical system. Continued integrating optical system and conduct preparation for laboratory testing. Began to develop system software and system test plan. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable.	1.197	0.000
Congressional Add: Applications of LIDAR to Vehicles with Analysis (ALVA). <i>FY 2009 Accomplishments:</i> In FY 2009: ALVA consists of two efforts: Standoff Intelligence Designator (SID) and Hi-Class. SID: Continued development of airborne night-time imaging for counter improvised explosive devices	6.981	5.975

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633150: <i>Advanced Optics Technology</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<p>(IEDs) and operational intel and targeting users such as Air Combat Command, and U.S. Special Operations Command. Supported transition of militarily useful lasers for nighttime video through deployment and flight testing. Integrated state-of-the-art sensors into real-world air frames and communications networks. Participated in war games and exercises. Hi-Class: Tested laser ranging detector with active tracking system. Continued research and data collection for three dimensional imaging of space objects and ranging applications. Developed capability to reliably conduct laser operations during the day.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for ALVA.</p>		
<p>Congressional Add: Real-time Optical Surveillance Applications (ROSA).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed model-assisted autonomous algorithms for satellite location and orientation. Continued simulation-based studies of various means to exploit data from ultra-sensitive time-resolved photon counter for space situational awareness capabilities. Continued development of high-fidelity end-to-end simulation environment of autonomous networked electro-optical sensors for research in resource management schemes in support of space track and catalog mission.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for ROSA.</p>	2.792	3.485
Congressional Adds Subtotals	10.970	9.460

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603444F: <i>Maui Space Surveillance Systems.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633150: <i>Advanced Optics Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>				PROJECT 633151: <i>Lasers and Imaging Development and Integration</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633151: <i>Lasers and Imaging Development and Integration</i>	26.467	21.965	6.883	0.000	6.883	16.487	21.563	22.887	23.452	Continuing	Continuing

Note

Note: In FY 2010, some of the efforts from Project 11SP, Advanced Optics and Laser Space Technology, are being moved to this Project to better align efforts. Also in FY 2010, some of the electric laser, relay mirror, and space situational awareness efforts in this project have been moved into PE 0602605F, Directed Energy Technology, to better reflect the technology readiness level of the efforts.

A. Mission Description and Budget Item Justification

This project provides for the development, integration, demonstration, and detailed assessment of optical imaging, laser, and beam control technologies needed for applications such as aircraft self-protection, force protection, force application, precision engagement, and space situational awareness. Critical technologies developed and demonstrated include: (1) compact, reliable, and affordable laser devices with good beam quality and scalability to high power; (2) advanced optics, imaging, and laser beam control components to compensate and propagate laser radiation through the atmosphere and/or to optically detect and characterize space objects. Perform laser system concept assessments to include vulnerability assessments and target effect testing.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate laser technologies for applications such as aircraft self-protection. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued to develop electric lasers for aircraft self-protection. Continued to focus on reducing size and weight, as well as increasing efficiency, affordability, reliability, maintainability, supportability, operational environmental acceptability, and ruggedness. Completed integration of a 15 kilowatt solid state laser with an existing beam control subsystem for an integrated laboratory testbed to support multiple applications.	5.729	2.223	2.693	0.000	2.693

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633151: <i>Lasers and Imaging Development and Integration</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
to PE 0602605F, Directed Energy Technology in order to better match available technology with transition opportunities in the future. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	25.510	16.547	6.883	0.000	6.883

	FY 2009	FY 2010
Congressional Add: Advanced Tactical Laser. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Tactical Laser.	0.000	2.231
Congressional Add: Advanced Fiber Lasers Systems and Components. <i>FY 2009 Accomplishments:</i> In FY 2009: Improved power scaling and efficiency of fiber laser components. Demonstrated architectural improvements to meet emerging DoD and commercial applications.	0.957	3.187

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633151: <i>Lasers and Imaging Development and Integration</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Advanced Fiber Lasers Systems and Components.		
Congressional Adds Subtotals	0.957	5.418

C. Other Program Funding Summary (\$ in Millions)

			<u>FY 2011</u>	<u>FY 2011</u>	<u>FY 2011</u>						<u>Cost To</u>	
<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>Base</u>	<u>OCO</u>	<u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Complete</u>	<u>Total Cost</u>	
• PE 0602102F: <i>Materials.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603270F: <i>Electronic Combat Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0601108F: <i>High Energy Laser Research Initiatives.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602890F: <i>High Energy Laser Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603924F: <i>High Energy Laser Advanced Technology Program.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602624A: <i>Weapons and Munitions Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603004A: <i>Weapons and Munitions Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633151: <i>Lasers and Imaging Development and Integration</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: <i>Ballistic Missile Defense Technology</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C: <i>Ballistic Missile Defense Boost Phase Segment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M-A: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M-B: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>				PROJECT 633152: <i>High Power Microwave Development and Integration</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
633152: <i>High Power Microwave Development and Integration</i>	8.506	13.369	10.578	0.000	10.578	12.196	11.186	11.655	12.492	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates high power microwave (HPM) and other unconventional weapon generation and transmission technologies that support a wide range of Air Force missions such as the potential disruption, degradation, damage, or destruction of an adversary's electronic infrastructure and military capability. These targeted capabilities include local computer and communication systems, as well as large and small air defense and command and control systems. In many cases, this effect can be covert with no collateral structural or human damage. In addition, millimeter wave force protection technologies are developed and demonstrated. It also develops a susceptibility, vulnerability, and lethality data base to identify potential vulnerabilities of U.S. systems to HPM threats and to provide a basis for future offensive and defensive weapon system decisions. Representative U.S. and foreign assets are tested to understand real system susceptibilities. Both wideband (wide frequency range) and narrowband (very small frequency range) technologies are being developed.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Develop and evaluate millimeter-wave Active Denial technologies for non-lethal, anti-personnel weapon applications such as ground force protection from a stand-off aircraft.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Continued to develop and evaluate technologies for Air Force non-lethal weapons applications. Continued development of first iteration full-power non-lethal test source for airborne/long range configurations. Continued hardware development, procurement, fabrication, and testing for the full power source test stand for airborne/long range configurations. Provided technical expertise and background to external organizations tailoring Active Denial concepts and capabilities to their needs and glean data relevant to airborne applications.</p>	2.369	0.542	0.652	0.000	0.652

