PE TITLE: Command Control and Communications

	Ex	hibit R-2, I	RDT&E Bu	ıdget Item	Justifica	tion			DATE	February 2005		
BUDGET ACTIVITY  PE NUMBER AND TITLE  0602702F Command Control and Communications												
	Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total	
	Total Program Element (PE) Cost	78.879	84.887	93.316	102.163	98.109	100.198	102.109	97.352	Continuing	TBI	
4519	Communications Technology	16.383	17.083	23.598	25.619	26.484	27.115	26.503	23.335	Continuing	TBD	
4594	Information Technology	28.345	27.765	27.570	30.404	30.244	29.754	30.213	30.336	Continuing	TBD	
4917	Collaborative Information Tech	7.678	5.587	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	TBD	
5581	Command and Control (C2) Technology	26.473	34.452	42.148	46.140	41.381	43.329	45.393	43.681	Continuing	TBI	

Note: Increased funding in FY 2006 and out reflects increased emphasis on developing high payoff applications of information technologies to meet C3 needs. In FY 2006, efforts in Project 4917 move into Project 4594, Project 4519, and Project 5581 in this PE.

## (U) 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 by providing the right information, at the right time, anywhere in the world. The program has four projects. The Communication Technology project develops assured and secure communications technology. The Information Technology project develops improved and automated capabilities to generate, process, fuse, exploit, interpret, and disseminate timely and accurate information. The Collaborative Information Technology project develops high payoff emerging technologies for the next generation of distributed, collaborative command and control systems. 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 compressed time scales required for tomorrow's conflicts. Note: In FY 2005, Congress added \$2.5 million for Measurement and Signatures Intelligence Warfighter Visualization Tools, and \$1.0 million for Joint Battlespace Infosphere. This program is Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

## (U) B. Program Change Summary (\$ in Millions)

	<u>FY 2004</u>	FY 2005	FY 2006	FY 2007
(U) Previous President's Budget	79.594	82.147	82.865	90.866
(U) Current PBR/President's Budget	78.879	84.887	93.316	102.163
(U) Total Adjustments	-0.715	2.740		
(U) Congressional Program Reductions		-0.006		
Congressional Rescissions		-0.754		
Congressional Increases		3.500		
Reprogrammings				
SBIR/STTR Transfer	-0.715			
(U) Significant Program Changes:				

Not Applicable.

R-1 Shopping List - Item No. 13-1 of 13-24

Exhibit R-2,	, RDT&E Budget Item Justification	DATE February 2005
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602702F Command Control and Comm	
C. Performance Metrics (U) Under Development.		
	R-1 Shopping List - Item No. 13-2 of 13-24	Exhibit R-2 (PE 0602702F)

	E	DATE	February 2	2005							
BUDGET ACTIVITY  02 Applied Research								CT NUMBER AND TITLE  Communications Technology			
	Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate		Cost to Complete	Total
4519	Communications Technology	16.383	17.083	23.598	25.619	26.484	27.115	26.50	23.335	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	•	0 0		

Note: Increased funding in FY 2006 and out reflects increased emphasis on developing information and networking technologies and the transfer of information technologies development effort from Project 4917 in FY 2006.

### (U) 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 command and control. A rapidly deployed EAF 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.

FY 2004

5.534

FY 2005

5.969

FY 2007

11.767

FY 2006

10.168

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

- (U) MAJOR THRUST: Develop assured and survivable information and networking technologies enabling worldwide command, control, and communications operations for the Air Force. Note: FY 2006 and out increase reflects increased emphasis on developing information and networking technologies.
- (U) In FY 2004: Developed technologies to improve quality of service for globally distributed information systems (e.g., Joint Battlespace Infosphere (JBI)). Developed assured networking and information systems technologies to improve survivability against critical infrastructure attacks. Developed securely managed enterprise network technology for development of assured network services across multiple network security domains and coalitions. Developed programmable networking algorithms that enable wide area dynamic creation of advanced information delivery services that are independent of the underlying physical infrastructure devices.
- (U) In FY 2005: Continue to develop technologies to improve quality of service and survivability for globally distributed information systems (e.g., JBI). Complete development of assured networking and information systems technologies to improve survivability against critical infrastructure attacks. Complete development of securely managed enterprise network technology to develop assured network services across multiple network security domains. Continue development of programmable networking algorithms that enable wide area dynamic creation of advanced information delivery services, independent of the underlying physical infrastructure devices. Initiate development of capabilities for self-organizing, self-healing, autonomous networking.
- (U) In FY 2006: Complete development of technologies to improve quality of service and survivability for

Project 4519 R-1 Shopping List - Item No. 13-3 of 13-24 Exhibit R-2a (PE 0602702F

	UNCLASSIFIED				
Exhibit R-2a, RDT&E Pr	oject Justification		DATE	February 2	2005
BUDGET ACTIVITY  02 Applied Research	PE NUMBER AND TITLE 0602702F Command Conf Communications	trol and	PROJECT NUME 4519 Commu	BER AND TITLE Inications Tec	hnology
globally distributed information systems (e.g., JBI). Complete develop networking algorithms that enable wide area dynamic creation of advant independent of the underlying physical infrastructure devices. Continuous self-organizing, self-healing, autonomous networking. Initiate developments self-organizing, self-healing, autonomous networking. Initiate developments to changes in (INFOCON) levels. Initiate developments focused on communications schemas and sensor exploitation technologies enabling the dynamic into sensor management functions for more effective moving target exploitate development of content-based delivery networking (CBDN) technological and management of end user information.  (U) In FY 2007: Complete development of capabilities for self-organizing, networking. Continue development of policy-based network management network response to changes in INFOCON levels. Continue development communications/resource network management schemas and sensor ex	nced information delivery services, are development of capabilities for oment of policy-based network a information condition s/resource network management regration of communications and ration and fusion. Initiate ries for intelligent network delivery self-healing, autonomous rent technologies for real-time rent and test of				
the dynamic integration of communications and sensor management fur target exploitation and fusion. Continue development of airborne CBD Tactical Radio System Wideband Networking Waveform's Network Se extremely dynamic infrastructure and network/platform mobility dictate (U)	nctions for more effective moving DN, synergistic with the Joint ervice Layer, and applied to				
(U) MAJOR THRUST: Develop improved, higher bandwidth communicat technologies to provide secure, adaptive, covert, anti-jam, and assured a highly mobile aerospace forces, while reducing the equipment footprint	global battlespace connectivity to	4.378	4.470	4.549	4.674
(U) In FY 2004: Developed information assurance technologies that will in Global Information Grid in both wireline and wireless networks for groenvironments to preclude information systems attacks, such as denial of device quality. Developed high performance, adaptable, and re-configuinglement new waveform technologies for improved robustness, securi Force command and control networks. Developed higher performance modulation techniques that enable critical objectives for high bandwidth exploitation capabilities over wireless channels.	mprove the robustness of the bund, air, and joint/coalition of service and degradation of urable wireless devices to ity, and affordability of critical Air video compression and				
(U) In FY 2005: Continue development of information assurance technolog of the Global Information Grid in both wireline and wireless networks i joint/coalition environments to preclude information systems attacks su and degradation of device quality. Continue to develop high performance	for air, space, ground, and ach as distributed denial of service ace, adaptable, and reconfigurable				
Project 4519 R-1 S	Shopping List - Item No. 13-4 of 13-24			Exhibit R-2a (P	∟ 0602702F)

