

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 2003

BUDGET ACTIVITY

03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and Personnel Protection Technology

COST (\$ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	32,115	39,235	34,487	32,881	32,614	33,197	33,700	34,171	Continuing	TBD
2830 Decision Support and Cognitive Systems	7,454	7,883	7,541	6,386	6,253	6,200	6,294	6,383	Continuing	TBD
3257 Helmet-Mounted Sensory Technologies	9,787	6,798	6,001	4,801	5,342	5,432	5,514	5,590	Continuing	TBD
4923 Logistics Readiness and Sustainment	9,124	8,170	11,569	10,560	10,877	11,227	11,398	11,557	Continuing	TBD
4924 Distributed Mission Training Technology	5,750	7,369	6,530	7,239	7,179	7,176	7,284	7,386	Continuing	TBD
5020 Directed Energy Protective Systems	0	9,015	2,846	3,895	2,963	3,162	3,210	3,255	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: In FY 2002, all activity previously reported in PE 0603106F will be reported in Project 4923 and all activity previously reported in PE 0603227F will be reported in Project 4924. In FY 2003, the Directed Energy Protective Systems program at Brooks City-Base, TX, will move from Project 3257 to Project 5020 to align resources with the Air Force Research Laboratory organization.

(U) **A. Mission Description**

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 Support and Cognitive Systems project develops and demonstrates crew system interface technologies and information operations technologies that promote effective decision-making, control, and execution in operational environments. The Helmet-Mounted Sensory Technologies project develops and demonstrates advanced operator interface technologies for multi-functional helmet-mounted displays and night vision devices, and laser eye protection. The Logistics Readiness and Sustainment project develops and demonstrates technologies that will protect the force, enhance logistics, and improve the design, deployability, performance, and support of current and future weapon systems. The Distributed Mission Training Technology project develops and demonstrates advanced training, simulation, and mission rehearsal technologies. The Directed Energy Protective Technologies project develops and demonstrates advanced technologies for laser eye protection and for assuring safety of personnel involved

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Technology(U) **A. Mission Description Continued**

with test, deployment, and operation of high-energy laser weapons and systems. Note: In FY 2003, Congress added \$1.0 million for Battlespace Logistics Readiness and Sustainment, \$3.5 million for Total Atmospheric Liquefaction System (TALON), \$1.8 million for Combat Automation Requirement Testbed, \$2.1 million for Special Operations Crew Research at Brooks AFB, \$0.9 million for Laser Eye Protection Research, and \$1.0 million for Helmet Cueing System Technology.

(U) **B. Budget Activity Justification**

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.

(U) **C. Program Change Summary (\$ in Thousands)**

	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>Total Cost</u>
(U) Previous President's Budget	34,023	29,690	35,193	TBD
(U) Appropriated Value	34,356	39,990		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-333	-423		
b. Small Business Innovative Research				
c. Omnibus or Other Above Threshold Reprogram		-332		
d. Below Threshold Reprogram	-1,751			
e. Rescissions	-157			
(U) Adjustments to Budget Years Since FY 2003 PBR			-706	
(U) Current Budget Submit/FY 2004 PBR	32,115	39,235	34,487	TBD

(U) **Significant Program Changes:**

Decrease in FY 2004 is to fund higher priority Air Force programs.

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Technology

PROJECT

2830

COST (\$ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
2830 Decision Support and Cognitive Systems	7,454	7,883	7,541	6,386	6,253	6,200	6,294	6,383	Continuing	TBD

(U) **A. Mission Description**

This project provides technology to improve human combat performance, combat support performance, and aerospace safety through better information delivery and crew station integration, which are achievable through effective decision support and cognitive systems engineering. Crew stations represent the fundamental interface between the warfighter and equipment across the gamut of aerospace operations. To cope with the recognized data overload in command centers and weapon platforms, this project develops technologies to quantify requirements, develop information interfaces, and evaluate crew performance in selected operational environments. This project includes bioacoustic technologies to complement decision support and visual information technologies as part of an integrated solution to negate information overload in the Air Expeditionary Force environment, while improving sound cueing, voice communications, and hearing protection for weapon systems operators, command centers, and security forces.

(U) **FY 2002 (\$ in Thousands)**

- (U) \$0 Accomplishments/Planned Program
- (U) \$1,250 Developed and demonstrated human modeling technologies and simulation tools to verify crew performance requirements, reduce the cost and time for system developers to isolate and analyze critical operator tactics in simulated operational exercises, and support clear accountability in design. Completed feasibility demonstration for integrating human modeling technology in a simulation-based testbed to establish performance-based crew system requirements. Developed plan to extend human modeling and simulation technologies to make effective trade off assessments of crew system concepts to quantify impact on performance, mission effectiveness, and affordability. Demonstrated feasibility of modeling teamwork, intra-team communications, and air center operations in support of effectiveness trades used during acquisition.
- (U) \$3,475 Developed and demonstrated aircrew escape subsystems to protect the aircrew member during emergency ejection in current and future high performance fighter aircraft. Developed head/neck protection systems and Helmet-Mounted Displays (HMD) that will provide a decrease in head and neck injuries for crewmembers wearing HMDs during high-speed emergency ejections. Conducted windblast testing to verify head, neck, and eye protection are provided to 600 Knots Equivalent Air Speed.
- (U) \$993 Developed and demonstrated user-tailored information management and portrayal technologies that enhance battlespace situational awareness for global- and MAJCOM-level information operations centers to reduce decision-making bottlenecks. Continued to develop user-tailored visualizations promoting battlespace situational awareness. Developed and demonstrated tools to improve information operations planning, execution, and combat assessment within the information warfare flights of the numbered air forces. Performed cross-cultural analysis as a first