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>		PROJECT 633152: <i>High Power Microwave Development and Integration</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: As a part of CHAMP, integrate narrowband HPM components into a aerial platform for counter-electronics demonstrations. Conduct ground testing of CHAMP including effects testing and environmental testing of the integrated system. Obtain flight certification of the CHAMP system. Conduct effects experiments using the CHAMP hardware including evaluating battle damage assessment capability. Refine and implement HPM source component technology to overcome unforeseen issues in application systems. Fabricate next-generation compact HPM components for candidate aerial platforms, implement in testbeds, and test operation and performance. Increased funding in FY 2010 for the Counter-electronics HPM Advance Missile Project (CHAMP) Joint Capability Technology Demonstration.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete the integration of narrowband HPM components into the CHAMP aerial platform. Continue ground testing of the CHAMP HPM system including effects testing and characterization of the performance. Conduct an inert flight test with the aerial platform to verify the guidance system accuracy, platform controllability for beam pointing, and timing for triggering of the HPM payload. Increased funding in FY 2011 for the CHAMP Joint Capability Technology Demonstration.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				8.506	13.369	10.578	0.000	10.578

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633152: <i>High Power Microwave Development and Integration</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0602202F: <i>Human Systems Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602624A: <i>Weapons and Munitions Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602114N: <i>Power Projection.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M-C: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603851M: <i>Nonlethal Weapons.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	54.614	50.502	39.701	0.000	39.701	40.359	41.015	41.691	42.355	Continuing	Continuing
635280: <i>Manufacturing Technologies</i>	50.876	46.528	37.701	0.000	37.701	39.359	41.015	41.691	42.355	0.000	0.000
635281: <i>Manufacturing Readiness</i>	3.738	3.974	2.000	0.000	2.000	1.000	0.000	0.000	0.000	0.000	0.000

Note
Note: In FY 2009 the AF Manufacturing Technology (ManTech) program transferred to PE 0603680F, Manufacturing Technologies, from PE 0708011F, Industrial Preparedness, to focus on long-term manufacturing and processes and to better align with the Office of the Secretary of Defense ManTech PE.

A. Mission Description and Budget Item Justification
The ManTech program is mandated by Section 2521, Title 10, United States Code, to create an affordable, world-class industrial base manufacturing capability responsive to the warfighter's needs. The Air Force ManTech major program tenets are: development and improvement of technologies and processes; collaboration with government program offices, industry, and academia; investments in generic technologies that can be applied to different applications, technologies beyond reasonable risk level for industry alone; cost-sharing; multiple system/customer applications; potential for significant return on investment; and customer commitment to implement. To this end, ManTech develops, demonstrates, and assesses advanced manufacturing processes and technologies to reduce costs, improve quality/capability, and shorten cycle times of weapon systems during design, development, production, and sustainment. Where mature processes are not available, laboratory-developed and demonstrated process capabilities are made available for transition into weapon system programs. ManTech objectives are conducted through partnerships with all industry levels, from large prime contractors to small material and parts vendors. Manufacturing Technologies is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates manufacturing technologies for existing upgrades and/or new system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
3600: <i>Research, Development, Test & Evaluation, Air Force</i>	PE 0603680F: <i>Manufacturing Technologies</i>
BA 3: <i>Advanced Technology Development (ATD)</i>	

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	56.376	39.913	0.000	0.000	0.000
Current President's Budget	54.614	50.502	39.701	0.000	39.701
Total Adjustments	-1.762	10.589	39.701	0.000	39.701
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.211			
• Congressional Adds		10.800			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-1.762	0.000	39.701	0.000	39.701

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 635280: *Manufacturing Technologies*

Congressional Add: *Advance Casting and Coating Technologies for Aircraft Canopies.*

Congressional Add: *Nano-Composite Structures Manufacturing Technology Development.*

Congressional Add: *Next Generation Manufacturing Process.*

Congressional Add: *Prepreg Thickness Variability Reduction Program.*

Congressional Add: *Technology Insertion Demonstration and Evaluation (TIDE).*

Congressional Add: *Laser Peening for Friction Stir Welded Aerospace Structures.*

Congressional Add: *Next Generation Casting Initiative.*

Congressional Add: *Production of Nanocomposites for Aerospace Applications.*

Congressional Add: *Automated Processing of Advanced Low Observables (RAPALO).*

Congressional Add: *Mobile Laser Systems for Aircraft Structures (MLSAS).*

Congressional Add: *Wire Integrity Technology.*

	<u>FY 2009</u>	<u>FY 2010</u>
	2.792	0.000
	0.798	0.000
	1.197	0.000
	1.596	0.000
	3.191	0.000
	1.596	1.593
	2.394	3.983
	1.596	1.593
	1.596	1.195
	0.000	0.797
	0.000	1.593

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2009	FY 2010
Congressional Add Subtotals for Project: 635280	16.756	10.754
Congressional Add Totals for all Projects	16.756	10.754

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

In FY 2010, Congress added \$1.2 million for Automated Processing of Advanced Low Observables (RAPALO), \$1.6 million for Laser Peening for Friction Stir Welded Aerospace Structures, \$0.8 million for Mobile Laser Systems for Aircraft Structures (MLSAS), \$4.0 million for Next Generation Casting Initiative, \$1.6 million for Production of Nanocomposites for Aerospace Applications, and \$1.6 million for Wire Integrity Technology.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>				PROJECT 635280: <i>Manufacturing Technologies</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635280: <i>Manufacturing Technologies</i>	50.876	46.528	37.701	0.000	37.701	39.359	41.015	41.691	42.355	0.000	0.000

Note

Note: In FY 2009, the AF Manufacturing Technologies program transferred to PE 0603680F, Manufacturing Technologies, from PE 0708011F, Industrial Preparedness, to focus on long-term manufacturing technologies and processes and to better align with the Office of the Secretary of Defense ManTech PE.

A. Mission Description and Budget Item Justification

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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and implement cost-effective maintenance, repair, and manufacturing technologies for sustainment of Air Force weapon systems. <i>FY 2009 Accomplishments:</i> In FY 2009: Continued cost-effective repair and manufacturing technologies for affordable sustainment of aircraft and turbine engine components. Continued Engine Rotor Life Extension technical effort to extend the life of critical, high value rotating engine components, which have been in service and scheduled for retirement. Continued assessments and manufacturing technology	6.387	13.982	15.080	0.000	15.080

