Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*				R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	26.915	24.814	25.319	-	25.319	26.218	27.756	29.566	30.050	Continuing	Continuing
635323: *Directed Energy Bioeffects Parameters*	1.650	2.270	2.289	-	2.289	2.240	2.332	2.456	2.496	Continuing	Continuing
635324: *Human Dynamics and Terrain Demonstration*	6.213	6.426	6.126	-	6.126	6.115	8.152	9.034	9.182	Continuing	Continuing
635325: *Mission Effective Performance*	4.008	4.530	5.156	-	5.156	5.407	4.712	5.011	5.094	Continuing	Continuing
635326: *Performance Enhancement Demonstration*	6.959	4.377	4.153	-	4.153	4.143	4.310	4.592	4.667	Continuing	Continuing
635327: *Warfighter Interfaces*	8.085	7.211	7.595	-	7.595	8.313	8.250	8.473	8.611	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to enhance human performance and effectiveness in the aerospace force. State-of-the-science advances are made in warfighter training, warfighter system interfaces, directed energy bioeffects, deployment and sustainment of warfighters in extreme environments, and understanding and shaping adversarial behavior. The Mission Effective Performance project develops, demonstrates, and transitions advanced training, simulation, mission rehearsal, and other performance-aiding methods and technologies to enhance warfighter readiness. The Warfighter Interfaces project develops, demonstrates, and transitions technologies to revolutionize the way human operators synergistically use Air Force systems, including autonomous machines and adaptive teams of humans and machines. The Directed Energy Bioeffects Parameters project develops, demonstrates, and transitions technologies to predict, evaluate, and mitigate the effects of directed energy on personnel and mission performance, and exploits the offensive capabilities of directed energy systems. The Performance Enhancement Demonstration project develops, demonstrates, and transitions technologies to increase survivability and performance of personnel during military operations. The Human Dynamics and Terrain Demonstration project develops, demonstrates, and transitions technologies to anticipate and influence adversarial behavior within the air, space, and cyber domains. Efforts in this program have been coordinated through the Reliance 21 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	**R-1 ITEM NOMENCLATURE** PE 0603456F: *Human Effectiveness Adv Tech Dev*

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	27.390	24.814	27.874	-	27.874
Current President's Budget	26.915	24.814	25.319	-	25.319
Total Adjustments	-0.475	-	-2.555	-	-2.555
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.475	-			
• Other Adjustments	-	-	-2.555	-	-2.555

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Project: 635326: *Performance Enhancement Demonstration*		
Congressional Add: *Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials*	2.928	-
Congressional Add Subtotals for Project: 635326	2.928	-
Congressional Add Totals for all Projects	2.928	-

Change Summary Explanation

The decrease in funding in FY 2012 is due to an adjustment to properly align the science and technology portfolio to Air Force priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635323: *Directed Energy Bioeffects Parameters*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635323: *Directed Energy Bioeffects Parameters*	1.650	2.270	2.289	-	2.289	2.240	2.332	2.456	2.496	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to predict, evaluate, and mitigate the effects of directed energy on personnel and mission performance, and exploits the offensive capabilities of directed energy systems. This project also develops the human-components of the guidelines for testing, deployment, and protection from high power microwave and high-energy laser systems and uses this information to enhance the effectiveness of these weapon systems in air, space, and cyber operations. The optical radiation bioeffects research develops and demonstrates technologies that counter optical threats, while exploiting optical systems for non-lethal applications. Radio frequency radiation bioeffects research develops, demonstrates, and transitions technologies to the warfighters. Biobehavioral systems efforts focus on the design and characterization of scalable non-lethal directed energy and novel effects weapons, including quantification of physiological and psychological effectiveness and risks associated with these weapons.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	0.791	0.770	0.820	-	0.820
Description: Develop and demonstrate protective technologies for aircrew and ground personnel to provide protection against directed energy threats. ***FY 2010 Accomplishments:*** Completed validation and verification of human systems integration tool for directed energy protective equipment (optical radiation only). Continued assessment of radio frequency radiation personnel protection technologies. Began monitoring optical radiation skin protection technologies. ***FY 2011 Plans:*** Incorporate validated human systems integration tools and techniques into vulnerability models. Continue monitoring optical radiation skin protection material technologies and radio frequency radiation personnel protection technologies. Initiate research into advanced modeling and simulation of the bioeffects of high energy directed energy weapon systems. Continue research into advanced modeling and simulation software to predict target and collateral effects of high energy directed energy systems. ***FY 2012 Base Plans:*** Test end-to-end laser eye protection (LEP) design capability by merging 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. Validate microwave modeling and simulation tool. Develop software to					