	February 2005		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	NUMBER AND TITLE
02 Applied Research	0602702F Command Control and	4519 Cc	ommunications Technology
	Communications		

wireless devices to implement new waveform technologies for improved robustness, security, and affordability of critical Air Force command and control networks. Continue development of higher performance video compression and modulation techniques that enable critical objectives for high bandwidth information transmission and exploitation capabilities over wireless channels. Explore the feasibility of implementation of above technologies, where applicable, to Joint Tactical Radio System or compatible software radios.

- In FY 2006: Continue development of information assurance technologies that improve the robustness of the Global Information Grid in both wireline and wireless networks for air, space, ground, and joint/coalition environments to preclude information systems attacks such as distributed denial of service and degradation of device quality. Continue development of higher performance, adaptively combined multi-dimensional (space, time, frequency, coding, polarization) transmission techniques that enable high bandwidth information transmission and exploitation capabilities over wireless channels which support command and control, and intelligence, surveillance, and reconnaissance missions, and the use of intelligent munitions. Complete development of higher performance video compression and modulation techniques that enable critical objectives for high bandwidth information transmission and exploitation capabilities over wireless channels. Initiate the design and development of a multi-mode, multi-function, sense-and-adapt air-mobile communications capability to dynamically alter communications methods to support, under fast-changing environments, higher-throughput, anti-jam, low probability of intercept, and/or robust [assured] voice, data, and video communications. Perform such design and development within the framework of the Joint Tactical Radio System or compatible software defined radios. Explore/exploit feasible applications of quantum key distribution and cryptography to effect ultra-secure communications for wireline and wireless networks.
- (U) In FY 2007: Complete first phase development of information assurance technologies that improve the robustness of the Global Information Grid in both wireline and wireless networks for air, space, ground, and joint/coalition environments to preclude information systems attacks. Demonstrate promising higher performance, adaptively combined multi-dimensional (space, time, frequency, coding, polarization) transmission techniques that enable high bandwidth information transmission and exploitation capabilities amongst airborne command and control, and intelligence, surveillance, and reconnaissance platforms and various weapon delivery systems with their smart munitions. Test and demonstrate a multi-mode, multi-function, sense-and-adapt air-mobile communications capability to dynamically alter communications methods under fast-changing environment within the framework of the Joint Tactical Radio System or compatible software defined radios. Develop and test promising quantum key distribution and cryptography technologies to effect ultra-secure communications for wired and wireless networks. Perform transition planning.

Project 4519 R-1 Shopping List - Item No. 13-5 of 13-24

	Exhibit R-2a, RDT&E Proje	ect Justification		DATE	February 2	2005	
BUDGET ACTIV  02 Applied R		PE NUMBER AND TITLE 0602702F Command Communications	d Control and	PROJECT NUME 4519 Commu	IMBER AND TITLE  nunications Technology		
integratio	THRUST: Develop critical information transmission technologie on of aerospace weapon systems' C2, intelligence, surveillance, an rmation. Note: Effort transferred from Project 4917 in FY 2006.	=	0.000	0.000	1.822	1.870	
(U) In FY200 (U) In FY200	<ul><li>14: Not Applicable.</li><li>15: Not Applicable.</li><li>16: Initiate exploration of techniques for tunable, high power radication frequency component equipment size, weight, and signal loss</li></ul>						
(U) In FY200 frequency losses. C informati	assessment of exploratory radio frequency and optical information 07: Continue to explore multiple technologies/techniques for tunally filtering to reduce overall radio frequency component equipment continue development, test, and assessment of exploratory radio from transfer technologies.	ole, high power radio t size, weight, and signal					
worldwid	THRUST/CONGESSIONAL ADD: Develop cyber operations te le command, control, communications and intelligence. Note: Thional Add funding of \$1.2 million in FY 2004.	-	6.471	6.644	7.059	7.308	
(U) In FY 20 Develope and to pr code. De advanced detection control, o	04: Developed automated capabilities for damage assessment and ed network forensics and data mining tools for detecting adversary ovide early warning notification. Developed detection and eradical eveloped active response technologies. Completed work in detectal correlation fusion techniques for defensive course of action analytechniques for wireless networks. Developed new tools and technomunications, intelligence, and information systems, and allowed on elements.	v information warfare attacks ation techniques for malicious ion of hidden data. Developed ysis. Developed intrusion niques to protect command,					
(U) In FY 20 technique detecting develope response course of Continue intelliger	05: Continue to develop automated capabilities for damage assesses. Complete development of network forensics. Continue development adversary information warfare attacks and provide early warning detection and eradication techniques for malicious code. Continue technologies. Continue development of advanced correlation fusion analysis. Continue development of intrusion detection techniques to protect command, continue, and information systems, and allow for integration of coalition to Continue development of intrusion detection techniques for which is continue development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of intrusion detection techniques for which is continued to development of the development of intrusion detection techniques for which is continued to development of the development of the development of the development of the development of t	pment of data mining tools for notification. Continue to e development of active ion techniques for defensive hniques for wireless networks. Introl, communications, in information elements.					
Project 4519	·	ping List - Item No. 13-6 of 13-24			Exhibit R-2a (P	E 0602702F)	

