

UNCLASSIFIED

PE NUMBER: 0603231F

PE TITLE: Crew Systems and Personnel Protection Technology

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2008
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BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology
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Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	39.503	38.406	26.630	32.630	30.534	33.017	34.942	Continuing	TBD
2830 Decision Effectiveness Technology	26.580	29.420	18.295	23.906	22.205	23.588	25.724	Continuing	TBD
4924 Warfighter Readiness Technology	9.149	6.209	6.050	5.737	5.301	6.062	5.896	Continuing	TBD
5020 Bioeffects & Protection Technology	3.774	2.777	2.285	2.987	3.028	3.367	3.322	Continuing	TBD

Note: FY 2008 funding totals do not include \$0.3 million FY 2008 GWOT requirements still pending Congressional consideration. Funds for the FY 2008 Congressionally-directed Virtual Medical Trainer in the amount of \$2.4 million are in the process of being moved to the Defense Health Program from PE 0603231F, Crew Systems and Personnel Protection Technology, for execution.

(U) A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to enhance human performance and effectiveness and to enable the aerospace force. State-of-the-art advances are made to train personnel, protect and sustain warfighters, and improve human interfaces with weapon systems. The Decision Effectiveness Technology project develops and demonstrates warfighter capability enhancing technologies that promote effective decision-making, control, and mission execution in the emerging network-enabled operational environments. The Warfighter Readiness Technology project develops and demonstrates advanced training, simulation, and mission rehearsal technologies. The Bioeffects and Protection Technology project develops and demonstrates advanced technologies to provide laser eye protection, assure the safety of personnel involved with test, deployment, and operation of high-energy laser weapons, enhance capabilities for sustained operations in extreme environments, and deliver novel, tailored bio-taggant and identification/neutralization capabilities to meet specific AF special operations needs. Note: In FY 2008, Congress added \$1.0 million for Variable Transmittance Visor, \$2.4 million for Virtual Medical Trainer, \$1.6 million for Battlefield Automatic Life Status Monitor (BALSM), \$2.7 million for Low Cost/Improved Performance for Helmet Display and Life Support Technologies, and \$2.4 million for Water Purification with Fused Carbon Nanotube Nanostructured Material. 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

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and Personnel Protection Technology

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

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	43.890	28.558	29.376
(U) Current PBR/President's Budget	39.503	38.406	26.630
(U) Total Adjustments	-4.387	9.848	
(U) Congressional Program Reductions			
Congressional Rescissions		-0.252	
Congressional Increases		10.100	
Reprogrammings	-3.518		
SBIR/STTR Transfer	-0.869		
(U) <u>Significant Program Changes:</u>			
Not Applicable.			

C. Performance Metrics
Under Development.

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)				PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology			PROJECT NUMBER AND TITLE 2830 Decision Effectiveness Technology		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
2830 Decision Effectiveness Technology	26.580	29.420	18.295	23.906	22.205	23.588	25.724	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: Funds for the FY 2008 Congressionally-directed Virtual Medical Trainer in the amount of \$2.4 million are in the process of being moved to the Defense Health Program from PE 0603231F, Crew Systems and Personnel Protection Technology, for execution.

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates warfighter capability enhancing technologies and information operations technologies that promote effective decision-making, control, and mission execution in the emerging network-enabled operational environment. Included are advanced technologies that improve the ability of battlefield airmen to rapidly assimilate critical information and make timely and correct decisions, display technologies and decision aids that enhance time-critical strikes, and warfighter interface technologies that simplify and speed critical operations in air operation centers and battle management platforms. The project also develops technologies that enhance logistics functions, improve the fidelity and accuracy of large-scale military simulations, protect deployed personnel, improve human effectiveness during aerospace and cyber operations, support development of novel, tailored bio-taggant and identification/neutralization capabilities, develop aircrew system technologies to support long duration missions, and improve the manhunt capabilities of AF special operations. The ultimate goal is to assure warfighter decision effectiveness in AF operations.

