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Exhibit R-2, RDT&E Budget Item Justification: PB 2015 Air Force **Date:** March 2014

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>					R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>							
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
Total Program Element	-	19.303	20.902	21.788	-	21.788	19.817	22.985	24.106	24.831	Continuing	Continuing
635323: <i>Directed Energy Bioeffects Parameters</i>	-	0.882	3.684	3.092	-	3.092	2.886	5.594	6.034	6.321	Continuing	Continuing
635324: <i>Human Dynamics and Terrain Demonstration</i>	-	8.335	8.622	8.839	-	8.839	7.197	6.812	6.993	7.128	Continuing	Continuing
635325: <i>Mission Effective Performance</i>	-	3.759	2.322	4.461	-	4.461	4.564	5.859	6.681	6.904	Continuing	Continuing
635327: <i>Warfighter Interfaces</i>	-	6.327	6.274	5.396	-	5.396	5.170	4.720	4.398	4.478	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

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 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 Human Dynamics and Terrain Demonstration project develops, demonstrates, and transitions human-centric technologies to address processing, exploitation, and dissemination of intelligence, surveillance, and reconnaissance (ISR) capability needs. 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. Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication. 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 2015 Air Force				Date: March 2014	
Appropriation/Budget Activity		R-1 Program Element (Number/Name)			
3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)		PE 0603456F I Human Effectiveness Advanced Technology Development			
B. Program Change Summary (\$ in Millions)	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO	FY 2015 Total
Previous President's Budget	21.523	20.967	21.520	-	21.520
Current President's Budget	19.303	20.902	21.788	-	21.788
Total Adjustments	-2.220	-0.065	0.268	-	0.268
• Congressional General Reductions	-0.029	-0.065			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.419	-			
• Other Adjustments	-1.772	-	0.268	-	0.268
Change Summary Explanation					
Decrease in FY13 Other Adjustments was due to Sequestration.					

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force										Date: March 2014		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development				Project (Number/Name) 635323 / Directed Energy Bioeffects Parameters			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
635323: Directed Energy Bioeffects Parameters	-	0.882	3.684	3.092	-	3.092	2.886	5.594	6.034	6.321	Continuing	Continuing
# The FY 2015 OCO Request will be submitted at a later date.												
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 thrust develops and demonstrates technologies that counter optical threats, while exploiting optical systems for non-lethal applications. The radio frequency (RF) radiation bioeffects thrust develops and demonstrates technologies to assess RF bioeffects and collateral hazards from high power RF directed energy systems.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2013	FY 2014	FY 2015	
Title: Optical Radiation Bioeffects									0.700	2.219	1.500	
Description: Develop and demonstrate optical protective technologies for aircrew and ground personnel to provide protection against directed energy threats. Develop modeling capabilities to assess collateral hazards from high power directed energy laser systems.												
FY 2013 Accomplishments: Integrated and tested physics-based modeling techniques for advanced Laser Eye Protection (LEP) technologies in next-generation cockpit scenarios for human systems integration and protection. Integrated laser bioeffects models and collateral effects algorithms into high-fidelity engagement simulations of high-energy laser weapon bioeffects. Matured products which enable safe testing of weapon effects and demonstrator concepts on test and evaluation ranges. Completed benchmarks of collateral hazard prediction algorithms for performance and validation and verification of engagement simulations.												
FY 2014 Plans: Merge a frame and format design capability with a visual performance metrics and modeling capability to create a single, integrated package allowing complete human systems integration of LEP. Use three-dimensional (3-D) optical modeling tools to quantify and visually render the effects of LEP filters on human vision. Participate in demonstration of mission planning analysis tool for optimization of directed energy/kinetic energy weapons use. Validate bioeffects models. Begin integration of probabilistic tools into high energy laser collateral damage models.												
FY 2015 Plans:												