					JNCLASSIF				DATE		
		Exhibi	t R-2a, RD	T&E Projec	ct Justifica	tion				February	2005
	GET ACTIVITY Applied Research				0602	UMBER AND TI 2702F Comm nmunications	and Control		ROJECT NUMBE 519 Commun		chnology
	develop automated capabilities defining defensive courses-of-active develop defensive techniques for and eradication techniques for network attack (CNA) technologies for defensive course of action at In FY 2007: Complete develop to develop automated capabilities for defining defensive courses-develop defensive techniques for and eradication techniques for netchnologies. Continue develop action analysis. Continue effort Total Cost	ction to counter r wireless, mob- nalicious code. gies. Continue nalysis. Initiate ment of intrusion es for damage a of-action to cou- r wireless, mob- nalicious code.	adversary info bile and embed Continue deve development of work addressi on detection tec ssessment and inter adversary bile and embed Continue deve eed correlation	ormation warfa ded systems. Colopment of act of advanced con ng self-healing chniques for win recovery. Con information wanted ded systems. Colopment of act	re attacks. Con Continue to devitive response a rrelation fusion g systems. ireless network attinue to develor arfare attacks. Continue to devitive response a	tinue to velop detection of computer a techniques as. Continue op techniques Continue to velop detection of CNA		292	17.083	22 508	25.610
(U)							16.3	383	17.083	23.598	25.619
(U) (U)	C. Other Program Funding Survey Related Activities: PE 0603789F, C3I Advanced Development. This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.  D. Acquisition Strategy Not Applicable.	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
Pro	ject 4519			R-1 Shoppi	ing List - Item No	. 13-7 of 13-24				Exhibit R-2a (I	PE 0602702F)

	E	DATE	DATE February 2005								
BUDGET ACTIVITY  02 Applied Research					060270	BER AND TITLE <b>2F Commar</b> unications			ROJECT NUMBE <b>594 Informati</b>		<b>y</b> gy
	Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate		Cost to Complete	Total
4594	Information Technology	28.345	27.765	27.570	30.404	30.244	29.754	30.21	3 30.336	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0		0		

#### (U) 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 and execution cycle 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 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.

FY 2004

6.571

FY 2005

6.753

FY 2006

6.460

FY 2007

7.241

## (U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>

- (U) MAJOR THRUST: Develop innovative multi-sensor collaborative fusion technologies in a fully distributed air and space environment.
- (U) In FY 2004: Developed techniques to quantitatively evaluate fusion algorithms that support the analysis of a new emerging information era. Developed optimized multi-source fusion techniques for continuous tracking of militarily significant vehicles in the battlespace. Developed and evaluated fusion technologies for enemy threat prediction through the use of multi-source fusion.
- (U) In FY 2005: Evaluate fusion techniques to determine optimal algorithms based upon data available that support the analysis of a new emerging information era. Continue to develop optimized multi-source fusion techniques for positive identification and continuous tracking of militarily significant vehicles in the battlespace. Continue development and evaluation of fusion technologies for enemy threat prediction based on the use of multi-source fusion.
- (U) In FY 2006: Continue to develop and evaluate fusion techniques for optimal fusion management. Test and analyze vehicle motion models for variable state multiple algorithm to associate the current location of vehicle with a future state. Enhance multi-source fusion techniques for probabilistic identification and continuous tracking of military significant threats in the battlespace. Evaluate evidence accrual and data mining techniques for improved fusion performance. Develop new measures of performance for higher levels of fusion in analyzing situational assessment and process refinement.
- (U) In FY 2007: Evaluate fusion management and advance the state-of-the-art in track-to-track fusion

Project 4594 R-1 Shopping List - Item No. 13-8 of 13-24

Exhibit R-2a (PE 0602702F)

	ONCEASSII IED		DATE				
Exhibit R-2a, RDT&E Pro	ject Justification		February 200				
BUDGET ACTIVITY  02 Applied Research	PE NUMBER AND TITLE 0602702F Command Communications	0602702F Command Control and			gy		
techniques. Continue the process of probabilistic identification though the Increase probabilistic confidence through the inclusion of higher-level fus situational assessment and process refinement area. Develop techniques to reasoning fusion engines to adapt to changing threat conditions. Develop reconnaissance management techniques that optimize the fusion process functional continuous tracking of military significant threats. Evaluate network cendistributed fusion techniques to the warfighter.  (U)	sion techniques in the to dynamically update advanced intelligence, surveillance, and for identification and						
<ul> <li>(U) MAJOR THRUST: Develop higher-level fusion and the enabling informatechnologies to achieve situational awareness at all command levels for the execution process.</li> </ul>	_	5.468	5.644	5.785	6.386		
(U) In FY 2004: Developed intermediate information extraction techniques to increase time allocated to analysis and decision-making, enabling the abil systems. Developed data mining techniques for a self-organizing data representation to support prediction of potential events in the world. Develop techniques, data filtering techniques, and information aggregation method understanding.	lity to populate knowledge base pository and content-based bed advanced web-based search						
(U) In FY 2005: Continue development of intermediate information extraction analysis time for decision-making and enabling the ability to populate know Continue development of data mining techniques for self-organizing data extraction to support identification of potential events in the world. Continue search techniques, data filtering techniques, and information aggregation the explosion of available data on the Web required for rapid situational utechniques addressing key entity extraction technology gaps, to improve the joint systems that exploit information from unstructured text for situation	owledge base systems. repositories and content-based inue development of web-based methods to take advantage of inderstanding. Develop new the accuracy of Air Force and						
(U) In FY 2006: Complete development of intermediate information extraction analysis time for decision-making and enabling the ability to populate known Complete development of techniques addressing key entity extraction techniques accuracy of Air Force and joint systems that exploit information from unsuranalysis. Continue development of interactive contextual reasoning with self-organizing data repositories, and content-based extraction to support events in the world. Continue enhancement of web-based search technique and information aggregation methods to take advantage of the explosion of the Web required for rapid situational understanding. Develop inferencing	on techniques to decrease owledge base systems. hnology gaps, to improve the structured text for situation inference techniques for identification of potential ues, data filtering techniques, of available open source data on						
	opping List - Item No. 13-9 of 13-24			Exhibit R-2a (Pl	E 0602702F)		