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635323: *Directed Energy Bioeffects Parameters*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
incorporate radio frequency energy-induced human effects from collateral hazard predictions into war-gaming scenarios. Increase computational speed of collateral hazard predictions for near real-time modules for weapon system fire control and mission planning applications. ***FY 2012 OCO Plans:***					
Title: Major Thrust 2 ***Description:*** Develop and demonstrate technologies to assess bioeffects and collateral hazards from directed energy systems. ***FY 2010 Accomplishments:*** Combined angular-dependent and individual/crowd behavior models as function of directed energy parameters. Integrated target effects across directed energy spectrum into collateral damage tool development. Conducted field validation studies of model predictions. Developed conceptual design for mission planning tools. ***FY 2011 Plans:*** Perform field and laboratory experiments to verify and validate collateral hazard assessment software models on high energy laser systems and evaluate next generation of directed energy hazard assessment tools. Initiate software development to incorporate directed energy human effects from collateral hazard predictions into war-gaming scenarios. Increase computational speed of collateral hazard predictions for near real-time modules for weapon system fire control and mission planning applications. ***FY 2012 Base Plans:*** Continue testing and validation of high energy laser collateral effects real-time predictive models for directed energy weapon systems. Continue integration of directed energy hazard assessment tools in war-gaming scenarios. Test and validate near real-time modules for weapon system fire control and mission planning applications. ***FY 2012 OCO Plans:***	0.859	1.500	1.469	-	1.469
Accomplishments/Planned Programs Subtotals	1.650	2.270	2.289	-	2.289

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635323: *Directed Energy Bioeffects Parameters*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635324: *Human Dynamics and Terrain Demonstration*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635324: *Human Dynamics and Terrain Demonstration*	6.213	6.426	6.126	-	6.126	6.115	8.152	9.034	9.182	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to anticipate and influence adversarial behavior within the air, space, and cyber domains. These technologies will enhance Air Force capabilities in intelligence, surveillance, and reconnaissance (ISR), layered sensing, decision aids for computer network attack/ defense/support, cyber force development and training, anticipatory command, control, and intelligence (C2I), measures of effectiveness for psychological operations, cross-cultural communication, and human-centric exploitation of measurement and signatures intelligence.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1 ***Description:*** Develop, mature, and demonstrate technology to provide mission-essential capabilities for Air Force cyber operator performance enhancement and situational awareness. ***FY 2010 Accomplishments:*** Developed technologies to enhance cyber operator situational awareness capabilities. Developed advanced cyber mission/ campaign planning tools that optimize blue force readiness and operational effectiveness. Developed, integrated, and assessed advanced cyber mission/ campaign planning tools that facilitate the operator's ability to anticipate and influence an adversary's behavior. ***FY 2011 Plans:*** Develop technologies to increase cyber operator situational awareness capabilities. Evaluate suitability of technologies to transition cyber operator tools that integrate advanced influence operations technologies designed to anticipate and influence an adversary's behavior. Identify, integrate, demonstrate, and evaluate readiness for transition of technologies that increase human performance within cyber domain operations. ***FY 2012 Base Plans:*** Continue cyber situational awareness integration technologies and develop technologies to enhance human performance in the cyber performance area. ***FY 2012 OCO Plans:***	2.181	2.365	0.253	-	0.253
Title: Major Thrust 2	0.987	1.045	2.342	-	2.342