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014	
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635323 / <i>Directed Energy Bioeffects Parameters</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014
Begin integration of physiological/behavioral response models into engagement-level simulation capabilities for directed energy weapon threats and concepts. Demonstrate modeling and simulation tools which transition engagement-level simulations to mission and campaign models to evaluate the utility and impact of directed energy systems. Apply these models in the battlespace simulation at tactical levels with contribution of bioeffect human vulnerability models in a DoD standardized format. Continue flight evaluation comparisons of predictive human system integration models to performance and acceptance of military users of these technologies in next-generation aircraft, identifying data gaps and optimizing future acquisitions.			
Title: Radio Frequency Bioeffects Description: Develop and demonstrate technologies to assess radio frequency (RF) bioeffects and collateral hazards from high power RF directed energy systems. FY 2013 Accomplishments: Demonstrated validated microwave modeling and simulation tools to non-lethal RF weapon wargames for realistic human effects. FY 2014 Plans: Identify candidate directed energy weapons system and begin to incorporate real-time collateral effects and hazard calculations into weapon systems. Participate in demonstration of mission planning analysis tool for optimization of directed energy/kinetic energy weapons use. Validate bioeffects models. Begin integration of RF bioeffects real-time model and control algorithms into RF weapons to optimize non-lethal human effects while minimizing collateral damage from RF weapons. FY 2015 Plans: Validate predictive capability of models against high average power scenarios and begin integration of high peak power models and high average power models into one software suite. Continue integration of RF bioeffects real-time model and control algorithms into RF weapons to optimize non-lethal human effects while minimizing collateral damage from RF weapons.		0.182	1.465
Accomplishments/Planned Programs Subtotals		0.882	3.684
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			

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Exhibit R-2A, RDT&E Project Justification: PB 2015 Air Force		Date: March 2014
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development	Project (Number/Name) 635323 / Directed Energy Bioeffects Parameters
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 2015 Air Force										Date: March 2014		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development				Project (Number/Name) 635324 / Human Dynamics and Terrain Demonstration			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
635324: Human Dynamics and Terrain Demonstration	-	8.335	8.622	8.839	-	8.839	7.197	6.812	6.993	7.128	Continuing	Continuing
# The FY 2015 OCO Request will be submitted at a later date.												
A. Mission Description and Budget Item Justification												
This project develops, demonstrates, and transitions technologies to identify human threats within the air, space, and cyber domains. These technologies will enhance Air Force capabilities in intelligence, surveillance and reconnaissance (ISR), layered sensing, autonomous and adaptive decision-making systems, decision aids for computer network attack/defense/support, ISR force development and training, anticipatory command, control, and intelligence (C2I), measures of enhanced psychological operations, cross-cultural communication, and human-centric exploitation of measurement and signatures intelligence.												
B. Accomplishments/Planned Programs (\$ in Millions)										FY 2013	FY 2014	FY 2015
Title: Human Analyst Augmentation										2.581	3.034	3.419
Description: Develop and demonstrate human-centered design processes and operational tools that optimize ISR information exploitation and analysis.												
FY 2013 Accomplishments: Developed an analyst testbed concept for evaluating effectiveness of analyst tool integration in the processing, exploitation, and dissemination process. Developed work aids for intelligence analysts and tools for collaborative synthesis and social cognitive analysis.												
FY 2014 Plans: Demonstrate work aids for intelligence analysts and tools for collaborative synthesis and social cognitive analysis. Demonstrate human-centric analytic work environment for intelligence analysis and behavioral influence analysis. Assess effectiveness of analyst aids in the processing, exploitation, and dissemination process.												
FY 2015 Plans: Develop analytical work environments and toolsets to create advanced situational performance for ISR work roles that span the processing, exploitation, and dissemination process from time-dominated tactical work situations to content-dominated operational and strategic reach back operations.												
Title: Human Trust and Interaction										2.073	2.394	2.150
Description: Develop/demonstrate technology to optimize human operator performance, adversarial modeling techniques, and automated speech translation tools to aid Air Force information/influence operations.												

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development	Project (Number/Name) 635324 / Human Dynamics and Terrain Demonstration		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014	FY 2015
FY 2013 Accomplishments: Developed tools, algorithms, and techniques that can be used for domain specific automatic speech recognition, machine translation, and natural language processing components in new languages and domains, especially those characterized by minimal data availability.				
FY 2014 Plans: Mature human language technologies to develop tools that improve the effectiveness of intelligence, surveillance, and reconnaissance (ISR) operators and intelligence analysts. Develop, assess, and test capabilities against specific customer data sets, especially those characterized by scientific and technical terminology. Evaluate and integrate algorithms into frameworks supporting ISR collection and exploitation.				
FY 2015 Plans: Develop advanced multimedia machine translation and automatic speech recognition tools. Develop 'soft' and 'hard' fusion methodology experiments.				
Title: Human Signatures Description: Develop automated and assisted methods to exploit human threat biosignatures to defeat terrorist activities and hidden person-borne threats. Provide improved models of virtual humans to deliver mission-ready training for intelligence, surveillance, and reconnaissance (ISR) analysts and create more immersive, realistic experiences in joint and coalition exercises.		3.681	3.194	3.270
FY 2013 Accomplishments: Developed human threat recognition capabilities by creating libraries of human signatures to include simple and complex motions and biofidelic avatars with variable dimensions in gender, age, size, and shape. Demonstrated initial libraries in joint virtual training software for human threat recognition and feasibility for integration into future on-board sensor systems.				
FY 2014 Plans: Initiate multimodal exploitation of signatures through fusion of radar, electro-optical, and infrared sensing. Collect outdoor signatures for hyperspectral and polarized light with realistic background. Begin development on multimodal avatar with radar output and morphology governing size, shape, and motion definition. Begin development of an on-the-job training platform for ISR analysts.				
FY 2015 Plans: Demonstrate utility of integrated normative anthropometric-based human signatures data sets. Demonstrate wearable wireless monitors for human performance real-time assessment for multiple operational settings.				
Accomplishments/Planned Programs Subtotals		8.335	8.622	8.839