	Exhibit R-2a, RDT&E P	roject Justification		DATE	TE February 2005		
BUDGET ACTIVITY  02 Applied Research	h	PE NUMBER AND TITLE 0602702F Command ( Communications	0602702F Command Control and			рду	
(U) In FY 2007: Enhance self-organizing date in the world. Continuous information aggree Web required for	n and predict enemy intent and threat possibility.  ance techniques for interactive contextual reasoning value repositories and content-based extraction to suppositinue enhancement of web-based search techniques, egation methods to take advantage of the explosion of rapid situational understanding. Continue developing the situation and for predicting enemy intent and threat	ort identification of potential events data filtering techniques, and f available open source data on the g inferencing techniques for					
petaflop processir (U) In FY 2004: Dev distributed knowle	Γ: Develop automatic and dynamically reconfigurable and technologies for real-time C2 global information seloped and demonstrated architectures for rapid extra edge bases. Evaluated architectures to support real-timess. Studied next generation information technolog	ystems. action of information from globally ime requirements for dominant	3.606	3.913	4.099	4.508	
(U) In FY 2005: Den knowledge bases. awareness. Conti	mputing) for C2 systems.  nonstrate architecture for rapid extraction of informat  Demonstrate architecture to support real-time require  nue study of next generation information technologie  mputing) for C2 systems.	rements for dominant battlespace					
awareness. Comp Continue evaluati development for r development for c	aplete architecture for support of real-time requiremental polete study results of next generation information technologies for C2 systems are the control of the control o	nnologies for C2 systems.  processing. Initiate algorithm  ems. Initiate architectural					
(U) In FY 2007: Com Continue algorith architectural deve characterization o development and	inplete evaluation of architectural features for cognitive mediated methods are the development for next generation information technology and the formation processing. Contifully, the first performance computers for quantum computers characterization of the next generation of high performance.	nologies for C2 systems. Continue inue development and ng applications. Initiate					
execution, and ass (U) In FY 2004: Com	<ul> <li>Γ: Develop modeling and simulation technologies for sessment environments.</li> <li>npleted model abstraction and multi-resolution model sting high-resolution models and simulations for nex</li> </ul>	ling techniques to reduce the	1.916	1.989	2.461	2.630	
Project 4594		Shopping List - Item No. 13-10 of 13-24			Exhibit R-2a (P	E 0602702F)	

	Exhibit R-2a, RDT&E Projec	t Justification	DAT		
51.15	-		I DD O JE OT NIJ J	February 2	2005
	GET ACTIVITY Applied Research	PE NUMBER AND TITLE  0602702F Command Control and  Communications		MBER AND TITLE  nation Technolo	ogy
	collaborative decision support environments. Developed decision support ted	chnologies and their			
	theoretical foundation to support high-profile system concepts, such as the Joand the Global Strike Task Force.	oint Synthetic Battlespace			
(U)	In FY 2005: Continue to develop modeling and simulation technologies to st	upport next generation			
	planning execution and assessment environments. Develop adversarial behavechniques for course of action assessment and prediction. Prototype and detechnologies and the theoretical foundation to support high-profile system concepts of Operations.	monstrate decision support such as Air Force			
(U)	In FY 2006: Continue to develop advanced modeling and simulation technologeneration planning execution and assessment environments. Continue developed behavior models and modeling techniques for dynamic course of action assess Initiate investigation of techniques for integrated interaction and assessment courses of action. Develop simulation techniques for dynamic situation assessment.	lopment of adversarial ssment and prediction. of friendly versus enemy			
(U)	In FY 2007: Demonstrate advanced modeling and simulation technologies to planning execution and assessment environments. Demonstrate adversarial be modeling techniques for course of action assessment and prediction. Conducting integrated interaction and assessment of friendly versus enemy courses of act prototypical dynamic situation assessment and prediction system. Investigate provide approaches for a modeling toolset that enables the warfighter to build	o support next generation behavior models and et concept demonstrations of tion. Demonstrate a e advanced concepts to			
(U) (U)	MAJOR THRUST: Develop real-time embedded information system technotime-critical, embedded systems to enable affordable design and development and software, innovatively incorporate new capabilities, reactively adapt to not changing environments, verify, validate, and assure functionality and integrit insertion to support real-time, collaborative operations within a net-centric entransfered from Project 4917 in FY 2006.	at of state-of-the-art hardware multiple missions and y, and facilitate rapid	0.000	2.007	2.130
(U)	In FY 2004: Not Applicable.				
(U)	In FY 2005: Not Applicable.				
(U)	In FY 2006: Continue development of dynamically reconfigurable aerospace computing techniques to support image/video processing and data compressive adaptive embedded computing technologies to support enhanced interoperable exchange between tactical C2 platforms to support network centric operation and reconfigurable computing. Continue to develop processes, methods, and assured performance, integrity, and security of real-time embedded information plect 4594  R-1 Shoppin	on. Continue to develop ility and information s, based on Real-Time Java techniques to provide		Exhibit R-2a (P	

		INCLASSIFIED				
	Exhibit R-2a, RDT&E Projec	et Justification		DATE	February 2	2005
	GET ACTIVITY Applied Research	PE NUMBER AND TITLE 0602702F Command Co Communications	PROJECT NUMBER AND TITLE 4594 Information Technology			
(U)	develop algorithms, methods, and processes to support real-time, adaptive respective resources across multiple tactical platforms. Continue to develop multiple for real-time embedded system architectures. Continue development of method computing processes using biologically-inspired and biologically-based computing processes using biologically-inspired and biologically-based computings application. Initiate development of power-aware, polymorphic aero mission-aware computing.  In FY 2007: Continue development of dynamically reconfigurable aerospace computing techniques to support image/video processing and data compression develop adaptive embedded computing technologies to support enhanced into information exchange between tactical C2 platforms to support network central Real-Time Java and reconfigurable computing. Continue to develop process to provide assured performance, integrity, and security of real-time embedded. Continue to develop algorithms, methods, and processes to support real-time management of system resources across multiple tactical platforms. Continue secure middleware for real-time embedded system architectures. Continue decomputation and computing processes using biologically-inspired and biologicall	Iti-level secure middleware mods of computation and putation for embedded ospace systems for  e systems using adaptive on. Complete program to eroperability and ric operations, based on es, methods, and techniques d information systems.  , adaptive resource e to develop multi-level evelopment of methods of gically-based computation for				
(U)	embedded systems application. Continue development of power-aware, poly for mission-aware computing.  MAJOR THRUST/CONGRESSIONAL ADD: Develop digital information electronic communications and special signals intelligence, imagery, and mentincrease accuracy, correlation, and timeliness of the information value to the effort includes Congressional Add funding of \$4.0 million in FY 2004 and \$2.00 million in FY 2004 and \$2	exploitation technologies for asurement signatures to decision maker. Note: This	10.784	9.466	6.758	7.509
(U)	In FY 2004: Developed advanced multi-sensor open systems techniques and exploiting measurement and signature intelligence, hyperspectral imagery, or new electronic signals, moving target indicator, and speech intelligence produawareness, indication and warning, and reporting capabilities. Researched te steganalysis, and watermarking of imagery, video, and speech for information authentication, intelligence exploitation, and analysis tool aids.	l automated analyst tools for n-board video processing, ucts for improved situational echniques in steganography,				
(U)	In FY 2005: Continue development of advanced multi-sensor and automated measurement and signature intelligence, commercial sources and hyperspectr processing, new digital electronic signals, moving target indicator, and speec feed an information fusion process in support of the decision maker. Continutechniques in steganography, steganalysis, watermarking, and digital data for and speech information protection and authentication, intelligence exploitation	ral imagery, on-board video th intelligence products to the development of the rensics for imagery, video,			Exhibit R-2a (P	E 0002702E\