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Exhibit R-2A (PE 0603231F)

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<p>(U) <u>A. Mission Description Continued</u></p> <p>(U) <u>FY 2002 (\$ in Thousands) Continued</u></p> <p>step in developing a tool to support understanding of adversarial decision-making. Demonstrated the effectiveness of combat assessment tools in joint or Air Force specific exercises.</p> <p>(U) \$744 Developed high performance bioacoustic hearing protection technologies to achieve 40-45 dB noise attenuation for personnel working in and around aircraft. Demonstrated improved noise attenuation performance metrics in laboratory and field environments. Integrated deep insert earplug technology to achieve 35-40 dB field attenuation.</p> <p>(U) \$992 Developed and demonstrated technologies to enhance security force situational awareness and threat response time using acoustic sensors. Demonstrated that using an eight microphone array can increase signal-to-noise ratio for a given look angle, provide three-dimensional (3-D) sound localization, and provide a limited remote detection capability for security forces. Developed and evaluated acoustic algorithms for locating, tracking, and detecting threats. Began to develop an information management concept for deployed security forces to improve situational awareness by using intelligent algorithms, 3-D audio, and audio symbology to code the detected threats and assist in threat intervention.</p> <p>(U) \$7,454 Total</p> <p>(U) <u>FY 2003 (\$ in Thousands)</u></p> <p>(U) \$0 Accomplishments/Planned Program</p> <p>(U) \$1,982 Develop and demonstrate human modeling technologies and simulation tools to justify crew performance requirements, reduce the cost and time for system developers to isolate and analyze critical operator tactics in simulated operational exercises, and support analysis of alternatives. Continue to extend human modeling and simulation technologies to make effective trade offs between crew system concepts and mission effectiveness. Begin to analyze and develop integrated crew system concepts to reduce manning within air operations centers, showing contribution of human modeling to substantiate time-critical targeting effectiveness and affordability. Begin development of extensions to the simulation testbed that will provide the capability to objectively and systematically assess the overall sensor-to-shooter process for time-critical targets.</p> <p>(U) \$2,708 Develop and demonstrate user-tailored information management and portrayal technologies that enhance battlespace situational awareness for global- and MAJCOM-level information warfare and air operations centers to reduce decision-making bottlenecks. Transition and integrate initial version of combat assessment tools into joint and/or Air Force weapon systems. Develop effects-based adversarial decision-making process and model to characterize different types of adversary systems and assess alternative ways they may be favorably influenced by allied force actions. Develop speech recognition front-end and advanced visualization for operations centers' information management tool. Improve</p>		
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<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"> <p>(U) <u>A. Mission Description Continued</u></p> <p>(U) <u>FY 2003 (\$ in Thousands) Continued</u></p> </div> <div style="width: 85%;"> <p>flow of time-critical targeting information into strike aircraft to enhance pilot situational awareness, exploiting capabilities inherent with helmet-mounted display technology.</p> <p>(U) \$893 Develop advanced high performance bioacoustic hearing protection technologies to achieve 40-45 dB noise attenuation for personnel working in and around fighter aircraft. Demonstrate communication capability in 150 dB noise fields. Integrate deep insert earplug technology with active noise reduction to achieve 45 dB field attenuation. Demonstrate improved attenuation and user acceptability in laboratory and field environments.</p> <p>(U) \$980 Develop and demonstrate advanced technologies to enhance security force situational awareness and threat response time using acoustic sensors. Demonstrate to deployed security forces an information management concept that can improve situational awareness by using intelligent algorithms, three-dimensional (3-D) audio, and audio symbology to code the detected threats and assist in threat intervention. Demonstrate at a military exercise the operational payoff from using 3-D audio radios and helmets in a mobile patrol squadron. Develop an automated threat assessment system to evaluate the severity and importance of detected noise.</p> <p>(U) \$1,320 Develop and demonstrate human-centered science and technology for the Air Force Information Warfare (IW) community. This research will provide the IW warrior with tailored decision support systems, guidelines for effective selection of information warriors, information operations simulators and training systems, improved operational shift schedules to increase personnel efficiency and effectiveness, enhanced decision-making tools, and automated tools to reduce operator task load. Tools will be developed to influence human senses to enable perception management and deception, model and simulate human behavior, develop adversary cultural and decision models, enhance predictive battlespace awareness, and improve interaction and monitoring capability by determining effectiveness of automated tools in support of intelligence and information warfare units.</p> <p>(U) \$7,883 Total</p> <p>(U) <u>FY 2004 (\$ in Thousands)</u></p> <p>(U) \$0 Accomplishments/Planned Program</p> <p>(U) \$1,077 Develop and demonstrate human modeling technologies and simulation tools to justify crew performance requirements, reduce the cost and time for system developers to isolate and analyze critical operator tactics in simulated operational exercises, and support analysis of alternatives. Integrate human modeling and simulation technologies into distributed simulation exercises to reduce manning within air operations centers and to shorten time-critical targeting cycle times.</p> <p>(U) \$3,250 Develop and demonstrate user-tailored information management and portrayal technologies that enhance battlespace situational awareness for</p> </div> </div>		
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<p>(U) <u>A. Mission Description Continued</u></p> <p>(U) <u>FY 2004 (\$ in Thousands) Continued</u></p> <div style="margin-left: 40px;"> <p>global- and MAJCOM-level information warfare and air operations centers to reduce decision-making bottlenecks. Develop effects-based adversarial decision-making modeling, simulation, and analysis tool to evaluate different types of adversary systems and to assess alternative ways they may be favorably influenced by allied force actions. Integrate this tool into next-generation planning and combat assessment tools to demonstrate enhanced information warfare planning. Develop dynamic user tailoring for operation centers' information management tool.</p> <p>(U) \$955 Develop and demonstrate advanced audio technologies to enhance security force situational awareness and threat response time using acoustic sensors. Demonstrate a user-centered interface to improve threat level and location awareness for security force command, as well as automated acoustic threat detection, localization and classification of foot traffic, land vehicles, air vehicles, and munitions firing. Demonstrate during a military exercise the operational payoff from using the combination of acoustic sensors, multimedia displays at the command center, and three-dimensional audio radios to assist mobile patrol squads.</p> <p>(U) \$910 Develop and demonstrate human-centered science and technology for the Air Force Information Warfare (IW) community. Develop technologies to provide human-centered alternatives to current IW architectures, systems, processes, and operations. These technologies will focus on predictive battlespace awareness and tailored decision support systems and tools to augment human operators' performance. Analysis of alternatives will lead to a modernization plan for IW as well as a detailed plan to support future demonstrations of Information Warfare tools, training, and requirements.</p> <p>(U) \$1,349 Develop and demonstrate a combined aerospace information system that provides combat effectiveness reporting, situation assessment updates, and decision support for Combined Air Operations Centers (CAOC). Perform work-centered analysis of key CAOC positions and develop measures of performance and effectiveness. Begin to develop visualizations promoting battlespace situational awareness.</p> <p>(U) \$7,541 Total</p> <p>(U) <u>B. Project Change Summary</u> Not Applicable.</p> <p>(U) <u>C. Other Program Funding Summary (\$ in Thousands)</u></p> <p>(U) Related Activities:</p> <p>(U) PE 0602202F, Human Effectiveness Applied Research.</p> <p>(U) PE 0604706F, Life Support Systems.</p> <p>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> </div>		
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<p>(U) <u>D. Acquisition Strategy</u> Not Applicable.</p> <p>(U) <u>E. Schedule Profile</u> (U) Not Applicable.</p>		
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Technology