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development	Project (Number/Name) 635324 / Human Dynamics and Terrain Demonstration
C. Other Program Funding Summary (\$ in Millions) N/A		
Remarks		
D. Acquisition Strategy N/A		
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 2015 Air Force										Date: March 2014		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development				Project (Number/Name) 635325 / Mission Effective Performance			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
635325: Mission Effective Performance	-	3.759	2.322	4.461	-	4.461	4.564	5.859	6.681	6.904	Continuing	Continuing
# The FY 2015 OCO Request will be submitted at a later date.												
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. Focus areas include integrated high-fidelity weapon systems training technologies for air, space, and cyber; tailored immersive simulation environments for airmen at the tactical and operational levels; and incorporating performance assessment and feedback tools. These methods and technologies facilitate the development of mission-essential competencies.												
B. Accomplishments/Planned Programs (\$ in Millions)									FY 2013	FY 2014	FY 2015	
Title: Continuous Learning									3.759	2.322	4.461	
Description: Develop and demonstrate secure, persistent, and standardized live, virtual and constructive (LVC) training enterprise. Utilize modeling capabilities for technology demonstration efforts focused on developing software-based tools for training that would replace human instructors. This enables more efficient mission execution training in an LVC environment.												
FY 2013 Accomplishments: Demonstrated learning-managed LVC for fifth generation air combat mission training. Completed evaluation of deployable training solutions across mission sets. Completed evaluation of prototype joint criteria, models, and tools for environmental certification applicable across LVC contexts. Demonstrated and validated standardized process and integrated toolsets for correlated simulation database development across different virtual environments.												
FY 2014 Plans: Complete development, demonstration, and initial transition of learning management system for distributed mission operations (DMO) and LVC operations. Initiate development of standards for shareable scenario content, data, and metrics.												
FY 2015 Plans: Complete performance-based LVC environment fidelity assessment system. Complete development of automated tools to analyze training utility for alternative ways to accomplish mixes of live and virtual training in and across mission sets. Begin development of common scenario, learner performance, and after action review content tagging for training. Develop learning management technologies for undergraduate pilot training. Develop adaptive training and performance measurement system for												

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635325 / <i>Mission Effective Performance</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014
intelligence, surveillance and reconnaissance (ISR) analysts. Develop low-cost, multiple-platform RPA training system. Initiate adaptive training for Red Flag preparation. Develop deployable LVC capability for emergency responders.			
Accomplishments/Planned Programs Subtotals		3.759	2.322
C. Other Program Funding Summary (\$ in Millions) N/A			
Remarks			
D. Acquisition Strategy N/A			
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 2015 Air Force										Date: March 2014		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development				Project (Number/Name) 635327 / Warfighter Interfaces			
COST (\$ in Millions)	Prior Years	FY 2013	FY 2014	FY 2015 Base	FY 2015 OCO #	FY 2015 Total	FY 2016	FY 2017	FY 2018	FY 2019	Cost To Complete	Total Cost
635327: Warfighter Interfaces	-	6.327	6.274	5.396	-	5.396	5.170	4.720	4.398	4.478	Continuing	Continuing

The FY 2015 OCO Request will be submitted at a later date.