		Exhibi	t R-2a, RD	T&E Proje	ct Justifica	ition			DATE	February 2	2005	
	GET ACTIVITY Applied Research		<u>,                                      </u>	<u> </u>	PE N <b>060</b> 2					DJECT NUMBER AND TITLE 4 Information Technology		
	Initiate investigation of new tech for enhanced indications and wa In FY 2006: Continue to develor Continue development of technic forensics for imagery, video, and exploitation, and analysts' tool a document and file tampering the In FY 2007: Complete first phat watermarking, and digital data for authentication, and intelligence	prining and situated proofs to increase questin stegand dispeech informatids. Continue rough the use of se development forensics for improved proposed for improved proofs.	tional awarene case the product ography, stegar nation protection the development f steganograph t of techniquest agery, video, a Continue the de	ess.  Action capability halysis, waterm on and authent int of tools to d y, steganalysis in steganograp ind speech info velopment of t	of the intelligentarking, and digication, intelligenteect, track, and, and digital waphy, steganalysomation protecthe multi- intelligenteect.	ence analyst. gital data gence d analyze atermarking. sis, tion and						
(U)	toolsets for the processing, explorated Cost	oitation and dis	semination of	actionable inte	lligence.		28.3	345	27.765	27.570	30.404	
(U) (U)	Related Activities: PE 0603789F, C3I Advanced Development. This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.  D. Acquisition Strategy Not Applicable.	mmary ( <b>\$ in N</b> FY 2004 Actual	Millions) FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost	
Pro	oject 4594			R-1 Shoppi	ng List - Item No.	. 13-13 of 13-24				Exhibit R-2a (P	E 0602702F)	

	Exhibit R-2a, RDT&E Project Justification									February 2	2005
BUDGET ACTIVITY 02 Applied Research				060270				PROJECT NUMBE		ation Tech	
	Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate		Cost to Complete	Total
4917	Collaborative Information Tech	7.678	5.587	0.000	0.000	0.000	0.000	0.00	0.000	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0		0		

Note: In FY 2006, efforts in this Project move to Project 4594, Project 4519, and Project 5581 in this PE.

#### (U) A. Mission Description and Budget Item Justification

To implement the Global Strike Task Force and other task force concepts, the Air Force requires a distributed, collaborative C2 system, allowing the majority of the C2 center to remain in the continental United States, while only a small command element is deployed forward. This project accomplishes the initial exploration of high payoff emerging technologies for the next generation of distributed collaborative C2 systems. This program develops technologies for platform connectivity, distributed collaboration, and embedded information systems. Platform connectivity technologies focus on advanced modulation waveforms for bandwidth efficiency, assured aerospace platform connectivity for C2, and conceptual design approaches for seamless integration of aerospace weapon systems into the information grid. Distributed collaboration technologies advance collaboration science, virtual environments, and predictive simulation tools to facilitate the development and fielding of next generation operational collaborative decision support systems. Embedded information systems technologies explore high payoff technologies for the next generation of distributed information integration architectures, which will provide cross disciplinary products/capability to a decision maker when, where, and how it is needed. It also provides embedded information system technologies for affordable and adaptable design and development of complex C2 systems, facilitated by an open system architecture approach.

(U)	B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2004</u>	FY 2005	FY 2006	FY 2007
(II)	MAJOR THRUST: Develop critical information transmission technologies to permit the seamless	1 989	1 992	0.000	0.000

- U) MAJOR THRUST: Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems' C2, intelligence, surveillance, and reconnaissance data/information. Note: In FY 2006, this effort moves to Project 4519 in this PE.
- (U) In FY 2004: Developed assured communications technology, leveraging commercial infrastructure, for positive C2 of aerospace assets in commercial airspace. Developed secure, wide-band wireless miniaturized transceiver information transfer technology for assured communications between munitions and aircraft.
- (U) In FY 2005: Continue the development of assured communications technology, leveraging commercial infrastructure for positive C2 of aerospace assets in commercial airspace. Complete the design and development of secure, wide-band wireless miniaturized transceiver information transfer technology for assured communications between munitions and aircraft. Develop, test, and assess exploratory information transfer technologies.
- (U) In FY 2006: Not Applicable.
- (U) In FY 2007: Not Applicable.

(II)

(U) MAJOR THRUST: Develop processes, methods, and techniques to provide assured performance,

1.388

1.495

0.000

0.000

Exhibit R-2a (PE 0602702F)

Project 4917

R-1 Shopping List - Item No. 13-14 of 13-24

Exhibit R-2a, RDT	&E Project Justification		DATE	DATE February 2005		
BUDGET ACTIVITY  02 Applied Research	PE NUMBER AND TITLE 0602702F Command Contro Communications	ol and	PROJECT NUMBER AND TITLE 4917 Collaborative Information Tec			
integrity, and security of real-time embedded information system to Project 4594 in this PE.  (U) In FY 2004: Developed dynamically reconfigurable aerospace techniques. Defined and developed algorithms, methods, and presource management of system resources across multiple tactic (U) In FY 2005: Continue development of dynamically reconfigura computing techniques. Continue to develop algorithms, method adaptive resource management of system resources across multiple and processes for implementation of Java and Real-Time Java Vaccomputing techniques.  (U) In FY 2006: Not Applicable.  (U) In FY 2007: Not Applicable.  (U) MAJOR THRUST/CONGRESSIONAL ADD: Develop advance collaborative decision support, knowledge management, and rappressions to the continually changing threat environment. Note: funding of \$2.4 million in FY 2004. In FY 2006, this effort mose funding of \$2.4 million in FY 2004. In FY 2006, this effort mose force Concepts of Operations (CONOPS). Developed distributed for effects-based operations and predictive battlespace awarenessensor-to-shooter scenario stressing time-critical target requirent sanctuary of time.  (U) In FY 2005: Continue development of techniques to perform correquired by the seven Air Force CONOPS. Continue development environment technology for effects-based operations and predictive work to develop technology to support a sensor-to-shooter scenarequirement, which will deny the enemy sanctuary of time.  (U) In FY 2006: Not Applicable.  (U) In FY 2007: Not Applicable.	systems using adaptive computing processes to support real-time, adaptive cal platforms.  able aerospace systems using adaptive ds, and processes to support real-time, siple tactical platforms. Develop methods Wirtual Machines using adaptive  acced information technologies for pid adaptation/re-allocation of assets in a This effort includes Congressional Address to Project 5581 in this PE.  collaborative planning for the seven Air ted collaborative environment technology and the seven and the seven which will deny the enemy collaborative, capability-based planning then of distributed collaborative environment technology and the seven and	4.301	2.100	0.000	0.000	
(U) (U) Total Cost		7.678	5.587	0.000	0.000	
Project 4917	R-1 Shopping List - Item No. 13-15 of 13-24			Exhibit R-2a (Pl	E 0602702F)	