PROJECT

3257

COST (\$ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
3257 Helmet-Mounted Sensory Technologies	9,787	6,798	6,001	4,801	5,342	5,432	5,514	5,590	Continuing	TBD

Note: In FY 2003, the Directed Energy Protective Systems program at Brooks City-Base, TX, will move from Project 3257 to Project 5020 to align resources with the Air Force Research Laboratory organization.

(U) A. Mission Description

This project develops and demonstrates advanced technologies for ejection-safe, multi-functional Helmet-Mounted Displays and night vision devices. Development of helmet-mounted tracker and display (HMT/D) technologies will enable pilots to detect, identify, target, and launch weapons faster and more accurately. Development of improved aircrew Night Vision Goggle (NVG) technologies will enhance aerial combat capabilities at night.

(U) FY 2002 (\$ in Thousands)

- (U) \$0 Accomplishments/Planned Program
- (U) \$4,830 Developed and demonstrated advanced HMT/D and subsystem technologies to improve mission effectiveness and pilot situational awareness during day and night missions in all-weather conditions. Demonstrated advanced symbology and video insertion on HMT/D for air-to-ground strike missions. Demonstrated inertial head tracker on HMT/D for air-to-ground strike missions. Developed and demonstrated high-brightness, high resolution, miniature flat-panel display and assessed utility of the new flat-panel display as a replacement for cathode ray tubes on daytime HMT/Ds.
- (U) \$2,216 Developed and demonstrated technologies for improved aircrew NVGs to increase mission effectiveness and enhance air operations by allowing the pilot to perform daytime tactics at night. Demonstrated miniature image sources and smaller format filmless image intensifier tubes to provide aircrew members a wider field-of-view, improved low-light level resolution, and reduced halo effects. Demonstrated Integrated Panoramic Night Vision Goggles (IPNVG) technologies integrated with Laser Eye Protection (LEP) technologies. Continued flight evaluation of IPNVG and demonstrated imagery insertion in flight.
- (U) \$2,741 Developed and demonstrated technologies that counter the multiple wavelength and agile laser threat and permit safe testing, deployment, and use of high-energy laser weapons. Continued evaluation of the biological effects of non-lethal laser weapons and high-energy laser systems. Finished aircrew evaluation of dye/dielectric stack combination LEP. Completed performance evaluation of vision-corrective prescription capability and airborne LEP of dielectric stack-based technologies, and began aircrew evaluations of these devices. Demonstrated next generation rugate technology for visible wavelength protection. Continued assessment of laser glare effects on visual performance of human subjects wearing reflective laser eye protection compared to combined dye/dielectric stack technologies.

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Exhibit R-2A (PE 0603231F)

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		PROJECT 3257

(U) **A. Mission Description Continued**

(U) **FY 2002 (\$ in Thousands) Continued**

(U) \$9,787 Total

(U) **FY 2003 (\$ in Thousands)**

(U) \$0 Accomplishments/Planned Program

(U) \$3,378 Develop and demonstrate advanced Helmet-Mounted Tracker and Display (HMT/D) and subsystem technologies to improve mission effectiveness and pilot situational awareness during day and night missions in all-weather conditions. These technologies help pilots to detect, identify, target, and engage with weapons faster and more accurately. Investigate and develop advanced symbology sets for tactical HMT/Ds to improve targeting, increase situational awareness, and reduce spatial disorientation. Integrate ultrasonic transducers with inertial head tracker to improve tracker accuracy. Investigate utility of advanced daytime HMT/D incorporating miniature color display for future simulations and flight evaluations.