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635324: *Human Dynamics and Terrain Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Description: Develop/demonstrate human-centered design processes and operational tools that optimize ISR information flows in a distributed, multi-source mission planning environment. ***FY 2010 Accomplishments:*** Developed and demonstrated automated tools and techniques designed to decrease an intelligence analyst's data overload condition and improve productivity. Concentrated technology development in the areas of ISR processes, ISR mission planning, and tool integration utilizing net-centric automated services to increase ISR enterprise capabilities, effectiveness, and quality, while reducing complexity, cost, and intelligence production cycle times. Demonstrated and transitioned technologies for ISR dynamic planning, geospatial intelligence tools, and multi-intelligence information operations tools used in Air Force ISR weapon systems. Developed and assessed the effectiveness of anticipatory approaches to enhance C2I. ***FY 2011 Plans:*** Develop and demonstrate advanced ISR analyst productivity tools. Demonstrate, validate, and transition human-centric decision-aids, tools, and process improvements in integrated, computer-based ISR system tools and related techniques supporting ISR weapon systems with an emphasis on anticipatory approaches to enhance C2I. Develop, mature, assess, and transition tools designed to increase ISR productivity by focusing on the interactions between humans and their automated planning and assessment tools. ***FY 2012 Base Plans:*** Deliver software prototype of unified analytical tool kit and work environment to support increased analyst speed and more robust, inclusive decision-making with lower cognitive overhead. Deliver prototype human-inspired cueing system to speed image analysis. ***FY 2012 OCO Plans:***					
Title: Major Thrust 3 ***Description:*** Develop/demonstrate anticipatory C2I decision-aiding technologies to rapidly assess battlefield situation, predict likely adversary behaviors, and select/prioritize courses of action. ***FY 2010 Accomplishments:*** Integrated decision-aiding tools into identified technology demonstration programs. Evaluated the methodologies developed to quantifiably measure the effectiveness of the commander's predictive environment decision	1.096	0.495	1.951	-	1.951

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635324: *Human Dynamics and Terrain Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
aids and simulation tools. Refined tools with emphasis on intelligence analysis and the anticipation elements. Evaluated the expanded operational benefits and utility of the decision aid tools and simulation in field exercises. ***FY 2011 Plans:*** Evaluate the suitability, maturity, and readiness of demonstrated decision-aiding technologies for transition to component users. Incorporate final improvements into end-products. ***FY 2012 Base Plans:*** Develop and test new methods to support visualization and manipulation of large, abstract data sets through combining recent advanced in neuroscience and neuro-imaging techniques with neural-based feature extraction and data filtering. Build in-house prototype to rapidly and effectively detect and correlate relationships with patterns of life and anomalous threat detection and identification. ***FY 2012 OCO Plans:***					
Title: Major Thrust 4 ***Description:*** Develop/demonstrate technology to optimize human operator performance, adversarial modeling techniques, and automated speech translation tools to aid Air Force information/influence operations. ***FY 2010 Accomplishments:*** Identified, integrated, demonstrated, and transitioned technology that optimizes human operator performance within Air Force influence operations. Illustrated adversarial cultural modeling techniques used to gauge adversarial threats. Matured and transitioned research into influence operations human performance training effectiveness, mission rehearsal, simulations, and combat readiness. Matured quantitative measures of effectiveness for psychological operations and selected influence operations capabilities. Developed and demonstrated next-generation information operations and cyber influence capabilities yielding non-kinetic warfighting options. Demonstrated and transitioned advanced speech-to-speech translation tools which support automated, cross-cultural communications. ***FY 2011 Plans:*** Demonstrate and determine the suitability, maturity, and readiness of next-generation information operations and cyber influence capabilities which yield non-kinetic warfighting options. Demonstrate and assess the effectiveness of advanced adversarial cultural modeling techniques used to gauge adversarial threats and behavior signatures. Develop, demonstrate, and assess the suitability of technology to transition advanced speech-to-speech translation tools that support automated, cross-cultural communications. Validate and	1.949	2.521	1.580	-	1.580

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
improve models used to demonstrate measures of effectiveness for selected Air Force influence operations capabilities. ***FY 2012 Base Plans:*** Develop advanced techniques to rapidly develop and easily maintain speech-to-speech translation systems in multiple languages and application domains with limited data availability. ***FY 2012 OCO Plans:***					
Accomplishments/Planned Programs Subtotals	6.213	6.426	6.126	-	6.126