	Exhibi	t R-2a, RD	T&E Projec	ct Justifica	tion			DATE	February 2005		
BUDGET ACTIVITY 02 Applied Research								ROJECT NUMBE	DJECT NUMBER AND TITLE 7 Collaborative Information Tech		
(U) C. Other Program Funding S  (U) Related Activities: PE 0603789F, C3I Advanced Development. This project has been coordinated through the (U) Reliance process to harmonize efforts and eliminate duplication.  (U) D. Acquisition Strategy Not Applicable.	Summary (\$ in I FY 2004 Actual	Millions) FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete Total Cost		
Project 4917			R-1 Shoppii	ng List - Item No.	13-16 of 13-24				Exhibit R-2a (PE 0602702F)		

	Exhibit R-2a, RDT&E Project Justification									February 2005		
	T ACTIVITY plied Research				060270	BER AND TITLE 2F Commanum Service Annications	≣ nd Control a	nd 55	OJECT NUMBE 81 Comman chnology		ol (C2)	
	Cost (\$ in Millions)	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total	
5581	Command and Control (C2) Technology	26.473	34.452	42.148	46.140	41.381	43.329	45.393	43.681	Continuing	TBD	
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0			

Note: Increased funding in FY 2006 and out reflects increased emphasis on developing automatically reconfigurable information system technologies and the transfer of collaborative technologies development effort from Project 4917 in FY 2006.

#### (U) A. Mission Description and Budget Item Justification

The Air Force requires C2 technologies that will provide the next generation of weapon systems with improved processing and presentation of information for real-time, distributed battle management. 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 detect, classify, identify, and track objects and events will improve the understanding and prediction of enemy 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.

FY 2004

6.576

FY 2005

7.327

FY 2007

6.943

FY 2006

6.924

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

- (U) MAJOR THRUST: Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems.
- (U) In FY 2004: Developed tools that will automate the intelligent extraction, correlation, and classification of link patterns for discovering relevant linkages between entities. Investigated and developed ultra-large, all-source information repositories and associated privacy protection technologies. Completed development of enhanced reasoning techniques for complex inferencing and performance of C2 systems.
- (U) In FY 2005: Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems. Continue to develop tools that will automate the intelligent extraction, correlation, and classification of link patterns for discovering relevant linkages between entities. Continue development of ultra-large all-source information repositories and associated privacy protection technologies.
- (U) In FY 2006: Demonstrate tools that will automate the intelligent extraction, correlation, and

Project 5581 R-1 Shopping List - Item No. 13-17 of 13-24 Exhibit R-2a (PE 0602702F

	Exhibit R-2a, RDT&E Project	Justification		D	DATE February 2005		
	OGET ACTIVITY Applied Research	PE NUMBER AND TITLE 0602702F Command C Communications	•	NUMBER AND TITLE			
	classification of link patterns for discovering relevant linkages between entities technologies for the rapid development and application of next generation knot C2 systems. Initiate development of foundations, technology, and tools to ena automated reasoning of the scale and complexity required for computers to per real world requiring intelligence. Initiate development of cognitive architecturagents.	wledge bases for aerospace ble effective, practical form complex tasks in the es for self-aware, learning					
(U)	In FY 2007: Complete development of technologies for the rapid developmen generation knowledge bases for aerospace C2 systems. Continue to develop for and tools to enable effective, practical automated reasoning of the scale and co-computers to perform complex tasks in the real world requiring intelligence. I specialized cognitive architectures using self-aware, learning agents that can glacknowledge bases for automated intelligent extraction, correlation, and classific discovering relevant linkages between entities.	oundations, technology, mplexity required for nvestigate and develop enerate well-focused					
(U)	MAJOR THRUST: Investigate, analyze, and develop technologies for automa distributed intelligent information systems to varying crisis levels faced by the Force. Note: FY 2006 and out increase reflects increased emphasis on develop reconfigurable information system technologies.	Expeditionary Aerospace	7.385	8.154	12.975	13.577	
(U)	In FY 2004: Developed a dynamic and adaptable interface technology that allea mission-tailored view of the configuration and status of the currently executi (AOC) C2 process. Developed advanced interactive displays suitable for deple applications and command centers. Completed the development of techniques visualization of multiple, heterogeneous data sets. Developed technologies to accuracy, and interconnection of computer-based wargames used to prepare coresponse strategies.	ng Air Operations Center by ment with C2 and applications for improve the fidelity,					
(U)	In FY 2005: Continue to develop dynamic and adaptable interface technology to create a mission-tailored view of the configuration and status of the currentl process. Continue to develop advanced interactive displays suitable for deploy and command centers. Initiate development of advanced techniques and AOC information visualization for use in conjunction with multiple, heterogeneous develop technologies to improve the fidelity, accuracy, and interconnection of used to prepare contingency plans and response strategies.	y executing AOC C2 ment with C2 applications -based applications for data sets. Continue to computer-based wargames					
D.	to create a mission-tailored view of the configuration and status of the currentl				Exhibit R-2a (F	DE 0602702E\	

	U	NCLASSIFIED		
	Exhibit R-2a, RDT&E Projec	t Justification		DATE February 2005
BUDGET ACTIVITY  02 Applied Rese	earch	PE NUMBER AND TITLE  0602702F Command Control and Communications		T NUMBER AND TITLE ommand and Control (C2) blogy
environments techniques as multiple, hete and intercom strategies. Ir study, analyz (U) In FY 2007: to create a m process. Cor environments techniques as multiple, hete and intercom strategies. C	attinue to develop advanced interactive displays suitable for deployations and command centers. Continue developed AOC-based applications for information visualization for use erogeneous data sets. Continue to develop technologies to improduction of computer-based wargames used to prepare contingenciatiate development of technologies for a holistic tool set that cone, visualize, reason, and predict activities in the battlespace. Continue to develop dynamic and adaptable interface technologies is insion-tailored view of the configuration and status of the current tinue to develop advanced interactive displays suitable for rapid with C2 applications and command centers. Continue developed AOC-based applications for information visualization for use erogeneous data sets. Continue to develop technologies to improduction of computer-based wargames used to prepare contingence on tinue development of technologies for a holistic tool set that canalyze, visualize, reason, and predict activities in the battlespace	ment of advanced in conjunction with ove the fidelity, accuracy, ry plans and response mmanders can use to probe,  ry that allows commanders tly executing AOC C2 I deployment in harsh ment of advanced in conjunction with ove the fidelity, accuracy, ry plans and response commanders can use to		
subscribe, an Sharing of in the informati	RUST: Investigate and develop technologies to securely share in d query with coalition partners as part of the overall Global Information is in part a function of secure sharing, but is also a fur on in assessing the trustworthiness of the information and its ma om the next Major Thrust below due to the increased emphasis of	rmation Grid approach. nction of the managing of urkup. Note: This effort was	5.22	9 6.548 9.248
(U) In FY 2005: information a and tools tha net-centric er coalition force (U) In FY 2006:	Not Applicable.  Initiate investigation and development of technologies to dynamical produce customized coalition information products. Start detail will ensure availability, integrity, and survivability of information avironment. Initiate development of technology approaches that we structure units into an operational Community of Interest (CO). Complete investigation of technologies to dynamically filter and omized coalition information products. Continue development of	evelopment of techniques ion within a coalition will rapidly incorporate I) Infosphere. d fuse information and		
rapidly assim information s	ilate appropriate coalition partners into appropriate COI Infosph haring research and development to include collaborative monit d enterprise resources such as firewalls/guards/routers, application	neres. Extend cross-domain coring and management of		Exhibit R-2a (PE 0602702F)