(U) \$979 Develop and demonstrate advanced head tracker technologies to improve helmet cueing capabilities for onboard weapons and sensors.

(U) \$1,504 Develop and demonstrate technologies for improved aircrew night vision goggles to increase mission effectiveness and enhance air operations by allowing the pilot to perform daytime tactics at night. Incorporate and evaluate laser hardening technologies for image intensifier tube. Integrate Integrated Panoramic Night Vision Goggles with an HMT/D.

(U) \$937 Develop and demonstrate subsystems to protect the aircrew member wearing Helmet-Mounted Displays (HMDs) during emergency ejection in current and future high-performance fighter aircraft. Advanced head/neck protection systems will provide a decrease in head and neck injuries for crewmembers wearing HMDs during high-speed emergency ejections. Conduct tests to verify head, neck, and eye protection are provided to 600 Knots Equivalent Air Speed (KEAS) threshold, 700 KEAS objective.

(U) \$6,798 Total

(U) **FY 2004 (\$ in Thousands)**

(U) \$0 Accomplishments/Planned Program

(U) \$2,333 Develop and demonstrate advanced HMT/D and subsystem technologies to improve mission effectiveness and pilot situational awareness during day and night missions in all-weather conditions. These technologies help pilots to detect, identify, target, and engage with weapons faster and more accurately. Demonstrate advanced symbology sets for tactical HMT/Ds in an operational environment to assess improvements to targeting, to increase situational awareness, and to reduce spatial disorientation. Demonstrate and assess utility of advanced head tracker that improves tracker accuracy, reduces system latency, and reduces mobility footprint.

(U) \$2,935 Develop and demonstrate advanced visual display technologies to provide integrated day/night capability for reducing pilot workload and

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(U) **A. Mission Description Continued**

(U) **FY 2004 (\$ in Thousands) Continued**

enhancing mission performance. Assess capabilities of emerging night vision devices and investigate head-mounted, multi-channel displays. Develop technologies to reduce bulk and head-supported weight required by existing cathode ray tube-based designs to improve aircrew safety and comfort.

(U) \$733 Develop and demonstrate subsystems to protect the aircrew member wearing Helmet-Mounted Displays (HMD) during emergency ejection in current and future high performance fighter aircraft. Aerodynamic lift-reducing helmet concepts will provide a decrease in head and neck injuries for crewmembers wearing HMDs during high-speed emergency ejections. Identify candidate lift-reducing concepts and integrate helmet design with emerging HMD designs. Conduct impact, windblast, and ejection sled tests to verify performance under high-speed ejection conditions.

(U) \$6,001 Total

(U) **B. Project Change Summary**
Not Applicable.

(U) **C. Other Program Funding Summary (\$ in Thousands)**

(U) Related Activities:

(U) PE 0602202F, Human Effectiveness Applied Research.

(U) PE 0602102F, Materials.

(U) PE 0603112F, Advanced Materials for Weapon Systems.

(U) PE 0603319F, Airborne Laser Program.

(U) PE 0604706F, Life Support Systems.

(U) PE 0604201F, Integrated Avionics Planning and Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) **D. Acquisition Strategy**
Not Applicable.

(U) **E. Schedule Profile**

(U) Not Applicable.

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PROJECT

4923

COST (\$ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
4923 Logistics Readiness and Sustainment	9,124	8,170	11,569	10,560	10,877	11,227	11,398	11,557	Continuing	TBD

(U) **A. Mission Description**

This project develops and demonstrates technologies that will enhance logistics and improve the design, deployability, performance, and support of current and future weapon systems. This includes technology development to model and simulate intelligent behavior; improve the accuracy of logistics process modeling; create intelligent software agents to perfect human and logistics representation in large-scale military simulations; and create more effective logistics information systems. This project also develops and demonstrates technologies to incorporate human operator, maintenance, and support considerations into the weapon systems design process, and to make related data available electronically throughout weapon systems life cycles. The resulting efforts will reduce deployment airlift and footprint requirements, improve the logistics information system, and improve the command, control, and decision-making in worldwide logistics management.

(U) **FY 2002 (\$ in Thousands)**

- (U) \$0 Accomplishments/Planned Program
- (U) \$1,608 Developed and demonstrated technologies that enhance and streamline aircraft maintenance processes to improve the Air Force's ability to meet Air Expeditionary Force requirements by providing faster and more accurate methods of diagnosing and predicting component failures. Continued development of diagnostics capability to provide technicians with more effective tools for isolating faults on software intensive, reconfigurable systems found on modern aircraft and advanced aircraft systems currently in development. Began development of a prognostics capability to accurately predict when a component will fail so that parts can be replaced before failure.
- (U) \$3,799 Developed and demonstrated intelligent software agents and realistic human behavior models. These software agents and models add realism and fidelity to large-scale synthetic environments and war games, and improve the user interaction with logistics information systems. Developed intelligent agents that extend the role player's ability to monitor events and execute missions, and better represent logistics functions in synthetic exercises. Developed software agents that anticipate problems and offer decision options to command center personnel during mobility operations.
- (U) \$3,717 Developed and demonstrated logistics technologies for improved deployment operations, supportability, and planning. These technologies enhance deployments and mobility operations. Continued to develop technology to provide wing commanders and senior logisticians with advanced logistics information and management capabilities, including rapid access to real-time resources status information, proactive problem identification, decision support aids, and process tracking. Focus on the information feeds required to support the wing commander and senior logisticians in effectively assessing the wing logistics support status.