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, multisensory fusion, high-resolution image displays, and 3-D 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 Programs (\$ in Millions)

	FY 2013	FY 2014	FY 2015
Title: Applied Neuroscience Description: Develop sense, assess, and augment technologies to facilitate efficient workflow in distributed operational environments. Develop empirically validated cyber operator-centered tools for distributed cyber operations integrated into a single user interface. FY 2013 Accomplishments: Developed neurophysiologic-sensored technology for determining operator workload. Integrated neurophysiologic sensors with automated system adaptation methods, software, and tools. Identified visualization, tool composition, and user interface requirements to support cyber operations. Analyzed human operator team composition and requisite skill sets based upon cyber tool set composition and information flow. Based upon human-computer interface requirements analyses, provided training recommendations for the transition of cyber offensive tools and technologies to the operational community. FY 2014 Plans: Complete analysis of human operator team composition and requisite skill sets based upon cyber tool set composition, operational information flow, and concept of operations. Begin initial design of an integrated offensive and defensive cyber operator tool set. FY 2015 Plans: Finalize design recommendations for an integrated offensive and defensive cyber operator tool set. Integrate neurophysiological sensors and validated biofluid sensors capable of real-time assessment of human cognition, human-machine teaming status, and calibrated trust. Conduct cognitive task analyses and cognitive work analyses in operational cyber and other operational domains	1.727	0.800	0.729

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014
to develop technical requirements and make operational recommendations based on findings. Integrate sensors, methodologies, and approaches to assess operator functional state relating to stress, cognition, trust, and human-machine teaming.			
Title: Battlespace Acoustics Description: Demonstrate ability to forecast acoustic profiles for any atmospheric/terrain condition. Demonstrate technologies to enhance the battlefield airman's situational awareness through wearable interfaces. FY 2013 Accomplishments: Developed 3-D acoustic models of manned and unmanned aircraft for incorporation into high-fidelity acoustic mission planning tools. Collected high-fidelity 3-D acoustic measurements of manned and unmanned aircraft. Determined aural detectability across a wide range of weather conditions, geography, and background sounds. Employed usability engineering methodologies to establish user requirements and use-case scenarios for the pararescue jumper community. Prototyped designs of wearable interface concepts. FY 2014 Plans: Refine high fidelity 3-D acoustic models for integration into mission planning tools. Validate acoustic models against real-world data obtained from airborne platform measurements. Incorporate weather effects, landscape sounds, and geography into acoustic models. Develop prototype user interfaces based on pararescue jumper requirements and use-case scenarios. Refine wearable interface designs based on operator feedback. FY 2015 Plans: Integrate real-time 3-D acoustic models into mission planning tools. Validate high-fidelity 3-D acoustic models against real-world data obtained from airborne platform measurements in different weather and terrain environments. Validate weather effects, landscape sounds, and geography used in developed acoustic models. Apply human factors and usability engineering methodologies to prototype and test wearable interfaces for seamless integration of data for battlefield airmen.		2.650	3.464
Title: Human Role in Semiautonomous Systems Description: Develop and demonstrate an integrated human-centered interface to control multiple remotely piloted aircraft (RPAs) that have various levels of autonomy and that optimize net-centric information flow. FY 2013 Accomplishments: Validated warfighter requirements for the next-generation operator control station that will accommodate advanced and legacy RPAs. Integrated and tested technologies for operator interface controls, displays, and decision-aids to manage multimission		1.950	2.010
			1.766

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2013	FY 2014
<p>RPA's and payloads. Conducted prototype evaluations of operator interface controls. Performed initial testing of technologies designed to assess the value of RPA operator immersion and telepresence for improving human and mission performance.</p> <p>FY 2014 Plans: Integrate, test, and evaluate operator interface designs to support decision-making and situation awareness while controlling multiple advanced and legacy RPA's in a dynamic mission environment. Develop multi-transit control station interface technology to enable a single pilot to simultaneously control multiple RPA's transiting through airspace. Begin developing and evaluating interface controls for a networked RPA collaborative environment allowing teams of pilots along with sensor and payload operators to work together during stringent mission phases.</p> <p>FY 2015 Plans: Demonstrate and evaluate operator interface designs to support decision-making and situation awareness while controlling multiple advanced and legacy RPA's in a dynamic mission environment. Perform initial evaluations of multitransit control station interface technology to enable a single pilot to simultaneously control multiple RPA's transiting through airspace by using high-fidelity simulations. Using high-fidelity simulations and flight tests, evaluate interfaces for a networked RPA collaborative environment to allow teams of pilot, sensor, and payload operators to work together during various RPA mission phases.</p>			
Accomplishments/Planned Programs Subtotals		6.327	6.274
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			
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.			