Exhibit R-2a, RDT&E Pr	roject Justification	DAT		=	
BUDGET ACTIVITY  02 Applied Research	PE NUMBER AND TITLE  0602702F Command Control and  Communications	5581 Comr	PROJECT NUMBER AND TITLE 5581 Command and Control (Control of the control of the		
detection systems, etc. Investigate the ability to perform and enforce ro			,		
COI Infospheres. Focus research on multi-domain event correlation froguarding services enabled, multi-level security repository) in order to e resource status with the ability to centrally react to that status. Continuations that will ensure availability, integrity, and survivability of information environment. Initiate development of publish/subscribe technologies for intelligent network management of user information.  (U) In FY 2007: Complete development of techniques and tools that will e survivability of information within a coalition net-centric environment. technology approaches to rapidly assimilate appropriate coalition partn Infospheres. Complete investigation on performing and enforcing role. Infospheres. Continue cross-domain information sharing research and collaborative monitoring and management of multi-national enterprise of techniques and tools that will ensure availability, integrity, and survice coalition net-centric environment. Investigate technologies, which can information in a coalition environment and assess the trustworthiness of shared throughout the coalition. Investigate and prototype the application management technologies such as fuselets to extend composition of a CBDN system for intelligent network management of a application to a CBDN system for intelligent network management of a survivability.	establish a composite picture of the development of techniques and thation within a coalition net-centric for application to a CBDN system  ensure availability, integrity, and the Complete development of the interest into appropriate COI the based access control to these COI development to include resources. Continue development tivability of information within a the determine the pedigree of the marked up information to be tion of information fusion and to osite views of events across a publish/subscribe technologies for				
<ul> <li>(U)</li> <li>(U) MAJOR THRUST: Develop distributed collaboration technologies, ad virtual environments, and predictive simulation tools to facilitate the degeneration operational collaborative decision support systems. Note: 7 Project 4917 prior to FY 2006.</li> </ul>	evelopment and fielding of next	0.000	2.002	1.937	
(U) In FY 2004: Not Applicable.					
<ul><li>(U) In FY 2005: Not Applicable.</li><li>(U) In FY 2006: Continue development of advanced information technology</li></ul>	gies for collaborative				
<ul> <li>(U) In FY 2006: Continue development of advanced information technology decision-making and knowledge management in support of capability-loof operations, and next generation planning, execution, and assessment development of distributed collaborative environment technology for o similar applications.</li> <li>(U) In FY 2007: Continue development of advanced information technology decision-making and knowledge management in support of capability-loof.</li> </ul>	based planning, Air Force concepts t environments. Continue operations other then war and gies for collaborative				
	Shopping List - Item No. 13-20 of 13-24		Exhibit R-2a (PE	= 0602702F\	

	Exhibit R-2a, RDT&E Project Jus	DATE	DATE February 2005			
	GET ACTIVITY Applied Research	PE NUMBER AND TITLE  0602702F Command Control and  Communications		PROJECT NUMI 5581 Comma Technology		
(U)	generation planning, execution, and assessment environments. Prototype distribute environment technologies for advanced decision support for high-profile system co Global Strike Concept of Operations and operations other then war.					
(U)	MAJOR THRUST/CONGRESSIONAL ADD: Develop next generation monitorin and assessment technologies and tools enabling distributed aerospace commanders collaboratively develop effects based campaigns. Note: This effort includes Congrof \$1.0 million in FY 2004.	to efficiently and	9.841	9.873	9.667	9.044
(U)	In FY 2004: Developed the next generation of monitoring, planning, execution, and technologies and tools enabling aerospace commanders to efficiently and collaborate effects-based campaigns. Developed technologies to dynamically and rapidly assess provide near-real-time command of manned and unmanned forces to execute the re Investigated developments in decision support science for incorporation into C2 too to visualize the probability of success of qualitatively different courses of action. Information systems capable of supporting joint/coalition C2 for various missions. assessed active template and semantic ontology technologies for use in mobile C2 and Developed tools to increase situational awareness through intelligent information prodynamic environments.	tively develop as the battlespace, and quired missions. als. Developed tools developed intelligent Developed and applications.				
(U)	In FY 2005: Continue to develop technologies to dynamically and rapidly assess the provide near-real-time C2 of available resources to execute the required missions in developments in decision support science. Complete development of tools to visual success of qualitatively different courses of action. Continue to develop intelligent capable of supporting joint/coalition C2 for various missions. Continue to develop template and semantic ontology technologies for use in C2 applications. Continue increase situational awareness through intelligent information push and pull in dyna Initiate investigation of intelligent information processing techniques to enhance the process, such as family of web service concepts; secure, shareable object spaces; le component-based architectures; information presentation components; and incorpor Centric Warfare Service concepts. Investigate application of decision support scient	lize the probability of information systems and assess active to develop tools to amic environments. e C2 decision-making gacy bridges; ration of Network				
(U)	within a Coalition AOC.  In FY 2006: Continue to develop technologies to dynamically and rapidly assess the special emphasis on effects based assessment. Continue to investigate application of sciences to C2 activities within a Coalition AOC. Extend Course of Action analysis collaboration between geographically remote locations. Continue to develop intelligible.	of decision support s capability to allow				