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(U) **A. Mission Description Continued**

(U) **FY 2002 (\$ in Thousands) Continued**

(U) \$9,124 Total

(U) **FY 2003 (\$ in Thousands)**

(U) \$0 Accomplishments/Planned Program

(U) \$2,591 Develop and demonstrate intelligent software agents and realistic human behavior models. These computer agents and models will add realism and fidelity to large-scale synthetic environments and war games, and improve the user interaction with logistics information systems. Develop intelligent software agents that mimic the functionality of command/control echelons and opposing forces and that better represent logistics functions in synthetic exercises.

(U) \$2,991 Develop and demonstrate logistics technologies for improved deployment operations and improved system supportability. These technologies will maximize the efficiency and effectiveness of Air Force deployments and mobility operations in support of agile combat support initiatives and the emerging Air Expeditionary Force (AEF) concepts. Continue to develop technology to provide wing commanders and senior logisticians with advanced logistics information and management capabilities, including rapid access to real-time resources status information, proactive problem identification, decision support, and process tracking. Initial software tool set will be tested and transitioned to users.

(U) \$1,609 Develop and demonstrate advanced user interface technologies to enhance the utility of Air Mobility Command's command and control systems. These interfaces will combine artificial intelligence software with automated, work-centered collaborative planning and decision support technologies. Command and control operators will have immediate access to integrated, decision-quality information from multiple sources, thereby enabling faster, more accurate decision-making and problem resolution during mobility operations.

(U) \$979 Develop and demonstrate technologies that will enhance Air Force maintenance and supply processes and improve the design, deployability, performance, and logistics support of current and future weapon systems.

(U) \$8,170 Total

(U) **FY 2004 (\$ in Thousands)**

(U) \$0 Accomplishments/Planned Program

(U) \$2,757 Develop and demonstrate technologies that will enhance and streamline aircraft maintenance processes to improve the Air Force's ability to meet AEF requirements by providing faster and more accurate methods of diagnosing and predicting component failures. Begin to develop cognitive decision technologies, new information fusion techniques, and algorithms to determine failure trends for improved maintenance troubleshooting. Develop revolutionary formats for presenting technical information and software tools that support collaborative problem solving during aircraft maintenance.

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<div style="margin-bottom: 10px;"> (U) <u>A. Mission Description Continued</u> </div> <div style="margin-bottom: 10px;"> (U) <u>FY 2004 (\$ in Thousands) Continued</u> </div> <div style="margin-bottom: 10px;"> (U) \$2,814 Develop and demonstrate intelligent software agents and realistic human and organizational behavior models. These computer agents and models will add realism and fidelity to large-scale synthetic environments and war games, provide intelligence analysts a way to model collected data, and improve the user interaction with logistics information systems. Develop computer models that mimic the functionality of command and control echelons and opposing forces and that better represent logistics functions in synthetic exercises. </div> <div style="margin-bottom: 10px;"> (U) \$4,441 Develop and demonstrate logistics technologies for improved deployment operations and improved system supportability. These technologies will maximize the efficiency and effectiveness of Air Force deployments and mobility operations in support of agile combat support initiatives and Air Expeditionary Force concepts. Complete development and transition of technology to provide wing commanders and senior logisticians with advanced logistics information and management capabilities, including rapid access to real-time resources status information, proactive problem identification, decision support, and process tracking. Begin to assess and develop technology to automatically collect and update critical information required to effectively manage logistics resources in support of combat operations. </div> <div style="margin-bottom: 10px;"> (U) \$1,557 Develop and demonstrate advanced job performance aiding technologies to enhance the utility of Air Mobility Command's (AMC) command and control systems. These technologies will provide command and control operators with automated access to integrated, decision-quality data from multiple sources and thus support faster, more accurate decision-making and problem resolution during mobility operations. Develop artificial intelligence software, work-centered collaborative planning tools, and advanced decision support technologies to augment AMC's command and control systems. </div> <div style="margin-bottom: 10px;"> (U) \$11,569 Total </div> <div style="margin-bottom: 10px;"> (U) <u>B. Project Change Summary</u> Not Applicable. </div> <div style="margin-bottom: 10px;"> (U) <u>C. Other Program Funding Summary (\$ in Thousands)</u> </div> <div style="margin-bottom: 10px;"> (U) Related Activities: </div> <div style="margin-bottom: 10px;"> (U) PE 0602201F, Aerospace Flight Dynamics. </div> <div style="margin-bottom: 10px;"> (U) PE 0602202F, Human Effectiveness Applied Research. </div> <div style="margin-bottom: 10px;"> (U) PE 0603721N, Environmental Protection. </div> <div style="margin-bottom: 10px;"> (U) PE 0604708F, Civil, Fire, Environmental, Shelter. </div> <div style="margin-bottom: 10px;"> (U) PE 0604740F, Integrated Command and Control Applications. </div> <div style="margin-bottom: 10px;"> (U) PE 0605801A, Programwide Activities. </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> Project 4923 Page 13 of 22 Pages Exhibit R-2A (PE 0603231F) </div>		

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<p>(U) <u>C. Other Program Funding Summary (\$ in Thousands)</u></p> <p>(U) PE 0708011F, Industrial Preparedness.</p> <p>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> <p>(U) <u>D. Acquisition Strategy</u></p> <p>Not Applicable.</p> <p>(U) <u>E. Schedule Profile</u></p> <p>(U) Not Applicable.</p>		
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03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and Personnel Protection
Technology

PROJECT

4924

COST (\$ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
4924 Distributed Mission Training Technology	5,750	7,369	6,530	7,239	7,179	7,176	7,284	7,386	Continuing	TBD

(U) **A. Mission Description**

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, command and control, 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 this global battlespace requires advances in training systems, interconnection, information, visual, and representation technologies. The resulting mission training and rehearsal capabilities will enhance the mission essential competencies of the combat and combat support individuals and teams that comprise the aerospace force.