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

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and demonstrate human-centered tools for the Air Force Information Operations (IO) and Intelligence, Surveillance and Reconnaissance (ISR) communities. Provide the IO/ISR/Cyber warrior with tailored decision support systems, guidelines for effective selection of IO/ISR/Cyber warriors, IO/ISR/Cyber simulators and training systems, enhanced decision-making tools, and automated tools to reduce ever-increasing data load and improve mission accomplishment.	2.778	1.682	2.685
(U) In FY 2007: Developed maturing IO/ISR tools, methods, and technology to gain, exploit, defend, and attack information. Matured and developed IO capabilities enhancement technology. Developed and demonstrated tools and techniques to improve operator performance for ISR planning and analysis. Began to develop ISR optimal displays and enhanced exploitation for ISR operators. Began to develop advanced training methodologies and tools for ISR operators.			
(U) In FY 2008: Develop and demonstrate the utility and effectiveness of ISR operator planning tools. Continue development and demonstration of operator-aiding technologies to exploit data from new ISR sensors and reduce data overload. Expand IO/ISR training research and evaluate new regimens to address training for new ISR missions. Develop Influence Operations technologies and facilitate transition into follow-on IO/ISR operator workload optimization development.			
(U) In FY 2009: Design advanced IO/ISR/Cyber technologies and demonstrate next-generation IO/ISR/Cyber operator			

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
03 Advanced Technology Development (ATD)	0603231F Crew Systems and Personnel Protection Technology	2830 Decision Effectiveness Technology		
(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
workstation capabilities to operationally integrate/normalize AF non-kinetic capabilities with kinetic operations. Continue development of operator-aiding and training tools for IO/ISR/Cyber operators. Initiate advanced Cyber influence development.				
(U) MAJOR THRUST: Develop and demonstrate human effectiveness technologies to improve combat effectiveness reporting, situation assessment updates, and decision support for Combined Air and Space Operations Centers (CAOC).		3.650	1.938	1.891
(U) In FY 2007: Commenced field tests of the visualization tools in an operational environment or exercise. Developed additional tools, including spatial audio and voice-over-Internet-protocol communication, to allow more advanced collaboration within the strategy division and with other groups in the CAOC.				
(U) In FY 2008: Develop a predictive analysis tool based on continuous and dynamic operational effects assessment. Based on operator field test results, develop enhancements that foster command level interaction with the visualization tool for rapid and actionable decision-making.				
(U) In FY 2009: Integrated visualization tools with other collaborative tools to create a seamless flow of operational assessment data into strategy planning data. Demonstrate a final visually-oriented, unified strategy planning and assessment support tool in a simulated CAOC.				
(U) MAJOR THRUST: Develop and demonstrate technologies to interface between ground controllers and multiple machine components through unified visual and auditory displays. Technologies address ground controller-specific requirements leading to faster mission execution timelines, reduced targeting and fratricide errors, and increased situational awareness through positional awareness of friend and foe in combat zones. Develop technologies permitting supervisory-level interfaces between ground controllers and multiple, highly autonomous unmanned aerial vehicles (UAV). Employ real-time wargaming simulations and field tests to quantify the decision-making benefits from advanced control/display portrayal concepts that optimize net-centric information flow to system operators.		3.935	3.651	3.933
(U) In FY 2007: Completed development and demonstration of advanced interface technologies between ground controllers and multiple machine components through unified visual and auditory displays. Demonstrated UAV interfaces featuring intelligent agent search patterns in the ground controller operational environment. Demonstrated operator headgear incorporating basic operator status reporting and wearable displays. Demonstrated user independent speech recognition and language translation customized for ground controller equipment and Terminal Attack Control (TAC) earplug microphones.				

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and
Personnel Protection Technology

PROJECT NUMBER AND TITLE

2830 Decision Effectiveness
Technology(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

- (U) In FY 2008: Commence a spiral development to extend the capabilities of the advanced interface technologies that link ground controllers with multiple machine components through unified visual and auditory displays. Demonstrate in an operational setting improved human interaction with transmission of target data, in order to improve speed and accuracy while offering a common situation display for Joint services interoperability. Provide human factors design updates to battlefield air operations kit components, providing faster setup and deployment of micro-UAV as well as integrated power management for wearable components. Demonstrate user-independent speech recognition and language translation customized for ground controller equipment and TAC earplug microphones. Begin hardware and software implementation of a supervisory control station technology baseline. Begin concept development for a next-generation supervisory control station, and plan to assess projected benefits in terms of operator mission performance and overall usability relative to the technology baseline station.
- (U) In FY 2009: Continue to develop and demonstrate human systems integration concepts for ground controllers and other battlefield airmen. Demonstrate technologies for three-dimensional audio navigation in visually obscured environments while improving team situational awareness by geo-location of voice communications. Incorporate a geo-located survival guide into a wearable computer, and demonstrate its value in an operationally relevant environment. Develop and incorporate an advanced battlefield air traffic control capability in the combat controller's software suite. Incorporate intelligent agent technology to improve battlefield airmen situational awareness in a dynamic wartime scenario. Complete hardware and software implementation of a supervisory control station technology baseline and a next-generation supervisory control station. Plan a technology demonstration program using real-time system simulation and field testing in spiral demonstration phases. Establish the scope of simulation and test activities, select experimental variables, determine key performance measures and commence the assessment.
- (U) MAJOR THRUST: Develop and demonstrate decision-aiding technologies that assist the Joint Forces Commander (JFC)/Joint Forces Air Component Commander (JFACC) to rapidly assess the battlefield situation, predict the most likely adversary behaviors, and select and prioritize the appropriate courses of action.
- (U) In FY 2007: Began first spiral development cycle of a decision aid that will support global military operations by providing a common global picture, fully integrating military planning, operations, and supporting intelligence. Enabled real-time reachback to operational and intelligence knowledge sources.
- (U) In FY 2008: Complete the first spiral development of CPE decision aids and simulation based on global strike and global persistent attack missions. Plan a technology demonstration program to evaluate benefits and utility of tools. Expand the scope of the scenario-based cognitive work to include non-traditional warfare such as humanitarian relief