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010						
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>		PROJECT 635280: <i>Manufacturing Technologies</i>						
B. Accomplishments/Planned Program (\$ in Millions)										
<p>manufacturing capabilities for advanced propulsion technologies. Continue rapid response process improvement efforts for selected high value programs. Continue efforts to address critical electronics manufacturing technologies for various C2ISR and space systems in order to improve affordability and producibility. Continue efforts on AESA radar to enable improved manufacturing processes for reduced costs and cycle times and greater production capacity of next generation radars. Continue efforts on affordable datalink components to enable advanced technology insertion through improved manufacturing processes to reduce costs and cycle times, as well as system miniaturization. Continue development of advanced manufacturing processes for pervasive space subsystems or components. Conduct assessments on critical technologies in lab and acquisition programs to ensure affordable, producible technology transition.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A.</p>						FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals						34.120	35.774	37.701	0.000	37.701
						FY 2009	FY 2010			
<p>Congressional Add: Advance Casting and Coating Technologies for Aircraft Canopies.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Advance Casting and Coating Technologies for Aircraft Canopies.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>						2.792	0.000			
<p>Congressional Add: Nano-Composite Structures Manufacturing Technology Development.</p>						0.798	0.000			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635280: <i>Manufacturing Technologies</i>	
B. Accomplishments/Planned Program (\$ in Millions)			
		FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Nano-Composite Structures Manufacturing Technology Development.			
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.			
Congressional Add: Next Generation Manufacturing Process.		1.197	0.000
<i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Next Generation Manufacturing Process.			
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.			
Congressional Add: Prepreg Thickness Variability Reduction Program.		1.596	0.000
<i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Prepreg Thickness Variability Reduction Program.			
<i>FY 2010 Plans:</i> In FY 2010: Not Applicable.			
Congressional Add: Technology Insertion Demonstration and Evaluation (TIDE).		3.191	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635280: <i>Manufacturing Technologies</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Technology Insertion Demonstration and Evaluation (TIDE).</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p>		
<p>Congressional Add: Laser Peening for Friction Stir Welded Aerospace Structures.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Laser Peening for Friction Stir Welded Aerospace Structures.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Laser Peening for Friction Stir Welded Aerospace Structures.</p>	1.596	1.593
<p>Congressional Add: Next Generation Casting Initiative.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Next Generation Casting Supplier Base Initiative.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Next Generation Casting Supplier Base Initiative.</p>	2.394	3.983
<p>Congressional Add: Production of Nanocomposites for Aerospace Applications.</p>	1.596	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635280: <i>Manufacturing Technologies</i>
B. Accomplishments/Planned Program (\$ in Millions)		
	FY 2009	FY 2010
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for Production of Nanocomposites for Aerospace Applications.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Production of Nanocomposites for Aerospace Applications.</p>		
<p>Congressional Add: Automated Processing of Advanced Low Observables (RAPALO).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Conducted Congressionally-directed effort for RAPALO.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for RAPALO.</p>	1.596	1.195
<p>Congressional Add: Mobile Laser Systems for Aircraft Structures (MLSAS).</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Mobile Laser Systems for Aircraft Structures (MLSAS).</p>	0.000	0.797
<p>Congressional Add: Wire Integrity Technology.</p>	0.000	1.593

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635280: <i>Manufacturing Technologies</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.		
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Wire Integrity Technology.		
Congressional Adds Subtotals	16.756	10.754

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0708011F: <i>Industrial Preparedness</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

All major contracts in this Program Element were awarded after full and open competition.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>				PROJECT 635281: <i>Manufacturing Readiness</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635281: <i>Manufacturing Readiness</i>	3.738	3.974	2.000	0.000	2.000	1.000	0.000	0.000	0.000	0.000	0.000

Note

Note: In FY 2009, the AF Manufacturing Technologies program transferred to PE 0603680F, Manufacturing Technologies, from PE 0708011F, Industrial Preparedness, to focus on long-term manufacturing and processes and to better align with the Office of the Secretary of Defense ManTech PE.

A. Mission Description and Budget Item Justification

Manufacturing readiness of technologies is a key concern when identifying and mitigating risk to successfully transition these technologies and systems into production. Within each product sector (aeronautical, space, munitions/directed energy, and C2ISR), manufacturing readiness assessments (MRAs) will be applied and manufacturing readiness levels (MRLs) utilized to gauge and manage manufacturing related issues. Advanced Technology Demonstrations (ATDs) will be used when appropriate to aid in efficient transition. Selected acquisition programs will also be assessed to determine readiness for milestone decisions and/or to reduce manufacturing risk. Pervasive, generic and system-specific manufacturing maturation plans will be developed and implemented based on the assessments to reduce overall program risk and to provide an increased awareness of manufacturing issues throughout major weapon system life cycles. Generic and pervasive manufacturing issues will be identified and considered as potential ManTech programs to transition advanced manufacturing technologies into multiple sectors.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Through application of MRAs, develop and implement manufacturing maturation plans to improve affordability and producibility and mitigate transition risk from development to production. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed Manufacturing Maturation Plans (MMPs) for all Category I ATDs and selected high-visibility program based on MRA. Selected MMPs were executed to increase the MRL and improve technology transition to production. Conducted MRAs on selected Air Force acquisition programs to aid in Milestone Decision Reviews and/or to mitigate cost, schedule, or rate issues. Manufacturing risk was documented based on the assessments and was delivered to the appropriate	3.738	3.974	2.000	0.000	2.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>		PROJECT 635281: <i>Manufacturing Readiness</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>program offices. Pervasive manufacturing issues discovered during the assessments were vetted through the ManTech requirements process.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue development of Manufacturing Maturation Plans (MMPs) for Category I ATDs and selected high-visibility programs based on MRA. Execute selected MMPs to increase the MRL and improve technology transition to production. Conduct MRAs on selected Air Force acquisition programs to aid in Milestone Decision Reviews and/or to mitigate cost, schedule, or rate issues. Document manufacturing risk based on the assessments and deliver to the appropriate program offices. Vet pervasive manufacturing issues discovered during the assessments through the ManTech requirements process.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue development of Manufacturing Maturation Plans (MMPs) for Category I ATDs and selected high-visibility programs based on MRAs. Execute selected MMPs to increase the MRL and improve technology transition to production. Conduct MRAs on selected Air Force acquisition programs to aid in Milestone Decision Reviews and/or to mitigate cost, schedule, or rate issues. Document manufacturing risk based on the assessments and deliver results to the appropriate program offices. Vet pervasive manufacturing issues discovered during the assessments through the ManTech requirements process.</p> <p><i>FY 2011 OCO Plans:</i> In FY2011 OCO: N/A.</p>								
Accomplishments/Planned Programs Subtotals				3.738	3.974	2.000	0.000	2.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635281: <i>Manufacturing Readiness</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (11524): <i>PE, 0708011F, Industrial Preparedness</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

All major contracts in this Program Element were awarded after full and open competition.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	0.000	46.414	32.382	0.000	32.382	39.295	44.272	46.913	48.504	Continuing	Continuing
635319: <i>Anticipatory OPS Intent and Response</i>	0.000	10.569	8.031	0.000	8.031	8.889	9.912	8.648	6.354	Continuing	Continuing
635320: <i>Assured Worldwide Connectivity</i>	0.000	18.572	8.216	0.000	8.216	12.076	13.064	17.965	22.253	Continuing	Continuing
635321: <i>Global Battlespace Awareness</i>	0.000	9.829	9.318	0.000	9.318	10.676	10.800	13.351	12.403	Continuing	Continuing
635322: <i>Knowledge Management and Computing</i>	0.000	7.444	6.817	0.000	6.817	7.654	10.496	6.949	7.494	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0603789F, C3I Advanced Development.