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635325: *Mission Effective Performance*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635325: *Mission Effective Performance*	4.008	4.530	5.156	-	5.156	5.407	4.712	5.011	5.094	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions advanced training, simulation, mission rehearsal, and other performance-aiding methods and technologies to enhance warfighter readiness. This project also develops advanced methods and technologies to enable interactive live, virtual, and constructive (LVC) environments for performance-aiding methods and technologies. Activities include development of computer-generated entities to support training, simulation, and mission rehearsal; integrated high-fidelity weapon-systems training technologies for air, space, and cyber; tailored immersive simulation environments for Airmen at the tactical and operational levels; robust performance assessment and feedback tools; and maturation of game-based technologies for effective and efficient training. These methods and technologies facilitate the development of mission-essential competencies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	2.002	1.753	1.964	-	1.964
Description: Advance aerospace/organizational behavior models for integrated warfighter training and rehearsal. Add realistic operations, command and control, force protection, and air base defense. ***FY 2010 Accomplishments:*** Evaluated and validated learning and mission performance impacts associated with common tools for mission planning, briefing, and after action review. Identified specific methods and tools of relevance within and across mission contexts and levels of decision making (e.g., tactical, operational, and strategic). Validated immersive training alternative environments for coalition training for close air support and air-to-ground coordination. Conducted schoolhouse and field training, rehearsal, and exercise evaluations and demonstrations in LVC contexts for close air support and command and control. Demonstrated integration of distributed air and space operations center (AOC) teams with tactical LVC operations for kill-chain training and operations. Fielded deployable distributed mission operations (DMO) training exemplars and conduct mission impact evaluations on their integration into routine operations training events. Completed development for deployable trainers and mission planning and after action review toolsets and update field deployed systems for further evaluation and training assessment. ***FY 2011 Plans:*** Complete field deployment and evaluation of embedded performance measurement and reporting system for combat mission readiness. Develop preliminary functionality for a learning management system for distributed					

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635325: *Mission Effective Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
mission operations and LVC training, rehearsal, and exercise. Develop and evaluate an integrated environment for learning and assessment that includes live, virtual, and constructive air operations center planners, ground command and control, close air support aircraft, terminal attack and control personnel, and air combat assets. Complete development and field assessment of tailored training inside the ready aircrew program allocation of sorties and mission types for at least three mission areas and operational systems. Develop specifications for interface and data control approaches for managing learning in LVC contexts. Begin development of a reconfigurable and deployable training environment for combat training and rehearsal. ***FY 2012 Base Plans:*** Conduct initial evaluations of the reconfigurable and deployable training environment for Air Force applications. Complete evaluation for deployable training for Combatant Commander capability assessment across LVC contexts. Complete specification development for an integrated learning assessment and management system for DMO and LVC operations. Complete and demonstrate team communication tracking and assessment methods in AOC and cyber operations training. Define data and interoperability standards for remotely piloted aircraft sensor and pilot training integration in LVC operations. Develop and demonstrate learning management tools. Demonstrate integration of performance metrics in the after action review tool kit. ***FY 2012 OCO Plans:***					
Title: Major Thrust 2 ***Description:*** Develop/demonstrate high-fidelity DMO training/rehearsal capability for AOC operators and electronic warfare (EW) training technologies for future threat systems/capabilities. ***FY 2010 Accomplishments:*** Developed the integrated strategy and plans division trainer based on competency-based training requirements and optimum mission rehearsal strategies. Developed individual interfaces between component simulations and AOC equipment systems. Began to code, integrate, and test the execution management capabilities for the simulation set. Began development of a DMO and C2ISR common database generation system and live EW range integration into DMO. Demonstrated an on-range live fly of LVC EW training with live emitters/ platforms. ***FY 2011 Plans:*** Develop code, integrate, and test the execution management capabilities for the simulation set. Develop, integrate, and test the performance assessment capability within the simulation set. Develop scenario authoring tools and integrate with simulation components. Test and integrate the entire strategy and plans division trainer	2.006	2.777	3.192	-	3.192