0.970

1.843

2.225

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology	PROJECT NUMBER AND TITLE 2830 Decision Effectiveness Technology		
		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>				
and global war on terrorism. Begin a cognitive work analysis with this expanded scope.				
(U) In FY 2009: Integrate tools developed in first spiral into identified technology demonstration program. Evaluate the CPE decision aids and simulation tools in the technology demonstration environment. Refine tools and begin the second spiral development cycle informed by the results of the technology demonstration with humanitarian relief and global war on terrorism emphases. Identify exercise to evaluate the expanded benefits and utility of the decision aid tools and simulation. Plan a technology demonstration program.				
(U)				
(U) MAJOR THRUST: Develop and demonstrate advanced visual display technologies to provide integrated day/night capability to reduce pilot workload and enhance mission performance. Note: In FY 2007, this effort was discontinued to align work with higher AF priorities.		0.242	0.000	0.000
(U) In FY 2007: Completed technology contribution to incorporate night agile laser protection in airborne displays.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) MAJOR THRUST: Develop and demonstrate novel, tailored bio-taggant and identification/neutralization capabilities to meet specific AF needs to enhance force protection and enable air operations commanders to maintain operations tempo.		1.137	1.493	1.552
(U) In FY 2007: Evaluated the capabilities of emerging aptamer technologies to enhance bio-taggant capabilities. Began development of these DNA-based identification and neutralization technologies that will lead to affordable and reliable techniques for special forces to locate, identify, track, and counter enemy activities.				
(U) In FY 2008: Select the best emerging technologies for bio-taggant and threat neutralization applications and begin to develop those technologies into fieldable counterproliferation capabilities. Aptamer based technology will also be used to enhance the effectiveness of the cold plasma and directed energy technologies. Develop the capability to attach quantum dots and mixed-metal nanoparticles to aptamers to serve as taggants for biological agents.				
(U) In FY 2009: Further develop the selected technologies and refine application to mission need to include incorporation of quantum dot and mixed-metal nanoparticle technologies. Develop models of optimal insertion/distribution of bio-taggants in target areas.				
(U)				
(U) MAJOR THRUST: Develop and demonstrate intelligent software agents, realistic human and organizational behavior models, and advanced job performance aiding technologies. Computer agents and models add realism and fidelity to large-scale synthetic environments and war games, and provide intelligence analysts a way to model		3.538	4.490	1.166