A. Mission Description and Budget Item Justification

This program develops and demonstrates Air Force Enterprise-Centric Information technologies for the warfighter. The technologies address the ability to support the global information exchange of correlated and fused information to ensure the Air Force can plan and execute missions in a dynamic, complex environment. The Global Battlespace Awareness project develops, integrates, and demonstrates advanced technologies to achieve comprehensive net-centric operations and total battlespace awareness by using and exploiting information from all sources. The Assured Worldwide Connectivity project provides advanced net-enabled architectures and communications technologies in support of global military operations including a secure information grid for worldwide information exchange of near-real-time multimedia (i.e., voice, data, video, and imagery) information. In addition, this project develops and demonstrates advanced optical networking and communications for Air Force air- and space-based information exchange on and between platforms. These developments implement and enable high capacity secure, assured networks for worldwide information exchange of near-real-time multimedia (i.e., voice, data, video, and imagery). These optical networks will be rapidly deployable, mobile, interoperable, and seamless between Air and Space Operations Centers (AOC) and air- and space- based platforms either en route or in theater. This project also provides the tools and applications leading to the development and integration of cyber deterrence technologies resulting in a strategic capability of cyber dominance within the secure information grid. The Knowledge Management and Computing project develops the technology applications that will provide for a secure, tailored, seamless exchange of information among producers, consumers, and managers of information relevant to a particular community of interest (COI). The project also provides the development of interactive and real-time computing technologies that greatly improve the usability of high performance computing for the exchange,

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>
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utilization, and management of information in the enterprise. The Anticipatory Ops Intent and Response project develops the technologies for dynamic planning and execution with the accuracy, fidelity, and timeliness needed to dominate the battlespace. This project will develop and demonstrate technologies necessary for dynamic decision making to create, plan, and execute complex effects on compressed time scales required for tomorrow's conflicts regardless of the warfighting domain - air, space, or cyber. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	0.000	39.708	0.000	0.000	0.000
Current President's Budget	0.000	46.414	32.382	0.000	32.382
Total Adjustments	0.000	6.706	32.382	0.000	32.382
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.194			
• Congressional Adds		6.900			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	32.382	0.000	32.382

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 635320: *Assured Worldwide Connectivity*

Congressional Add: *Massively Parallel Optical Interconnects for Battlespace Information Exchange.*

Congressional Add: *Cyber Attack and Security Environment.*

Congressional Add Subtotals for Project: 635320

Congressional Add Totals for all Projects

	<u>FY 2009</u>	<u>FY 2010</u>
	0.000	3.983
	0.000	2.888
	0.000	6.871
	0.000	6.871

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force

DATE: February 2010

APPROPRIATION/BUDGET ACTIVITY

3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603788F: *Global Information Dev/Demo*

Change Summary Explanation

Note: In FY 2010, Congress added \$4.0 million for Cyber Attack and Security Environment and \$2.9 million for MPOI for Battlespace Information Exchange. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>				PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635319: <i>Anticipatory OPS Intent and Response</i>	0.000	10.569	8.031	0.000	8.031	8.889	9.912	8.648	6.354	Continuing	Continuing

Note

Note: Prior to FY 2010, these efforts were performed in PE 0603789F, C3I Advanced Technologies, Project 4872.

A. Mission Description and Budget Item Justification

In order to achieve information dominance, the Air Force must be able to monitor, assess, plan and execute (MAPE) missions rapidly across the full spectrum of operations (air, space, and cyberspace) at all levels of war (strategic, operational, and tactical) and during all phases of conflict (pre-conflict, conflict through stability operations). This project develops and integrates decision support technologies that will enhance the commander's ability to anticipate and dominate the future battlespace by more effectively forecasting the evolution of the battlespace and by more rapidly generating options to "virtually checkmate" the adversary. It develops the decision aid technologies and processes to plan the use of various assets and assess their effects in the battlespace. It provides a tailorable information environment to effectively portray complex data sets accurately in real-time.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate distributed information technologies that are scalable and reconfigurable and provide seamless access to tailored multi-media and multi-spectral data. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Continue developing capabilities to allow seamless information sharing for enhanced situational awareness and understanding by the decision maker. Continue the development of an initial capability to plan and measure effectiveness of information operations synchronized with precision munitions to determine successful achievement of command intent in time and location.	0.000	1.694	1.446	0.000	1.446

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>		PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Continue development of capabilities to be more agile within a net centric enabled environment. Continue development of timely option generation, selection, and coordination capabilities that account for uncertainty and missing and erroneous information and supports intuitive decision making processes. Continue to develop dynamic workflow and workload management capabilities to manage the command and control enterprise. Initiate development of a capability to assess adverse events that could potentially impact air and space mobility operations and suggest courses of action (COAs) that could be initiated to continue operations. Investigate methods to evaluate mobility COAs covering planning through assessment that anticipates multiple constraints and provides prioritized feasible recommendations that meets commander's intent. Develop capability to assess the impact of cyber on air and space C2 operations and suggest COAs to be initiated to continue operations in the face of cyber threats.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue development of capabilities to be more agile within a net centric enabled environment. Continue development of timely option generation selection and coordination capabilities that account for uncertainty and missing and erroneous information, and supports intuitive decision making processes. Continue to develop dynamic workflow and workload management capabilities to manage the command and control enterprise. Complete development of a capability to assess adverse events that could potentially impact air and space mobility operations and suggest COAs that could be initiated to continue operations. Continue the investigation of methods to evaluate mobility COAs covering planning through assessment that anticipates multiple constraints and provides prioritized feasible recommendations that meets commander's intent. Continue development of capability to assess the impact of cyber on air and space C2 operations and suggest COAs to be initiated to continue operations in the face of cyber threats.</p>								

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
to anticipate and shape all aspects of the future battlespace. Continue development of predictive battlespace planning tools with the ability to reason over models of the "enemy as a system." Demonstrate a suite of interacting tools/services that assist analysts in estimating the cascading effects of proposed actions in near real-time for diverse COAs. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	10.569	8.031	0.000	8.031

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (11746): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>				PROJECT 635320: <i>Assured Worldwide Connectivity</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635320: <i>Assured Worldwide Connectivity</i>	0.000	18.572	8.216	0.000	8.216	12.076	13.064	17.965	22.253	Continuing	Continuing

Note

Note: Prior to FY 2010, these efforts were performed in PE 0603789F, C3I Advanced Technologies, Project 4216.