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
and begin integration with the AOC part task trainer. Develop vendor-specific real-time database examples from the database generation system's outputs. Begin development of methodologies for real-time incorporation of data into DMO, homeland security, and C2ISR databases. Demonstrate a multi-ship/onboard networked LVC EW training concept. Conduct an integrated, on-board EW training demonstration with live aircraft and with a major test/training range. ***FY 2012 Base Plans:*** Begin definition of multi-level security rule sets for integrated LVC operations across fourth and fifth generation operational systems and different classification enclaves. Develop and demonstrate efficient multi-level rule set definition and accreditation tools for secure training and rehearsal within a single classification enclave. Complete development and demonstration of common competency-based training and assessment for cyber and LVC operations. Complete transition and field integration of embedded performance assessment system in optional mission training centers. ***FY 2012 OCO Plans:***					
Accomplishments/Planned Programs Subtotals	4.008	4.530	5.156	-	5.156

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635326: *Performance Enhancement Demonstration*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635326: *Performance Enhancement Demonstration*	6.959	4.377	4.153	-	4.153	4.143	4.310	4.592	4.667	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to increase survivability and performance of personnel during military operations. Bioscience efforts develop advanced biotechnology, nanotechnology, and neuroscience solutions for the protection and enhanced effectiveness of battlefield airmen. Counterproliferation efforts develop biotechnology and bio-taggants to advance the ability to detect, identify, monitor, and neutralize biological threat agents. The counterproliferation effort also demonstrates and transitions modeling and simulation techniques for operational assessment of pre- and post-bio-agent attack. Biobehavioral and biomechanics focus areas develop aircrew support technologies that enhance warfighter protection and improve performance during long-duration missions. The biomechanics focus area also develops technology to rapidly integrate multi-sensor data with automated dynamic human modeling to anticipate and identify human adversarial threats.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	1.522	1.925	2.049	-	2.049
Description: Demonstrate tailored bio-taggant and identification/neutralization capabilities to enhance force protection/enable air operations commanders to maintain operations tempo. ***FY 2010 Accomplishments:*** Optimized the selected bio-taggant technologies and began the development of platforms to employ the bio-taggants. Optimized the insertion/distribution of bio-taggants in target areas. Evaluated taggant technologies in simulated operational environments. Initiated research to develop capabilities to track biological warfare agents inside buildings and vehicles. ***FY 2011 Plans:*** Validate selected bio-taggant technologies in the laboratory. Continue to investigate suitable platforms to integrate bio-taggant technologies. ***FY 2012 Base Plans:*** Validate selected bio-taggant technologies in a simulated operational environment. Identify an integration platform. Demonstrate taggant technology that performs stand off detection of biological agents in an operational environment to include: line-of-sight and free-from-sight stand-off detection of biological warfare agents and personnel who have been exposed to Weapons of Mass Destruction. ***FY 2012 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 2 ***Description:*** Apply human threat signatures to inform sensor development to develop research to enhance threat detection training for intelligence analysts, reconnaissance patrol, and force protection security operators. ***FY 2010 Accomplishments:*** Developed methods to identify key human threat indicators to reduce bandwidth requirements and enable real-time threat assessment from the air. Developed enhanced anthropometric visualization techniques that integrate heterogeneous sensor data of potential adversaries. ***FY 2011 Plans:*** Demonstrate a morphable 3D dynamic human model that adapts to different sensor input, predicts threat, and optimizes sensor combination and placement for human threat detection. Develop new human shape variation and visualization for threat awareness capability for the deployed airmen. ***FY 2012 Base Plans:*** Develop training based on physical/physiological indicators of deceptive behavior. Initiate development of software training module for human threat indicators. Provide requirements for sensor resolution and optimized sensor placement for human threat indicator detection. ***FY 2012 OCO Plans:***	2.509	2.452	2.104	-	2.104
Accomplishments/Planned Programs Subtotals	4.031	4.377	4.153	-	4.153

	FY 2010	FY 2011
Congressional Add: Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials ***FY 2010 Accomplishments:*** Conducted Congressionally-directed effort. ***FY 2011 Plans:***	2.928	-
Congressional Adds Subtotals	2.928	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635326: *Performance Enhancement Demonstration*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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.