(U) **FY 2002 (\$ in Thousands)**

- (U) \$0 Accomplishments/Planned Program
- (U) \$1,728 Advanced warfighter training capabilities by developing and demonstrating representational technologies and training techniques for integrated aerospace operations training, which includes training for aerospace, command and control, force protection, and warfighters. Techniques developed will increase fidelity of mission training and rehearsal systems, reduce the learning time for new operators, sustain critical mission competencies, and ensure that deployed personnel have the knowledge and skills to accomplish their mission. Demonstrated training benefits of distributed mission training technology for fighter aircraft individual flying skills, fighter weapons school, and aircrew training program. Completed development of a tactical decision trainer for security forces. Began development of data capturing tools for crew and team performance assessment in both simulator and field environments. Designed and developed technologies for realistic databases and electronic combat simulators.
- (U) \$875 Developed and demonstrated the application of information and communications technologies for realistic mission training and mission rehearsal in a distributed simulation environment. These technologies will increase readiness training by enabling more realistic employment of weapon systems within a horizontally and vertically integrated system of sensors, command and control, and weapons platforms. Designed a communication bridge to enable virtual simulators, operating at different security levels, to interact with one another in a real-time simulation environment. Developed and demonstrated enhancements to the High-Level Architecture that will enable more rapid development of simulator federations and enhanced simulator performance. Developed a testbed for command and control training research with links to existing

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		PROJECT 4924
(U)	<u>A. Mission Description Continued</u>	
(U)	<u>FY 2002 (\$ in Thousands) Continued</u>	
	command and control centers. Evaluated techniques for integrating operational command and control systems into the Distributed Mission Training (DMT) environment.	
(U)	\$1,393	Demonstrated advances in simulator visual system technologies through the development of high-fidelity image generation, display, and databases. Advanced visual systems will provide operators greater visual definition to identify other aircraft, ground vehicles, roads, and bridges at realistic tactical ranges or to properly assess their aspect angle, increasing mission rehearsal capability for the warfighter. Continued development of a PC-based, high resolution, real-time image generator. Continued development of an ultrahigh resolution laser projector for DMT simulators.
(U)	\$1,754	Developed and demonstrated technologies for high-fidelity Night Vision Goggle (NVG) simulation to support and increase mission training, preview, and rehearsal capabilities. This development will reduce the cost of initial NVG qualification, allow for effective advanced night operation mission pretraining prior to in-aircraft training, and increase combat training realism by adding simulated weather, seasonal, and environmental changes. Tested the use of an automated material classification toolset for rapid build of multi-spectral databases. This toolset increased the capability to rapidly respond to world changes with realistic visualization of the new or changing operating areas. Evaluated effectiveness of on-line NVG and laser courseware, and assessed impact of these technologies on mission effectiveness and risk management.
(U)	\$5,750	Total
(U)	<u>FY 2003 (\$ in Thousands)</u>	
(U)	\$0	Accomplishments/Planned Program
(U)	\$2,731	Advance warfighter training capabilities by developing and demonstrating representational technologies and simulation techniques for integrated training and rehearsal, which includes training for aerospace operations, command and control, force protection, and air base defense warfighters. Develop and validate training technologies and methods to enable deployed personnel to maintain mission essential skills. Implement and evaluate the next generation threat system in DMT testbed, while integrating with multi-hyperspectral and weather databases. Develop functional requirements for hyperspectral databases to support realistic sensor simulation.
(U)	\$766	Develop and demonstrate the application of information and communications technologies for realistic mission training and mission rehearsal in a distributed simulation environment. These technologies will increase readiness training by enabling more realistic employment of weapon systems within a horizontally and vertically integrated system of sensors, command and control, and weapons platforms. Demonstrate the capability to establish a High-Level Architecture (HLA) federation that provides aircrew and command and control training to geographically separate audiences. Demonstrate an HLA federation operating at multiple security levels.
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<div style="margin-bottom: 10px;"> (U) <u>A. Mission Description Continued</u> </div> <div style="margin-bottom: 10px;"> (U) <u>FY 2003 (\$ in Thousands) Continued</u> </div> <div style="margin-bottom: 10px;"> (U) \$1,768 Demonstrate advances in simulator visual system technologies through the development of high-fidelity image generator display, components, and databases. Advanced visual systems will provide operators enhanced cueing in simulated high-definition immersive environments and greater visual detail to identify other aircraft, ground vehicles, roads, and bridges at realistic tactical ranges, thus increasing mission rehearsal capability for the warfighter. Develop and demonstrate less expensive, thin-film holographic collimating display components for the simulator. Develop and demonstrate a proof-of-concept ultrahigh resolution, color laser projector. Integrate and evaluate high bandwidth PC-based image generator with high resolution laser projector. </div> <div style="margin-bottom: 10px;"> (U) \$2,104 Develop and demonstrate technologies for night vision device training and high-fidelity Night Vision Goggle (NVG) simulation. This development will reduce the cost of initial NVG qualification and increase combat training realism. Complete generic NVG simulation and generic Forward Looking Infrared simulation using the same tools used for NVG functionality, allowing for high-fidelity, completely correlated visible and sensor simulation imagery. Develop proof-of-concept for dual mode, covert and overt, external aircraft lighting for fighter aircraft. Complete digital conversion of introductory and instructor courseware. Evaluate simulator-based training scenarios for initial qualification, spatial orientation, and advanced combat night operations. </div> <div style="margin-bottom: 10px;"> (U) \$7,369 Total </div> <div style="margin-bottom: 10px;"> (U) <u>FY 2004 (\$ in Thousands)</u> </div> <div style="margin-bottom: 10px;"> (U) \$0 Accomplishments/Planned Program </div> <div style="margin-bottom: 10px;"> (U) \$1,277 Advance integrated warfighter training and rehearsal technologies for aerospace operations, command and control, force protection, and air base defense warfighters. Increase training effectiveness and efficiency, and decrease time to mission qualification. Develop mission essential competency analysis toolset for air superiority that identifies those critical knowledge, skills, and experiences that are important enablers of mission performance for individuals and teams. Develop specifications for virtual and live training performance assessment and measurement to enable deployed personnel to maintain mission essential skills, and develop training and simulation technologies that will enable integrated command and control training within the distributed mission training environment. Demonstrate competency-based design of a simulator performance measurement and tracking system, and develop a stand-alone performance monitoring and tracking capability for live-fly instrumented range data. </div> <div style="margin-bottom: 10px;"> (U) \$943 Develop and demonstrate the application of information and communications technologies for realistic mission training and mission rehearsal in a distributed simulation environment. These technologies will increase readiness training by enabling more realistic employment of weapon systems within a horizontally and vertically integrated system of sensors, command and control, and weapons platforms. Demonstrate a </div>		
Project 4924		Exhibit R-2A (PE 0603231F)