A. Mission Description and Budget Item Justification

The Air Force requires advanced net-enabled architectures and communications technologies in support of global kinetic and non-kinetic military operations including a secure information grid for worldwide information delivery and exchange of near-real-time information including voice, data, video, and imagery. This secure environment will be rapidly deployable, mobile, interoperable, and seamless between Air and Space Operations Centers (AOC) and aircraft, either en route or in theater. This project provides secure information transmission capabilities for a persistent, global, survivable communications backbone network accessible for warfighters operating in all domains; it provides self-healing, self-configuration, anti-jam communication networking capabilities; and it provides enterprise networking capabilities for agile, policy-based network management. In addition, this project develops and demonstrates advanced optical networking and communications for Air Force air- and space-based information exchange on and between platforms including development of highly integrated multi-gigabit optical and radio frequency networks, all optical data routers, optical backbone interface circuits for on board information exchange, and integrated electronic, adaptive optic systems for atmospheric mitigation. The Air Force also requires the ability to deliver sovereign options in cyberspace through the development and integration of cyber attack, cyber defense, and cyber support technologies for a strategic capability of cyber dominance. This project develops the ability to deliver: 1) Cyber attack capabilities: access, stealth and persistence, cyber intelligence, and weapons delivery, 2) Cyber defense capabilities: attack detection, attack attribution, and response automation, and 3) Cyber support capability: situational awareness and war gaming.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate secure wideband assured networking between weapon platforms, ground facilities, and Special Operations teams. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	1.426	0.313	0.000	0.313

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>		PROJECT 635320: <i>Assured Worldwide Connectivity</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Continue development of small form-factor networking and reachback capability. Initiate design and demonstration of soldier interface, perform initial flight test.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Complete development of small form-factor networking and reachback capability.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Proactively defend cyberspace through cyber situational awareness, detecting, and defeating cyber threats, and surviving through adaptation and self-generation.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Demonstrate a fleet of 1,000 cooperative, positively controlled, trusted agents that can defend mission critical information system assets and collect actionable CybINT for cyber situation awareness. Continue assured end-to-end Quality of Service (QoS) and Quality of Assurance (QoA) integration to the information system enterprise during malicious and non-malicious faults. Develop capability to geo-locate red, blue, and non-combatant IP addresses and devices globally and locally to achieve better situational awareness to efficiently position cyber defenses. Initiate development of a complete situational awareness capability of cyber network assets, both red and blue forces, to include both virtual and physical cyber assets.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue development of a comprehensive situational awareness and understanding capability of cyber network assets, both red and blue forces, to include both virtual and physical cyber</p>				0.000	4.270	3.333	0.000	3.333

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>		PROJECT 635320: <i>Assured Worldwide Connectivity</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
to automatically generate secure system/network configuration based on policy, architectural specifications, and operational requirements. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A								
MAJOR THRUST: Develop and demonstrate flight ready systems consisting of high capacity radio frequency (RF) and optical components and architectures for next generation communications. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable. <i>FY 2010 Plans:</i> In FY 2010: Complete the design of higher throughput RF waveform data link for operation under adverse weather conditions. Begin fabrication of several flight test ready RF waveform data link systems. <i>FY 2011 Base Plans:</i> In FY 2011: Effort moves to 0602788F, Project 5315. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A				0.000	1.283	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals				0.000	11.701	8.216	0.000	8.216
				FY 2009	FY 2010			
Congressional Add: Massively Parallel Optical Interconnects for Battlespace Information Exchange.				0.000	3.983			

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635320: <i>Assured Worldwide Connectivity</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.		
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Massively Parallel Optical Interconnects for Battlespace Information Exchange.		
Congressional Add: Cyber Attack and Security Environment.	0.000	2.888
<i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.		
<i>FY 2010 Plans:</i> In FY 2010: Conduct Congressionally-directed effort for Cyber Attack and Security Environment.		
Congressional Adds Subtotals	0.000	6.871

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (12059): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>				PROJECT 635321: <i>Global Battlespace Awareness</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635321: <i>Global Battlespace Awareness</i>	0.000	9.829	9.318	0.000	9.318	10.676	10.800	13.351	12.403	Continuing	Continuing

Note

Note: Prior to FY 2010, these efforts were performed in PE 0603789F, C3I Advanced Technologies, Project 4072.

A. Mission Description and Budget Item Justification

In order to achieve information dominance, the Air Force must be able to monitor, assess, plan, and execute (MAPE) missions rapidly across the full spectrum of operations (air, space, and cyberspace) at all levels of war (strategic, operational, and tactical) and during all phases of conflict (pre-conflict, conflict through stability operations). This project develops, integrates, and demonstrates advanced technologies to achieve comprehensive net-centric operations and Predictive Battlespace Awareness using information from all sources. Technology development includes: tasking information collectors (intelligence, surveillance, and reconnaissance platforms, national intelligence sources, etc.); correlating and geo-registering the collected data; exploiting the data to extract information of military significance; fusing information from multiple sources to create a digital n-dimensional representation of the battlespace; assessing the situation; predicting adversary courses of action (COA); and archiving the results for ready use by decision makers. This is a dynamic, complex process that involves technologies for information exploitation, fusion, processing, storage, and retrieval, as well as technologies for machine reasoning, pattern recognition, and timeline analysis.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>MAJOR THRUST: Demonstrate advanced signal and data exploitation technologies for detection, tracking, identification, and targeting of time-critical targets, and information extraction.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Initiate the development of a set of algorithms that can automatically develop, reason, dynamically update various sub-sets of the existing intelligence preparation of the battlespace</p>	0.000	2.961	3.400	0.000	3.400

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635321: <i>Global Battlespace Awareness</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>into a development program, providing information assurance and provenance to the data. Begin development of protocols for the application of watermarking in specific provenance, pedigree, and information assurance scenarios.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue integration of developed techniques and protocols for information assurance. Work toward integration of technologies into network-centric programs of record for the purpose of providing information provenance. Formalize methods for the development of protocols.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>					
Accomplishments/Planned Programs Subtotals	0.000	9.829	9.318	0.000	9.318

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (12252): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>				PROJECT 635322: <i>Knowledge Management and Computing</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635322: <i>Knowledge Management and Computing</i>	0.000	7.444	6.817	0.000	6.817	7.654	10.496	6.949	7.494	Continuing	Continuing

Note

Note: Prior to FY 2010, these efforts were performed in PE 0603789F, C3I Advanced Technologies, Project 4872.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that will provide the decision maker and staff with seamless access to tailored information within a mobile, dynamic, and scalable, globally distributed Air and Space Operations Center (AOC) as well as among other producers, consumers, and managers of information relevant to other particular communities of interest (COI). This project demonstrates the enterprise management capabilities needed for the rapid distribution of actionable information as well as the needed advances in high performance computing to ensure this complex capability. This project develops an agile information environment that focuses on quality of service, transformation and brokering, a federated information environment focusing the relationship among the members of the environment, a secure cross-domain information sharing capability that focuses on the security layer and inter-COI information exchange in different security domains, and a collaboration environment focusing on the information workflow layer of the enterprise. This project will also develop: 1) a computational science and engineering capability demonstrating new models of computation, 2) novel approaches for high performance, interactive, net-centric, distributed, and embedded computing systems, and 3) the technological tools enabling affordable, large scale, complex, software intensive systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate computer architectures with greater capacity and sophistication to enable game changing computing power to the warfighter, anywhere, anytime. <i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.	0.000	0.491	1.259	0.000	1.259