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603456F: *Human Effectiveness Adv Tech Dev*	PROJECT 635327: *Warfighter Interfaces*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635327: *Warfighter Interfaces*	8.085	7.211	7.595	-	7.595	8.313	8.250	8.473	8.611	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to revolutionize the way human operators optimize the capabilities of Air Force systems, including autonomous machines and adaptive teams of humans and machines. Improvements in the presentation of operational information to the community of users, from the system operator to the commander, must be developed in step with advancements in the acquisition, storage, and retrieval of information. This project provides the advances in understanding of human cognitive abilities, as well as the utilization of human interfaces, multi-sensory fusion, high-resolution image displays, and three-dimensional audio to customize communications and enhance shared understanding across a diverse user community in air, space, and cyber for maximum situational awareness.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	1.002	1.550	3.545	-	3.545
Description: Develop immersion technologies and augmented vision, to facilitate team building and workflow in a distributed C2 environment and exploit telepresence in urban operations. ***FY 2010 Accomplishments:*** Analyzed the hardware and software trade-space options for a future C2 collaborative interface environment. Began concept development of sensemaking technologies and collaborative decision support tools for the resulting net-centric C2 environment infrastructure. ***FY 2011 Plans:*** Develop flexible and modular proof-of-concept interface tools used for team formation, intense collaboration, sensemaking, distributed decision support, and workflow. These tools will be used by C2 collaborators under cyber fight-through conditions and when conducting cyber-supported mission assurance activities. Integrate and test functionality of the modular distributed tools for demonstration in various C2 team decision making environments. Initiate technology demonstrations in representative users' cyber environments. ***FY 2012 Base Plans:*** Develop technology to assess the value of operator immersion and related virtual presence technology for improving human and mission performance, design novel warfighter visualizations, and develop intuitive control methods for exercising telepresence in the urban battlespace. Develop conceptual operator telepresence					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
interfaces (remote and on-scene) for the larger context of supervisory control of the sensor networks and ISR services. ***FY 2012 OCO Plans:***					
Title: Major Thrust 2 ***Description:*** Demonstrate technologies to interface between airmen and visual/auditory displays for battlefield airmen. Demonstrate ability to forecast acoustic profiles for any atmospheric/terrain condition. ***FY 2010 Accomplishments:*** Developed integrated multi-sensory interfaces for ground-based combat controllers. Developed and demonstrated advanced cabling and wireless technologies to improve operator mobility, decrease system setup time, and reduce the probability of user errors or system malfunctions. Demonstrated integrated human-centered concepts for enhanced portability, maintainability, and usability. Refined audio and visual interfaces to enhance operator survivability, improve communication effectiveness, and allow effective use of wearable computers without impairing the mobility of dismounted combat controllers. ***FY 2011 Plans:*** Complete final evaluations of integrated components. Demonstrate the integrated system concept, including advanced audio, speech, and visual interfaces, improved human-centric software applications, wearable power management systems, and ergonomically improved cabling and carriage concepts. Conduct laboratory evaluations to assess effectiveness of integrated system and compare performance to original baseline. Conduct field evaluations of technology components and prepare for transition to operational capability. ***FY 2012 Base Plans:*** Integrate a high fidelity acoustic simulation model into existing Air Force fielded software applications to demonstrate technology in the user's environment. Perform initial proof-of-concept verification and validation of the integrated acoustic model. Develop and test field data collection procedures to validate the acoustic predictions of sound propagation and source characterization. Collect soundscape data for a background noise database. Perform related research on human hearing and vigilance. ***FY 2012 OCO Plans:***	2.995	1.500	0.973	-	0.973
Title: Major Thrust 3	1.532	1.458	1.034	-	1.034