	UNCLASSIFIED				
Exhibit R-2a, RDT&E P	roject Justification		DATE	February 2	2005
BUDGET ACTIVITY  02 Applied Research	PE NUMBER AND TITLE  0602702F Command (  Communications	0602702F Command Control and			ol (C2)
systems capable of supporting joint/coalition C2 for various missions. semantic ontology technologies for use in C2 applications, such as eff tasking. Continue to develop tools to increase situational awareness the and pull in dynamic environments. Continue investigation of intelliges techniques to enhance the C2 decision-making process, such as family shareable object spaces; legacy bridges; component-based architecture components; and incorporation of Network Centric Warfare Service of techniques and demonstrate feasibility and usefulness. Explore the application of systems engineering principles to enable joint C2 capability. In FY 2007: Complete development of next generation of monitoring assessment technologies and tools enabling aerospace commanders to develop effects-based campaigns. Complete development of technologies are technologies and provide near-real-time command of manner the required missions. Complete the incorporation of decision support Course of Action analysis capability to allow collaboration between gone Continue to investigate application of decision support sciences and at to C2 activities within a Coalition AOC. Continue to develop intelliges supporting joint/coalition C2 for various missions in a dynamically chapplication of system of systems and federation of systems engineering capabilities. Explore the application of intelligent software agents as an enhance various C2 processes. Develop and demonstrate an effects-base enhance various C2 processes.	ects-based planning and dynamic brough intelligent information push ent information processing of web service concepts; secure, es; information presentation concepts. Prototype these eplication of system of systems and lities.  In planning, execution, and efficiently and collaboratively egies to dynamically and rapidly d and unmanned forces to execute the science into C2 tools. Complete ecographically remote locations. In devanced decision-making concepts ent information systems capable of langing environment. Continue to commation processing. Continue the g in the creation of joint C2 evirtual battle staff members to				
enabled by dynamically accessible data and information services.  (U) MAJOR THRUST/CONGRESSIONAL ADD: Investigate and develor flexible, high performance, secure, scalable, and survivable information services to enable a Global Information Grid-based COI Infosphere. No Congressional Add funding of \$1.0 million in FY 2005.	op technologies to implement on management and dissemination	2.671	3.869	4.032	5.391
(U) In FY 2004: Developed techniques and tools for integrating legacy clublish, subscribe, and query infosphere.	ient-server C2 systems into a				
(U) In FY 2005: Complete development of techniques and tools for integral systems into a publish, subscribe, and query COI infosphere. Continut publish, subscribe, and query technologies enabling a secure infosphere and intelligence, surveillance, and reconnaissance clients at various less can operate within a coalition warfighting environment. Investigate no	e to investigate and develop re that can support thousands of C2 vels of security classification, and				
Project 5581 R-1 S	Shopping List - Item No. 13-22 of 13-24			Exhibit R-2a (Pl	E 0602702F)

# Exhibit R-2a, RDT&E Project Justification PE NUMBER AND TITLE Occupancy PROJECT NUMBER AND TITLE Occupancy PROJECT NUMBER AND TITLE Occupancy Occup

and query technologies for the information management services, which provide higher levels of performance, security, and scalability to meet Air Force net-centric requirements. Investigate techniques to optimize these publish, subscribe, and query mechanisms to be used within bandwidth limited environments. Investigate automated methods of tailoring the user perspective of the COI Infosphere to reduce information overload and increase information awareness and utilization. Investigate the interoperability of various COI Infospheres (e.g., Combat Support, Intel, Business) with respect to the management and sharing of information across them. Investigate the ability to monitor, obtain feedback, and assert control over the COI Infosphere.

- In FY 2006: Continue to investigate and develop publish, subscribe, and query technologies enabling a secure infosphere that can support thousands of C2 and intelligence, surveillance, and reconnaissance clients at various levels of security classification, and can operate within a coalition warfighting environment. Complete investigation of new advanced publish, subscribe, and query technologies for the Information Management services, which provide higher levels of performance, security, and scalability to meet Air Force net-centric requirements. Complete investigation of techniques to optimize these publish, subscribe, and query mechanisms to be used within bandwidth-limited environments. Continue to investigate automated methods of tailoring the user perspective of the COI Infosphere to reduce information overload and increase information awareness and utilization. Complete investigation of the interoperability of various COI Infospheres (e.g., Combat Support, Intel, Business) with respect to the management and sharing of information across them. Develop high payoff publish, subscribe and query laboratory prototypes which provide higher levels of performance, security, and scalability capable of exceeding commercial products and support Air Force Net-centric environment needs. Continue to investigate automated methods of tailoring the user perspective of the COI Infosphere to reduce information overload and increase information awareness and utilization. Focus on automated composition of tailoring entities, and runtime environments. Continue to investigate methods and techniques for dynamically evolving the net-centric environment so as to avoid system crashes or latency as new information sources arrive or depart the environment. Focus is on representation of real-time performance guarantees and negotiation for various levels of service as would be required in tactical aircraft. Investigate and assess the use of semantic markup and semantic web languages as part of the COI Infosphere. Initiate the investigation of technology and approaches to prioritizing information in a COI Infosphere so as to effectively utilize communication and computing resources. Continue to develop technology and techniques to monitor, obtain feedback, and assert control over the COI Infosphere.
- (U) In FY 2007: Complete investigation in the use of semantic markup and semantic web languages as part of the COI Infosphere. Complete investigation of technology and approaches to prioritizing information

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Exhibit R-2a (PE 0602702F)

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Exhibit R-2a, RDT&E Project Justification  Exhibit R-2a, RDT&E Project Justification  February 2005										2005	
BUDGET ACTIVITY  02 Applied Research						UMBER AND TIT 2702F Commanmunications	and Control	PROJECT NUMBER AND TITLE 5581 Command and Control (C2) Technology			
	in a COI Infosphere so as to effectively utilize communication and computing resources. Continue to develop high-payoff publish, subscribe, and query laboratory prototypes, which provide higher levels of performance, security, and scalability capable of exceeding commercial products and support Air Force net-centric environment needs. Continue to investigate automated methods of tailoring the user perspective of the COI Infosphere to reduce information overload and increase information awareness and utilization. Continue to develop technology and techniques to monitor, obtain feedback, and assert control over the COI Infosphere. Investigate the security policy enforcement between COI Infospheres at										
	various levels of security classification. Continue to investigate methods and techniques for dynamically evolving the net-centric environment so as to avoid system crashes or latency as new information sources arrive or depart the environment.										
(U)	-						26.	473	34.452	42.148	46.140
(U) (U)	Related Activities: PE 0603617F, C3 Applications. PE 0303401F, Communications-Computer Systems (C-CS) Security RDT&E. PE 0603789F, C3I Advanced Development. This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.	mmary (\$ in N FY 2004 Actual	fillions) FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate		Cost to Complete	Total Cost
Pr	oject 5581			R-1 Shoppi	ng List - Item No.	. 13-24 of 13-24				Exhibit R-2a (P	E 0602702F)