Exhibit R-2a, RDT&E Project Justification	DATE February 2008
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BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology	PROJECT NUMBER AND TITLE 2830 Decision Effectiveness Technology
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(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
collected data. Job aiding technologies provide command and control operators with automated access to a manageable amount of multi-source critical information to avoid operator overload and to support fast and accurate decision-making during mobility operations. Note: Decreased emphasis in FY 2009 reflects completion of advanced demonstration effort in FY 2008.			
(U) In FY 2007: Began a series of critical experiments toward modeling a society as a complex system of systems. Transitioned work-centered collaborative planning and decision-making software to the Air Mobility Command. Developed composable command and control (C2) human computer interface elements that can be assembled via computer network into a rapidly reconfigurable C2 system. Conducted initial laboratory experiments on composable C2 modules.			
(U) In FY 2008: Continue to develop and experiment with system-of-systems societal modeling, increasing the complexity and degree of dynamic change. Expand development of work-centered collaborative planning, analysis, and decision-making software tools into the unstructured C2 work environment of dynamic mission re-synchronization. Investigate the value of implementing human-computer interfaces as services or as service layers of an enterprise architecture.			
(U) In FY 2009: Continue to develop human behavior modeling of individuals and groups in highly dynamic situations. Continue to experiment with system-of-systems societal modeling, using increasingly complex scenarios. Demonstrate how information flows through and is modified by a society. Develop design reference scenarios to be used as standards for evaluating different modeling approaches. Continue to evaluate promising models and modeling approaches.			
(U) MAJOR THRUST: Develop and demonstrate logistics technologies for improved deployment operations and improved system supportability. These technologies will improve the efficiency and effectiveness of AF deployments and mobility operations in support of Agile Combat Support initiatives and Air Expeditionary Force concepts.	1.965	1.221	0.895
(U) In FY 2007: Completed development and application of technology to automatically collect and update critical information required to effectively manage logistics resources in support of combat operations. Completed design and development of very fast, easy-to-use dynamic planning/replanning capabilities for adaptive logistics. Worked to define coalition C2 information requirements to support cross-cultural planning and coordination. Began work on defining requirements for emergency response logistics needs.			
(U) In FY 2008: Evaluate methods for organizational impact analysis of new information and network-based tools to support collaborative logistics. Collect human-centric performance data from critical experiments and joint exercises			

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology	PROJECT NUMBER AND TITLE 2830 Decision Effectiveness Technology		
	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	
(U) B. Accomplishments/Planned Program (\$ in Millions)				
to benchmark improvements in maintenance, transportation, and supply functions in contingency support.				
(U) In FY 2009: Develop organizational-level change templates for effective applications of net-based logistics operations. Validate these change templates in operational settings (e.g., airlift control centers, logistics readiness centers) for effective implementation of advanced automation technologies.				
(U)				
(U) MAJOR THRUST: Develop and demonstrate cognitive-based analytic and design methods and computer software tools for C2 operations to synchronize personnel in distributed locations with a shared understanding of the C2 battlespace. Increasingly, C2 personnel operate in a complex information environment that inhibits situation understanding and complicates operational decision-making. This decision support technology exploits an emerging work-centered user interface concept having the potential to rapidly configure common visualizations of C2 operations and streamline decision-making.	2.443	1.426	1.933	
(U) In FY 2007: Began to analyze the work aiding requirements for specific distributed C2 users, such as for rapid course of action development teams supporting global operations. Began to apply the work-centered user interface concept to develop shared visualizations and decision support for synchronizing global operations involving distributed C2 resources, such as for the dynamic management of air refueling operations.				
(U) In FY 2008: Continue to analyze the work aiding requirements for specific distributed C2 users such as for rapid course of action development teams supporting global operations, to include coverage both for planning and execution. Conduct experiments to test and evaluate the ability of the work-centered user interface services approach to provide effective visualizations and decision support for global C2 operations.				
(U) In FY 2009: Refine the methods and techniques to decrease the analysis, design and development time of providing work-centered support services for global C2 operations. Demonstrate in a simulation of global C2 operations that geographically distributed personnel can develop a shared situation understanding of the C2 battlespace.				
(U)				
(U) MAJOR THRUST: Develop and demonstrate human protective system technologies for extended missions. Technologies will improve aircrew comfort, resulting in increased performance. Note: In FY 2008, this effort is discontinued to align work with higher AF priorities.	0.657	0.751	0.000	
(U) In FY 2007: Researched optimizing seat system technologies to improve safety, comfort, and performance. Developed and evaluated candidate seat system optimization technologies that reduce aircrew fatigue and discomfort, while maintaining spinal alignment. Extended design concepts to ensure accommodation of the full aircrew population.				