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>		PROJECT 635322: <i>Knowledge Management and Computing</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Initiate development of petaflops embedded on-demand computing. Evaluate options for on-board processing of common sensor algorithms. Complete design of a fungible node for autonomous systems. Initiate development of a stacked chip architecture for cognitive and autonomous systems. Develop scalable stacked chip architecture for highly modular computing system for cognitive and autonomous systems.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Continue the development of petaflops embedded on-demand computing. Demonstrate achieved performance and functionality. Continue development of stacked chip architecture for cognitive and autonomous systems. Demonstrate performance. Develop and demonstrate high-payoff high performance computing applications to reduce size, weight and power restrictions.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
<p>MAJOR THRUST: Demonstrate how a publish, subscribe, and query information management paradigm can enable vertical and horizontal integration of Air Force information systems.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Not Applicable.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Develop secure, creditable services to assist in information sharing between two or more independent security domains while preventing information disclosure to untrustworthy users. Develop a single multi-level repository which can securely store information containing multiple security levels but can be accessed from multiple security domains. This capability will promote IT consolidation and reduce the duplicate information storage within each security domain. Develop a common security labeling methodology that promotes the automatic flow of time-sensitive information</p>				0.000	5.354	3.138	0.000	3.138

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>		PROJECT 635322: <i>Knowledge Management and Computing</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2010 Plans:</i> In FY 2010: Develop and demonstrate pub/sub/query mechanisms for tactical airborne platforms such as Global Hawk and Joint STARS. These tactical sharing mechanisms will be evaluated against operational concepts of employment and the ability to perform the operational objectives.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Initiate development of tactical information management pub/sub/query mechanisms focusing on stability, performance, and reliability. Establish mechanisms for assured access and isolation from malicious client applications, assured levels of quality of service, and in some cases best case where all resources are not locally controlled. Develop tactical service approaches that appear similar to conventional service oriented architectures but operate and compensate for airborne based disruptions. Initiate development of tactical information dominance capabilities that include unmanned aerial systems, "wide-body" assets and high-altitude platforms. Complete the development of the capability to integrate a variety of common operating display technologies to visualize individual data set contexts for better situational awareness across the air, space, and cyber domains at the strategic, operational, and tactical levels.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: N/A</p>								
Accomplishments/Planned Programs Subtotals				0.000	7.444	6.817	0.000	6.817

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635322: <i>Knowledge Management and Computing</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (12415): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>
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COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	32.986	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
634072: <i>Dominant Battlespace Awareness</i>	8.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
634216: <i>Battlespace Information Exchange</i>	14.345	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
634872: <i>Aerospace Information Dominance</i>	10.539	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note
Note: In FY 2010 efforts in this PE move to PE 0603788F, Global Information Dev/Demo.

A. Mission Description and Budget Item Justification
This program develops and demonstrates Air Force Command, Control, Communications, and Intelligence (C3I) technologies for the warfighter. The technologies address the ability to support the global information exchange of correlated and fused information to ensure the Air Force can plan and execute missions in a dynamic, complex environment. The Dominant Battlespace Awareness project will provide affordable operational data capabilities for personnel to understand militarily relevant situations, on a consistent basis, with the precision and timeliness needed to accomplish the mission. The Battlespace Information Exchange project will develop reliable, secure, jam-resistant, inter-operable worldwide global information enterprise capabilities, providing the Air Force assured communications and reach-back capability in a distributed operational environment. It will also demonstrate offensive cyber operations technologies allowing attack and exploitation of adversary information systems by the Air Force. The Aerospace Information Dominance project provides the technology and demonstrations needed to allow the warfighter to plan, assess, execute, monitor, and re-plan on the compressed time scales required for tomorrow's conflicts, whether in combat or peacekeeping missions. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing upgrades and/or new system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>
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B. Program Change Summary (\$ in Millions)

	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>
Previous President's Budget	33.902	0.000	0.000	0.000	0.000
Current President's Budget	32.986	0.000	0.000	0.000	0.000
Total Adjustments	-0.916	0.000	0.000	0.000	0.000
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.916	0.000	0.000	0.000	0.000

Change Summary Explanation

Note: In FY 2010, Congress added \$4.0 million for Cyber Attack and Security Environment and \$2.9 million for MPOI for Battlespace Information Exchange . These efforts were transferred to PE 0603788F, Global Information Dominance, via Form 1414. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>				PROJECT 634072: <i>Dominant Battlespace Awareness</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634072: <i>Dominant Battlespace Awareness</i>	8.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note
Note: In FY 2010 this effort moves to PE 0603788F, Project 5321, Global Battlespace Awareness.

A. Mission Description and Budget Item Justification

This project develops, integrates, and demonstrates advanced technologies to achieve Dominant Battlespace Awareness (DBA) and Predictive Battlespace Awareness using information from all sources. DBA is the information required to support dynamic planning and execution with the accuracy, fidelity, and timeliness needed to dominate the battlespace. Technology development includes: tasking information collectors (intelligence, surveillance, and reconnaissance platforms, national intelligence sources, etc.); correlating and geo-registering the collected data; exploiting the data to extract information of military significance; fusing information from multiple sources to create a digital n-dimensional representation of the battlespace; assessing the situation; predicting adversary courses of action (COA); and archiving the results for ready use by decision makers. This is a dynamic, complex process that involves technologies for information access, extraction, fusion, processing, storage, and retrieval, as well as technologies for machine reasoning, pattern recognition, and timeline analysis.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate advanced signal and data exploitation technologies for detection, tracking, identification, and targeting of time-critical targets. <i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated a real-time signal processing and geolocation capability for emerging commercial communications used by military and asymmetrical threats. Demonstrated airborne-cued ground-based signal processing. Developed multi-sensor exploitation tools to enable characterization and assessment of adversary satellites. Integrated intelligence data and analysis products to produce anticipatory ground to space awareness picture.	2.215	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>	PROJECT 634072: <i>Dominant Battlespace Awareness</i>
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B. Accomplishments/Planned Program (\$ in Millions)	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.					
Accomplishments/Planned Programs Subtotals	8.102	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (12597): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702F: <i>Command, Control, and Communications.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603203F: <i>Advanced Aerospace Sensors.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>				PROJECT 634216: <i>Battlespace Information Exchange</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634216: <i>Battlespace Information Exchange</i>	14.345	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010 this effort moves to PE 0603788F, Project 5320, Assured Worldwide Connectivity.