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Description: Develop and demonstrate an integrated human-centered interface to control multiple remotely piloted aircraft (RPA) that have various levels of autonomy and that optimize net-centric information flow. ***FY 2010 Accomplishments:*** Developed warfighter interface control station technologies permitting the effective conduct of cooperative dynamic reconnaissance, surveillance, and target acquisition missions either by a single warfighter or by a two-person crew in the next-generation supervisory control station. Integrated advanced mission and sensor management controls, displays, and decision aids with multi-RPA cooperative control automation for demonstration of the next-generation supervisory control station. Began to demonstrate and assess system performance and mission effectiveness in high-fidelity virtual simulation and flight test environments. ***FY 2011 Plans:*** Complete the development of advanced multi-RPA control station technology for dynamic reconnaissance, surveillance, and time-critical target acquisition missions. Complete the integration of cooperative engagement algorithms and operator interface technologies for technology demonstration. Complete the demonstration and assessment of system performance and mission effectiveness enabled by the next-generation supervisory control station, using high-fidelity virtual simulation and flight test environments. Determine how many vehicles an RPA operator can effectively manage/supervise. ***FY 2012 Base Plans:*** Analyze warfighter requirements for a future generation control station that will accommodate advanced and legacy RPAs. Develop and integrate operator interface controls, displays, and decision-aid technologies for effective situation assessment, decision-making, and action implementation to manage semi-autonomous, multi-mission RPAs and heterogeneous payloads. Test control station technology to determine baseline functionality and performance. ***FY 2012 OCO Plans:***					
Title: Major Thrust 4 ***Description:*** Develop job performance aiding technologies that assess workload and performance to more effectively determine work re-allocation in a command and control distributed environment. ***FY 2010 Accomplishments:***	0.551	1.112	1.013	-	1.013

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Began to develop a visual interface concept that planners may use to visualize the primary constraints within capacity-based planning. Included alternative planning algorithms that exploit cognitive engineering and work-centered design principles. Outlined a program plan featuring interactive simulations as a way to optimize resource allocation in complex time-sensitive deployments. ***FY 2011 Plans:*** Develop visual interface and incorporate advanced algorithms for planning military mobility operations. Demonstrate the ability to exploit automated planning to optimize the use of resources within Joint Deployment and Distribution Enterprise capacity constraints. Provide for real-time operator interaction within the capacity-based planner and begin to quantify the benefits of the human-automation interaction relative to current capabilities. ***FY 2012 Base Plans:*** Assess hardware and software technology options for developing team workload and performance detection capability and visualization requirements. Begin to develop and plan to integrate both on-human and off-human sensors. Work with command and control operational users from Control and Reporting Centers to identify characteristics of team membership and visualization requirements. ***FY 2012 OCO Plans:***					
Title: Major Thrust 5 ***Description:*** Develop cognitive-based analytic/design methods and computer software tools for C2 operations to synchronize personnel in distributed locations and obtain visually intuitive battlespace awareness. ***FY 2010 Accomplishments:*** Began analysis and refined analytic methods and techniques to support unified action for large, cross-organizational C2 teams and teams-of-teams. Began concept development of an extensible work-aiding framework that integrates future and current work aids into a coherently unified framework that affords efficient and effective action of large distributed and semi-independent teams and individuals. ***FY 2011 Plans:*** Demonstrate and evaluate a unifying C2 work-aiding framework supporting distributed cross-organizational teams and individuals, including integration of a representative set of existing tools. Examine results and refine	2.005	1.591	-	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
work-centered analytic, design, and development methods and techniques as applied to teams. This effort completes in FY 2011. ***FY 2012 Base Plans:*** ***FY 2012 OCO Plans:***					
Title: Major Thrust 6 ***Description:*** Develop and demonstrate space visualization technologies that provide visually intuitive awareness of the battlespace, including trend portrayal useful for decision making. NOTE: The increase in FY12 is due to greater emphasis in this area. ***FY 2010 Accomplishments:*** ***FY 2011 Plans:*** ***FY 2012 Base Plans:*** Examine and analyze the workflow and information required to provide warfighters with an inherent awareness of the operational space situation. Exploit available cognitive task analyses of space operations and develop user requirements for visualization tools that simplify the process of portraying relevant data from large data sets. Develop and test laboratory prototypes of visualization tools developed from user-derived requirements. ***FY 2012 OCO Plans:***	-	-	1.030	-	1.030
Accomplishments/Planned Programs Subtotals	8.085	7.211	7.595	-	7.595

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

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E. Performance Metrics

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