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
03 Advanced Technology Development (ATD)	0603231F Crew Systems and Personnel Protection Technology	2830 Decision Effectiveness Technology		
(U) B. Accomplishments/Planned Program (\$ in Millions)		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2008: Validate system specification through testing of candidate seat system designs. Continue research and development of seat system technologies to improve performance, safety, and comfort. Demonstrate performance of candidate seat system optimization technologies.				
(U) In FY 2009: Not Applicable.				
(U) MAJOR THRUST: Develop and demonstrate technologies for improved force protection, the maintenance of peak warfighter performance in known toxic environments, and the identification of difficult-to-detect enemy threats. Develop capabilities for real-time human monitoring in the field and the identification of toxic substance exposure before the warfighters' health and combat effectiveness are compromised. Develop model-based threat awareness, health status, visualization, risk assessment technologies, and intent of human adversaries. Note: This major thrust is a continuation of previous work in PE 0602202F.		0.000	0.892	2.015
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Begin development of detection technologies to identify kidney and liver organ selective degradation using streamlined, yet robust, assay procedures and biomarkers. Generate selection criteria and integration algorithms that fuse varied biomarker data. Multiple specific biomarkers will allow for early detection of low level toxic exposure of deployed forces.				
(U) In FY 2009: Continue development of biomarker based detection technologies. Develop methods for collecting human biosample input in the field. Develop new concepts for lightweight monitoring devices that are operable by non-medical personnel for demonstration of the analysis and detection techniques. These technologies will identify potentially threatening toxic exposures to warfighters to protect AF personnel. Develop predictive human models for threat detection and exposure. Develop enhanced anthropometric visualization techniques that integrate heterogeneous sensor data of potential adversaries.				
(U) CONGRESSIONAL ADD: Air Force Advanced Micro-Compression Sock (AFAMS).		0.975	0.000	0.000
(U) In FY 2007: Conducted Congressionally-directed effort for AFAMS.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) CONGRESSIONAL ADD: Variable Transmittance Visor.		0.975	0.993	0.000
(U) In FY 2007: Conducted Congressionally-directed effort for Variable Transmittance Visor.				
(U) In FY 2008: Conduct Congressionally-directed effort for Variable Transmittance Visor.				

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
03 Advanced Technology Development (ATD)	0603231F Crew Systems and Personnel Protection Technology	2830 Decision Effectiveness Technology		
(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Phasor-Bird Helmet Tracker (previously titled Next Generation Helmet Tracking and Display Technology).		1.268	0.000	0.000
(U) In FY 2007: Conducted Congressionally-directed effort for Phasor-Bird Helmet Tracker.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Field Deployable Influenza Genotyping System.		0.975	0.000	0.000
(U) In FY 2007: Conducted Congressionally-directed effort for Field Deployable Influenza Genotyping System.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Low Cost/Improved Performance for Helmet Display and Life Support Technologies.		1.072	2.683	0.000
(U) In FY 2007: Conducted Congressionally-directed effort for Low Cost Improved Performance Helmet Display.				
(U) In FY 2008: Conduct Congressionally-directed effort for Low Cost/Improved Performance for Helmet Display and Life Support Technologies.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Virtual Medical Trainer.		0.000	2.384	0.000
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Conduct Congressionally-directed effort for Virtual Medical Trainer.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Battlefield Automatic Life Status Monitor (BALSM).		0.000	1.589	0.000
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Conduct Congressionally-directed effort for BALSM.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Water Purification with Fused Carbon Nanotube Nanostructured Material.		0.000	2.384	0.000
(U) In FY 2007: Not Applicable.				

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology	PROJECT NUMBER AND TITLE 2830 Decision Effectiveness Technology
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(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2008: Conduct Congressionally-directed effort for Water Purification with Fused Carbon Nanotube Nanostructured Material.			
(U) In FY 2009: Not Applicable.			
(U)			
(U) Total Cost	26.580	29.420	18.295

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
(U) Related Activities:									
(U) PE 0602202F, Human Effectiveness Applied Research.									
(U) PE 0604706F, Life Support Systems.									
(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.									
(U) <u>D. Acquisition Strategy</u> Not Applicable.									

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)				PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology			PROJECT NUMBER AND TITLE 4924 Warfighter Readiness Technology		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
4924 Warfighter Readiness Technology	9.149	6.209	6.050	5.737	5.301	6.062	5.896	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced training, simulation, and mission rehearsal technologies that will improve warfighter capabilities and mission readiness by enhancing operator and team performance skills. This effort includes the development of technologies that enable integration of computer models, live weapon systems, and weapon system simulators to portray the global battlespace, including all-weather, day/night flight operations, C2, force protection, and aerospace operations. This project develops and demonstrates advanced training and simulation technologies that will improve warfighter readiness by enhancing mission training and mission rehearsal capabilities. Development and effective use of the global battlespace requires advances in training systems and in interconnection, information, visual, and representation technologies. The resulting mission training and rehearsal capabilities will enhance the mission essential competencies of combat and combat support individuals and teams that comprise the aerospace force.