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced communications technologies for the Air Force that implement a secure environment for worldwide information exchange of near-real-time multimedia (i.e., voice, data, video, and imagery) information. This secure environment will be rapidly deployable, mobile, interoperable, and seamless between Air and Space Operations Centers (AOC) and aircraft, either en route or in theater. It will: a) provide interoperability across echelons, services, coalition, and multi-national force boundaries; b) support mobile information superiority, sensor-to-shooter operations, and the battle management decision process; and c) provide in-transit visibility of en route aircraft, cargo, mission status, and reachback capabilities for aircraft to operations centers in the continental United States (e.g., updating information and mission changes to en route aircraft). Technology developments include an information assurance decision support system, advanced information management, multi-level/secure communications, secure survivable networks, mission and content-based routing, quality-of-service mechanisms, communications transmission systems, cyber situational awareness, and offensive cyber operations capabilities to attack and exploit adversary information and information systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate secure wideband assured networking between weapon platforms, ground facilities and Special Operations teams. <i>FY 2009 Accomplishments:</i> In FY 2009: Developed small form-factor networking and reachback capability. Began certification of the capability in preparation for transition to the Special Operations Forces.	1.087	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>	PROJECT 634216: <i>Battlespace Information Exchange</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
networking, while denying the adversary the same. Conducted Congressionally directed effort for Massively Parallel Optical Interconnects for Battlespace Information Exchange. <i>FY 2010 Plans:</i> In FY 2010: Not Applicable. <i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable. <i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.					
Accomplishments/Planned Programs Subtotals	14.345	0.000	0.000	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE Not Provided (12844): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>				PROJECT 634872: <i>Aerospace Information Dominance</i>				
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
634872: <i>Aerospace Information Dominance</i>	10.539	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010 efforts moves to PE 0603788F, Project 5321, Global Battlespace Awareness, Project 5322, Knowledge Management and Computing and Project 5319, Anticipatory Ops Intent and Response.

A. Mission Description and Budget Item Justification

In order to achieve information dominance, the Air Force must be able to plan, assess, monitor, and replan missions rapidly across the full spectrum of operations (air, space, and cyberspace) at all levels of war (strategic, operational, and tactical) and during all phases of conflict (pre-conflict, conflict, and stability operations). This project develops and demonstrates technologies necessary for dynamic decision making. It provides the technology and demonstrations needed to enable the warfighter to monitor, assess, plan, and execute (MAPE) on the complex and compressed time scales required for tomorrow's conflicts, whether they are combat or operations other than war. It will develop and demonstrate a new generation of planning and assessment technologies that enable a new paradigm of network enabled operations, allowing decision makers to determine the desired operational effects and prosecute the mission accordingly. This project will develop innovative capabilities that will realize a strategy-to-task approach to warfare, exploiting anticipatory environments and agile command and control concepts. It will develop and demonstrate distributed information technologies that provide the decision maker and staff with seamless access to tailored multi-media and multi-spectral data within a mobile, dynamic, scalable, globally distributed Air and Space Operations Center (AOC). This project will also develop knowledge-based intelligent information technologies to support robust, real-time, large-scale Air Force command and control systems.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and demonstrate distributed information technologies that are scalable and reconfigurable and provide seamless access to tailored multi-media and multi-spectral data. <i>FY 2009 Accomplishments:</i> In FY 2009: Initiated the development of capabilities to allow seamless information sharing for enhanced situational awareness and understanding by the decision maker. developed an	1.453	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>		PROJECT 634872: <i>Aerospace Information Dominance</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p>initial capability to plan and measure effectiveness of information operations in conjunction with precision munitions to determine successful achievement of command intent in time and location to achieve "self-synchronization." Conducted campaign of experimentation to quantitatively measure transformational command and control concepts enabled by net centric warfare capabilities. Completed the development of polymorphic (adaptable) computing technology for persistent surveillance systems using faster processing and greatly reduced size, weight, and power requirements for processing hardware. Developed an application of MLS/MSLS middleware technologies for persistent surveillance systems to support user access/denial of information at multiple security levels.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>								
<p>MAJOR THRUST: Develop and demonstrate the integration of planning tools and information-based intelligent agents for adaptive preplanning and decision support tools.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Initiated development of capabilities to be more agile within a net centric enabled environment. Developed timely option generation selection and coordination capabilities that account for uncertainty and missing and erroneous information, and supports intuitive decision making process between man and machine collaborating on complex, dynamic problems exploiting the respective strengths of machines (process lots of data) and human (analytical reasoning). Developed dynamic</p>				0.662	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010																			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>		PROJECT 634872: <i>Aerospace Information Dominance</i>																			
B. Accomplishments/Planned Program (\$ in Millions)																							
<table border="1"> <thead> <tr> <th></th> <th>FY 2009</th> <th>FY 2010</th> <th>FY 2011 Base</th> <th>FY 2011 OCO</th> <th>FY 2011 Total</th> </tr> </thead> <tbody> <tr> <td> <p>workflow and workload management capabilities to manage the command and control constellation of resources.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p> </td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td> <p>MAJOR THRUST: Demonstrate an effects-based approach for the next generation of planning and assessment techniques that enable decision makers to determine the desired operational effects.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated technology to meet the needs for effects-based assessment in an operational environment. Designed, developed, and demonstrated the capabilities for continuous effects-based assessment in a dynamic tasking environment. Demonstrated techniques to accomplish up-to-date awareness on whether the execution of the battle plan is meeting the desired effects. Investigated the methods to enable a decision support environment that enables the decision maker to anticipate and shape all aspects of the future battlespace. Initiated development of predictive battlespace awareness tools with the ability to reason over models of the "enemy as a system." Conducted analysis of cascading effects in real-time for diverse courses of action. [Conducted research to forecast actionable futures to support a decision maker's ability to appraise and plan the "best" blue course of action for RDAA. Conducted investigation of ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threat(s).] Initiated assured end-to-end Quality of Service and Quality of Assurance integration to the information system enterprise during malicious and non-malicious faults.</p> </td> <td align="center">3.153</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> <td align="center">0.000</td> </tr> </tbody> </table>							FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	<p>workflow and workload management capabilities to manage the command and control constellation of resources.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>						<p>MAJOR THRUST: Demonstrate an effects-based approach for the next generation of planning and assessment techniques that enable decision makers to determine the desired operational effects.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated technology to meet the needs for effects-based assessment in an operational environment. Designed, developed, and demonstrated the capabilities for continuous effects-based assessment in a dynamic tasking environment. Demonstrated techniques to accomplish up-to-date awareness on whether the execution of the battle plan is meeting the desired effects. Investigated the methods to enable a decision support environment that enables the decision maker to anticipate and shape all aspects of the future battlespace. Initiated development of predictive battlespace awareness tools with the ability to reason over models of the "enemy as a system." Conducted analysis of cascading effects in real-time for diverse courses of action. [Conducted research to forecast actionable futures to support a decision maker's ability to appraise and plan the "best" blue course of action for RDAA. Conducted investigation of ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threat(s).] Initiated assured end-to-end Quality of Service and Quality of Assurance integration to the information system enterprise during malicious and non-malicious faults.</p>	3.153	0.000	0.000	0.000	0.000
	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total																		
<p>workflow and workload management capabilities to manage the command and control constellation of resources.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>																							
<p>MAJOR THRUST: Demonstrate an effects-based approach for the next generation of planning and assessment techniques that enable decision makers to determine the desired operational effects.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2009: Demonstrated technology to meet the needs for effects-based assessment in an operational environment. Designed, developed, and demonstrated the capabilities for continuous effects-based assessment in a dynamic tasking environment. Demonstrated techniques to accomplish up-to-date awareness on whether the execution of the battle plan is meeting the desired effects. Investigated the methods to enable a decision support environment that enables the decision maker to anticipate and shape all aspects of the future battlespace. Initiated development of predictive battlespace awareness tools with the ability to reason over models of the "enemy as a system." Conducted analysis of cascading effects in real-time for diverse courses of action. [Conducted research to forecast actionable futures to support a decision maker's ability to appraise and plan the "best" blue course of action for RDAA. Conducted investigation of ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threat(s).] Initiated assured end-to-end Quality of Service and Quality of Assurance integration to the information system enterprise during malicious and non-malicious faults.</p>	3.153	0.000	0.000	0.000	0.000																		