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<div style="margin-bottom: 10px;"> (U) <u>A. Mission Description Continued</u> </div> <div style="margin-bottom: 10px;"> (U) <u>FY 2004 (\$ in Thousands) Continued</u> </div> <div style="margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">(U) \$1,800</div> <div style="width: 85%;"> near-real-time High-Level Architecture (HLA) based training environment enabling aircrew and command and control training for geographically separated training audiences. Validate performance of an HLA network guard federation operating at multiple security levels and produce documentation to support certification and accreditation. </div> </div> </div> <div style="margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">(U) \$1,623</div> <div style="width: 85%;"> Demonstrate advances in simulator visual system technologies through the development of ultrahigh resolution projection systems, low-cost high-fidelity image generator, and thin-film holographic collimating display technologies. Technologies will create high-definition immersive virtual environment for aircrew readiness training and mission rehearsal, increasing mission rehearsal capability for the warfighter. Fabricate and evaluate efficient, full-size, thin-film holographic collimating screen materials. Develop a 5120 x 4096 pixel low cost PC-based image generator. </div> </div> </div> <div style="margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">(U) \$887</div> <div style="width: 85%;"> Advance warfighter integrated training and rehearsal for aerospace operations, command and control, force protection, and air base defense warfighters. Technologies will increase training effectiveness and efficiency, and decrease time to mission qualification. Develop a sample database using hyperspectral imagery to test alternative data storage and real-time run formats. Model advanced radio frequency threats, infrared threats, and countermeasures and incorporate into the distributed mission training research testbed threat system. Incorporate performance characteristics of the panoramic night vision goggle (NVG) into the testbed's existing NVG simulation model. </div> </div> </div> <div style="margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">(U) \$6,530</div> <div style="width: 85%;"> Develop and demonstrate a high-fidelity distributed mission operations training and rehearsal capability for operators in an Air Operations Center (AOC). Link AOC operational mission requirements and principles of instruction to enable effective and efficient training at both the AOC Formal Training Unit and the operational units. Develop specifications, strategies, and methods for individual-, team-, and division-level training and rehearsal within an AOC. Develop preliminary guidelines and metrics for assessing mission readiness levels for AOC members. </div> </div> </div> <div style="margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">(U) \$6,530</div> <div style="width: 85%;">Total</div> </div> </div> <div style="margin-bottom: 10px;"> (U) <u>B. Project Change Summary</u> Not Applicable. </div> <div style="margin-bottom: 10px;"> (U) <u>C. Other Program Funding Summary (\$ in Thousands)</u> </div> <div style="margin-bottom: 10px;"> (U) Related Activities: </div> <div style="margin-bottom: 10px;"> (U) PE 0602202F, Human Effectiveness Applied Research. </div> <div style="margin-bottom: 10px;"> (U) PE 0604227F, Distributed Mission Training. </div> <div style="margin-bottom: 10px;"> (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication. </div>		
<div style="display: flex; justify-content: space-between;"> <div>Project 4924</div> <div>Page 18 of 22 Pages</div> <div>Exhibit R-2A (PE 0603231F)</div> </div>		

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<p>(U) <u>D. Acquisition Strategy</u> Not Applicable.</p> <p>(U) <u>E. Schedule Profile</u> (U) Not Applicable.</p>		
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BUDGET ACTIVITY

03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and Personnel Protection
Technology

PROJECT

5020

COST (\$ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
5020 Directed Energy Protective Systems	0	9,015	2,846	3,895	2,963	3,162	3,210	3,255	Continuing	TBD

Note: In FY 2003, the Directed Energy Protective Systems program at Brooks City-Base, TX, will move from Project 3257 to Project 5020 to align resources with the Air Force Research Laboratory organization.