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

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Advance aerospace and organizational behavior models for integrated warfighter training and rehearsal. These computer agents and models will add realism operations, C2, force protection, and air base defense warfighters. Technologies will increase training effectiveness and efficiency, and decrease time to mission qualification.	2.974	3.088	2.692
(U) In FY 2007: Developed interface parameters to link DMO mission training centers and live training ranges. Developed a proof of concept joint close air support schoolhouse simulation environment. Developed preliminary exercise planning and analysis shells to enable a robust scenario authoring capability that reduces training development time. Developed performance measurement/monitoring technologies and methods for a deployable training environment. Performed a small-footprint training demonstration in a persistent wargaming environment. Initiated development of functional requirements for managing learning in distributed training contexts.			
(U) In FY 2008: Develop integrated methods for assessing and tracking performance in live, virtual, and constructive environments. Develop and demonstrate integrated readiness assessment for air-to-air, air-to-ground, close air support, and C2. Demonstrate interface and training capability between DMO and live range exercises. Continue development of scenario authoring shells amenable for guiding training and learning in virtual and live contexts. Develop integrated methods for evaluating the impact of different levels of fidelity in simulation environments on performance and readiness. Finalize the development of functional requirements for managing learning in distributed training contexts.			
(U) In FY 2009: Demonstrate adaptive training within DMO using embedded knowledge and skills assessment. Develop common tools for mission planning, briefing, and after action review that function across air combat,			

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and
Personnel Protection Technology

PROJECT NUMBER AND TITLE

4924 Warfighter Readiness
Technology(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

ground operations, and combat operations and planning in an AOC. Complete integration and evaluation of joint close air support (JCAS) environment for schoolhouse training. Demonstrate and validate technology alternatives for in-garrison and field deployable JCAS training and rehearsal system. Initiate development of specifications for integrating forward deployed battlefield coordination and command simulation with JCAS schoolhouse training. Demonstrate embedded training and performance assessment in a deployed combat training environment. Demonstrate integrated deployed DMO capability in large scale Live, Virtual, and Constructive (LVC) event. Demonstrate quantitative methods for certifying simulation fidelity and readiness training capabilities.

(U)

(U) MAJOR THRUST: Develop a low-cost, deployable visual simulation system with sufficient image resolution and performance capable of supporting the imaging of high-resolution fast-moving targets, high-density terrain, texture, surround imagery, and helmet-mounted sights. This technology will provide the warfighter realistic air-to-air and air-to-ground visual simulation environments to support aircrew training during expeditionary deployments and at mission training centers.

1.142

1.276

1.192

(U) In FY 2007: Began development of advanced, ultra resolution head-mounted and deployable Compact Immersive Visual Environment (CIVE) proof-of-concept display components. Began engineering and human factors analyses of the display components.

(U) In FY 2008: Continue engineering and human factors analyses of the CIVE display and image generation components to assess feasibility of new scanning architectures, image fidelity and stability, portability, resolution, size, weight, transport delay, and user acceptance.

(U) In FY 2009: Develop CIVE head-mounted and compact off-the-head display/image generation proof of concept component demonstrations. Begin human factors analyses and technology performance evaluations of the concept demonstrations.

(U)

(U) MAJOR THRUST: Develop and demonstrate training technologies and techniques to optimize night vision device-aided night operations. These technologies could reduce the cost of Night Vision Goggle (NVG) qualification and increase combat capability. Note: In FY 2007, this effort terminated due to higher AF priorities.

0.716

0.000

0.000

(U) In FY 2007: Developed NVG simulator scenarios and related performance metrics for advanced NVG employment training. Developed geo-specific databases and database modification tools for desktop NVG visualization training. Test simulated panoramic NVG in DMO testbed. Developed untethered NVG simulation for NVG video and head position by application of broadband wireless technology. Demonstrated head position driven simulated NVG imagery viewable by multiple viewers in an open space.

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and
Personnel Protection Technology

PROJECT NUMBER AND TITLE

4924 Warfighter Readiness
Technology(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

(U) In FY 2008: Not Applicable.

(U) In FY 2009: Not Applicable.

(U)

(U) MAJOR THRUST: Develop and demonstrate a high-fidelity DMO training and rehearsal capability for operators in an Air and Space Operations Center (AOC). Link AOC operational mission requirements and performance metrics to develop team learning environments for AOC units. Develop and demonstrate high-fidelity, interactive Electronic Warfare (EW) training technologies for use with live-virtual-constructive training networks for future threat systems/capabilities and advanced sensor platforms and weapons systems. These technologies provide AF, Joint, and coalition warfighters with more realistic EW mission training and rehearsal environments that accurately represent 21st century threats, thereby increasing operational readiness and capability.