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force				DATE: February 2010				
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>		PROJECT 634872: <i>Aerospace Information Dominance</i>				
B. Accomplishments/Planned Program (\$ in Millions)								
				FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2009 Accomplishments:</i> In FY 2009: Developed and demonstrated technologies that enable pub/sub/query information dissemination across multiple security level boundaries. Initiated the study of discovery and filter technology to assess, evaluate, and convert unstructured information into structured information feeds. Demonstrated capability integrating tactical and edge user information management requirements. Developed information transformation services and adaptive information management services that learn, self-configure, self-manage, and are self-healing. Conducted study on collaboration services on demand that will exploit dynamic information services matching end user devices (laptops, cell phones, etc.) with appropriate information formats. Supported context aware collaborative user interfaces and semantic interoperability.</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>								
Accomplishments/Planned Programs Subtotals				10.539	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603789F: <i>C3I Advanced Development</i>	PROJECT 634872: <i>Aerospace Information Dominance</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE Not Provided (13037): <i>Activity Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>								
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	3.899	3.794	1.847	0.000	1.847	1.122	1.237	1.569	2.382	Continuing	Continuing
635095: <i>High Energy Laser Advanced Technology Program</i>	3.899	3.794	1.847	0.000	1.847	1.122	1.237	1.569	2.382	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds high energy laser (HEL) advanced technology development through the HEL Joint Technology Office (JTO). HEL weapons have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HEL weapons have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase, defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles, and the ultra-precision negation of targets in urban environments with little/no collateral damage. This program is part of an overall Department of Defense (DoD) HEL Science and Technology program. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	4.002	3.831	0.000	0.000	0.000
Current President's Budget	3.899	3.794	1.847	0.000	1.847
Total Adjustments	-0.103	-0.037	1.847	0.000	1.847
• Congressional General Reductions		-0.021			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.016			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-0.103	0.000	1.847	0.000	1.847

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Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force

DATE: February 2010

APPROPRIATION/BUDGET ACTIVITY

3600: *Research, Development, Test & Evaluation, Air Force*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603924F: *High Energy Laser Advanced Technology Program*

Change Summary Explanation

The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics
Under Development.

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force								DATE: February 2010			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>				PROJECT 635095: <i>High Energy Laser Advanced Technology Program</i>			
COST (\$ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
635095: <i>High Energy Laser Advanced Technology Program</i>	3.899	3.794	1.847	0.000	1.847	1.122	1.237	1.569	2.382	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds high energy laser (HEL) advanced technology development through the HEL Joint Technology Office (JTO). HEL weapons have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HEL weapons have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase, defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles, and the ultra-precision negation of targets in urban environments with little/no collateral damage. This program is part of an overall Department of Defense (DoD) HEL Science and Technology program. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Advance solid state laser development. Develop beam-control technologies for surface and air mission areas. <i>FY 2009 Accomplishments:</i> In FY 2009: Under the Joint High Power Solid State Laser (JHPSSL) project, completed the integration of modules for the 100 kilowatt project and demonstrated performance in a laboratory environment. <i>FY 2010 Plans:</i> In FY 2010: Initiate a joint high-power beam director development effort, suitable for mating with a JHPSSL device.	3.899	3.794	1.847	0.000	1.847

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>	PROJECT 635095: <i>High Energy Laser Advanced Technology Program</i>
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B. Accomplishments/Planned Program (\$ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
<p><i>FY 2011 Base Plans:</i> FY 2011: Integrate a joint high-power beam director, with a JHPSSL-like device. Conduct integrated system tests in a field environment.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>					
<p>MAJOR THRUST: Develop and evaluate HPM and other unconventional weapon technologies including integration on various platforms, including aerial. Investigate specific target sets of interest.</p> <p><i>FY 2009 Accomplishments:</i> In FY 2011 OCO: N/A</p> <p><i>FY 2010 Plans:</i> In FY 2010: Not Applicable.</p> <p><i>FY 2011 Base Plans:</i> In FY 2011: Not Applicable.</p> <p><i>FY 2011 OCO Plans:</i> In FY 2011 OCO: Not Applicable.</p>	0.000	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	3.899	3.794	1.847	0.000	1.847

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0602890F: <i>High Energy Laser Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force **DATE:** February 2010

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>	PROJECT 635095: <i>High Energy Laser Advanced Technology Program</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011 Base</u>	<u>FY 2011 OCO</u>	<u>FY 2011 Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• PE 0603444F: <i>Maui Space Surveillance System.</i>											
• PE 0603605F: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0601108F: <i>High Energy Laser Research Initiatives.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603883C: <i>Ballistic Missile Defense Boost Phase Segment.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602605F: <i>Directed Energy Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602307A: <i>Advanced Weapons Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602114N: <i>Power Projection Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602120A: <i>Sensors and Electronic Survivability.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603004A: <i>Weapons and Munitions Advanced Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602702E: <i>Tactical Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603175C: <i>Ballistic Missile Defense Technology.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0602651M: <i>Joint Non-Lethal Weapons Applied Research.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force	DATE: February 2010
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>	PROJECT 635095: <i>High Energy Laser Advanced Technology Program</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u> <u>Base</u>	<u>FY 2011</u> <u>OCO</u>	<u>FY 2011</u> <u>Total</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• PE 0603651M: <i>Joint Non-Lethal Weapons Technology Development.</i>											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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