(U) **A. Mission Description**

This project develops and demonstrates advanced technologies for Laser Eye Protection (LEP) and for assuring safety of personnel involved with test, deployment, and operation of high-energy laser weapons and systems. The project develops technologies to provide protection against laser threats and hazards, without compromising performance, vigilance, and mission effectiveness. It also develops tools and guidelines for testing and deploying high-energy laser systems and technologies to enhance personnel safety and effectiveness in aerospace operations and increase Air Expeditionary Force deployability through innovative on-board oxygen generation capabilities for cargo aircraft.

(U) **FY 2002 (\$ in Thousands)**

(U) \$0 Accomplishments/Planned Program
 (U) \$0 FY 2002 activity reported in PE 0603231F, Project 3257.
 (U) \$0 Total

(U) **FY 2003 (\$ in Thousands)**

(U) \$0 Accomplishments/Planned Program
 (U) \$1,470 Develop and demonstrate LEP technologies in the form of spectacles and visors for aircrew and ground personnel to provide protection from lasers while minimizing negative impacts on vision. Complete evaluation of protective performance, visual acuity impacts, life support equipment compatibility, and aircrew acceptability of next-generation LEP, designed to provide acceptable visual performance while protecting against a second laser in the visible spectrum. Develop and demonstrate LEP for air-based laser platforms and for special operations teams. Demonstrate and evaluate LEP with vision corrective prescriptions. Accelerate operational utility evaluations of prescription-capable LEP and include first response capability to 'pop-up' laser threats.
 (U) \$1,312 Develop and demonstrate agile LEP technologies for aircrew and ground personnel that will provide a single device that can be used by all aircrew for protection against any laser hazard or threat. Continue development and demonstration of LEP with laser hardened night vision goggles. Continue design, development, and evaluation of a Laser Familiarization Program for warfighters toward integration with Distributed

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PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology		
(U)	<u>A. Mission Description Continued</u>	
(U)	<u>FY 2003 (\$ in Thousands) Continued</u>	
	Mission Training system. Continue supporting development and evaluation of a Laser Detector and Warning system toward integration into aircraft cockpits and with agile Laser Eye Protection (LEP).	
(U) \$711	Develop and demonstrate technologies that permit safe testing, deployment, and use of high-energy laser weapons and systems. Begin integration of probabilistic risk assessment technology into laser range hazard assessment tools for use by test ranges with high-energy laser weapon systems, including airborne laser flight tests. Continue to evaluate the biological effects of high-energy laser systems. Conduct damage threshold studies on short pulse (sub-microsecond) high-energy laser pulses. Continue to evaluate the biological effects of non-lethal laser weapons.	
(U) \$3,451	Design, fabricate, and test a palletized advanced technology demonstrator for on-board production of oxygen and nitrogen for airlift aircraft. Technology will increase the availability of high-purity nitrogen gas for fuel tank inerting; provide high-purity oxygen for aircrew, paratrooper, and patient life support; and reduce aircraft dependency on the costly and extensive deployment footprint of liquid oxygen. Fabricate and test a cryocooler for liquefaction of nitrogen and oxygen from compressed air, and produce a detailed aircraft integration plan for the palletized system.	
(U) \$2,071	Develop technologies to counter warfighter fatigue, identify and neutralize biological agents, and reduce casualties and attrition in special operations training and operations.	
(U) \$9,015	Total	
(U)	<u>FY 2004 (\$ in Thousands)</u>	
(U) \$0	Accomplishments/Planned Program	
(U) \$370	Develop and demonstrate LEP technologies in the form of spectacles and visors for aircrew and ground personnel to provide protection from lasers while minimizing negative impacts on vision. Begin design and development of a laser protective visor compatible with Night Vision Goggles (NVG). Continue demonstration and evaluation of LEP for air-based laser platforms. Evaluate protective performance, visual acuity impacts, equipment compatibility, and user acceptability of LEP for special operations teams. Transition technology for vision corrective prescription LEP, and for wide-band, near-infrared, and two visible laser line protection.	
(U) \$1,600	Develop and demonstrate agile LEP technologies for aircrew. Begin evaluating and integrating optical limiters, tunable liquid crystals, photochromic and electrochromic materials, reflective technologies, and advanced dyes toward demonstration of agile LEP. Continue development, integration, and evaluation of LEP spectacles with laser hardened NVGs. Continue supporting development and evaluation of a Laser Detector and Warning system toward integration into aircraft cockpits and agile LEP. Continue development and evaluation of a Laser Familiarization Program for warfighters toward integration with Distributed Mission Training system.	
Project 5020		Exhibit R-2A (PE 0603231F)

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BUDGET ACTIVITY

03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603231F Crew Systems and Personnel Protection
Technology

PROJECT

5020

(U) **A. Mission Description Continued**(U) **FY 2004 (\$ in Thousands) Continued**

(U) \$876 Develop and demonstrate technologies that permit safe testing, deployment, and use of high-energy laser weapons and systems. Release version 2.0 of Laser Range Safety Tool (LRST) and complete integration with laser test range personnel to permit rapid analysis of high energy laser test operations. Integrate laser bioeffects data to refine laser safety parameters for computer code supporting LRST. Refine software damage models for high-energy laser weapons based on bioeffects studies and field test measurements.

(U) \$2,846 Total

(U) **B. Project Change Summary**

Not Applicable.

(U) **C. Other Program Funding Summary (\$ in Thousands)**

(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) **D. Acquisition Strategy**

Not Applicable.

(U) **E. Schedule Profile**

(U) Not Applicable.