2.075

1.845

2.166

(U) In FY 2007: Developed a proof-of-concept multiteam competency-based training package with performance assessment system capability for the AOC. Developed initial competency-based scenario selection guidelines and conducted a proof-of-concept test of competency-based scenario training capability for operational planners.

(U) In FY 2008: Develop competency-based training requirements for team and functional areas within strategy and plans divisions including IO and ISR teams. Develop optimum training and mission rehearsal strategies to employ information simulation into AOC weapon systems planning tools. Survey instructional methods for employment in targeted training of mission-essential knowledge and skills and develop most capable method(s) for integration. Begin the design and development of architectures and hardware that integrate live EW range data into shared networked simulations. Begin the development of a simulation of an advanced fighter-specific EW sensor suite for DMO application. Demonstrate guiding a single EW training illuminator on a live electronic combat range with fully integrated, computer-generated, and live forces.

(U) In FY 2009: Develop integrated strategy and plans division trainer based on competency-based training requirements and optimum mission rehearsal strategies. Develop integration methods for fielded and emerging systems and applications. Develop team, inter-team and division-level event specifications for mission qualification training and continuation training scenarios. Validate environment approaches through exercise simulations, data capture, and analysis to define quality of experience, spectrum of training capability, and performance assessment capabilities. Complete live EW range integration into DMO. Develop a simulation of an advanced platform-specific EW sensor suite for DMO. Develop a proof-of-concept desktop system integrating multiple EW suite simulations with a synthetic threat environment featuring advanced missile fly out models and basic directed energy threats. Begin measuring and validating improvements in EW training using these technologies and techniques. Begin the development of methods for improved, embedded EW training capability on airborne aircraft and design systems and

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology	PROJECT NUMBER AND TITLE 4924 Warfighter Readiness Technology
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(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
demonstrate these technologies during a live-fly exercise at an EW training range.			
(U) CONGRESSIONAL ADD: Authentic Tactical Flight Simulator for JSF.	1.267	0.000	0.000
(U) In FY 2007: Conducted Congressionally-directed effort for Authentic Tactical Flight Simulator for JSF.			
(U) In FY 2008: Not Applicable.			
(U) In FY 2009: Not Applicable.			
(U) CONGRESSIONAL ADD: Database Integration Tools.	0.975	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for Database Integration Tools.			
(U) In FY 2008: Not Applicable.			
(U) In FY 2009: Not Applicable.			
(U) Total Cost	9.149	6.209	6.050

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
(U) Related Activities:									
(U) PE 0602202F, Human Effectiveness Applied Research.									
(U) PE 0604227F, Distributed Mission Training.									
(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.									
(U) <u>D. Acquisition Strategy</u>									
Not Applicable.									

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)				PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology			PROJECT NUMBER AND TITLE 5020 Bioeffects & Protection Technology			
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total	
5020 Bioeffects & Protection Technology	3.774	2.777	2.285	2.987	3.028	3.367	3.322	Continuing	TBD	
Quantity of RDT&E Articles	0	0	0	0	0	0	0			

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

This project integrates and demonstrates technologies to provide protection against directed energy threats and hazards, without compromising performance, vigilance, or mission effectiveness, and man-portable technologies for the neutralization of threats. Development and demonstration efforts focus on advanced technologies for laser eye protection (LEP), preventing injurious exposures of personnel involved with test and evaluation of high power microwave or high-energy laser weapons, and enabling operational employment of these systems. It also develops tools and guidelines for testing and deploying high power microwave and high-energy laser systems and technologies to enhance personnel safety and effectiveness in aerospace operations. Biobehavioral performance capabilities are developed and demonstrated to enable sustained and enhanced operations in extreme environments to include surge, night, global, information warfare, C2, and other operations.

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

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and demonstrate multiwavelength LEP technologies for aircrew and ground personnel to provide protection against any laser hazard or threat in a single device. Note: This effort completed in FY 2007.	0.572	0.000	0.000
(U) In FY 2007: Completed development of integrated eye protection technologies. Demonstrated and delivered second-generation LEP goggles for Special Operations air and ground forces, assessing human factors and mission compatibility.			
(U) In FY 2008: Not Applicable.			
(U) In FY 2009: Not Applicable.			
(U) MAJOR THRUST: Develop and demonstrate technologies that permit safe testing, deployment, and use of high energy laser weapons and systems.	0.782	0.902	0.875
(U) In FY 2007: Combined modeling and experimental measurement of additional multiple-wavelength exposures to airborne laser wavelength and other near-infrared laser beams to define the relative damage thresholds of the combined exposures when compared to their single-wavelength counterparts.			
(U) In FY 2008: Release laser range safety software tool including dynamic bi-directional reflectivity distribution function to support live fire test of major systems. Initiate validation, verification, and accreditation package for new software package. Continue assessment of probabilistic risk assessment for use with laser hazard assessment.			
(U) In FY 2009: Complete validation, verification, and accreditation package for laser range safety tool. Release collateral hazard assessment software tool to enable analysis of tactical uses for high-energy laser systems.			
(U) MAJOR THRUST: Develop and demonstrate technologies to assess bioeffects and protection from radio frequency	0.000	0.882	1.142

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
03 Advanced Technology Development (ATD)	0603231F Crew Systems and Personnel Protection Technology	5020 Bioeffects & Protection Technology		
(U) B. Accomplishments/Planned Program (\$ in Millions)		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(RF) systems, including terahertz technologies. Note: This major thrust is a continuation of previous work in PE 0602202F.				
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Initiate program to develop solutions for both laser and other non-ionizing radiation to personnel. Integrate laser solutions into solutions for RF, microwave, terahertz, and other regimes of electromagnetic radiation for personnel protection.				
(U) In FY 2009: Continue to develop laser and RF and other non-ionizing protective solutions for personnel protection. Develop bioeffects-based fire-control algorithms for directed energy weapons. Continue integration of laser protective technologies with those for RF, microwave, terahertz, and other regimes of electromagnetic radiation for personnel protection. Establish preliminary design specifications for directed energy protective equipment. Continue long-term studies of RF weapon systems effects.				
(U) MAJOR THRUST: Develop and demonstrate ability to support testing of counterforce technologies and to enable man-portable threat neutralization capabilities.		0.823	0.635	0.268
(U) In FY 2007: Refined and downselected neutralization devices, developed simulant testing capabilities, and integrated with threat detection technologies. Demonstrated most promising man-portable threat neutralization technologies in simulated environments.				
(U) In FY 2008: Begin developing technologies that will provide the capability to neutralize threats without leaving evidence for special applications. Develop technologies to enable safe return and avoid contaminating aircraft or other equipment.				
(U) In FY 2009: Continue development of technologies that will provide the capability to neutralize threats without evidence for special applications. Improve technologies to enable safe return and avoid contaminating aircraft or other equipment.				
(U) MAJOR THRUST: Develop a fatigue management capability to alleviate the negative effects of fatigue on human performance in aerospace operations. Results will extend and enhance human performance and survivability in sustained and continuous (24/7) mission environments for all aviation, C2, special operations, maintenance, and space operators. Note: This effort completes in FY 2008.		0.622	0.358	0.000
(U) In FY 2007: Integrated biobehavioral performance model for selected military tasks, such as airlift/tanker crew scheduling and special forces mission planning.				
(U) In FY 2008: Complete development and demonstrate quantitative biobehavioral performance management tools to				

Exhibit R-2a, RDT&E Project Justification							DATE February 2008		
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)			PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology			PROJECT NUMBER AND TITLE 5020 Bioeffects & Protection Technology			
(U)	<u>B. Accomplishments/Planned Program (\$ in Millions)</u>					<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	
	provide scheduling solutions and operational risk management calculations to extend and enhance human performance in sustained and continuous (24/7) military operations.								
(U)	In FY 2009: Not Applicable.								
(U)	CONGRESSIONAL ADD: Full Spectrum Laser Eye Protection.					0.975	0.000	0.000	
(U)	In FY 2007: Conducted Congressionally-directed effort for Full Spectrum Laser Eye Protection.								
(U)	In FY 2008: Not Applicable.								
(U)	In FY 2009: Not Applicable.								
(U)	Total Cost					3.774	2.777	2.285	
(U)	<u>C. Other Program Funding Summary (\$ in Millions)</u>								
		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>
		<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>
									<u>Total Cost</u>
(U)	PE 0602102F, Materials.								
(U)	PE 0602202F, Human Effectiveness Applied Research.								
(U)	PE 0603112F, Advanced Materials for Weapon Systems.								
(U)	PE 0603319F, Airborne Laser Program.								
(U)	PE 0604706F, Life Support Systems.								
(U)	This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.								
(U)	<u>D. Acquisition Strategy</u>								
	Not Applicable.								