

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

DATE

February 2000

BUDGET ACTIVITY

03 - Advanced Technology Development

PE NUMBER AND TITLE

0603231F Crew Systems and Personnel Protection Technology

COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	28,372	30,953	12,479	13,157	14,901	15,170	17,470	Continuing	TBD
632830 Crewstations, Life Support, and Escape	11,404	20,057	5,841	6,884	8,298	8,435	8,671	Continuing	TBD
633257 Helmet-Mounted Sensory Technologies	16,968	10,896	6,638	6,273	6,603	6,735	8,799	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

(U) A. Mission Description

This program develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments. Specific projects advance and integrate human factors technologies into crew workstation, command center, life support, and protective equipment designs. Technologies encompass the development and demonstration of escape system flight control and life protection devices for high-speed and low-altitude, adverse-attitude flight regimes to include those derived from the Russian ejection seat (U.S. - Russian cooperation). Life support technology improvements principally focus on protecting aircrew from effects of altitude and G-forces in high performance aircraft and adjusting specifications of existing equipment to accommodate the increasing operational envelope and a more diversified population of aircrew members. Technologies demonstrated will improve the ability to quantify the effects of human performance on mission effectiveness, improvements due to crew system automation, and allow for interaction of critical human performance data and constructive analysis in simulation. Multi-sensory command and control technologies will be demonstrated to reduce data overload and improve information use. Models of human perception, cognitive functions, and goal-oriented decision making will be developed and applied to improve operator performance in high workload environments, facilitate battlespace situational awareness, decrease response time to critical situations, and support coordinated performance in a distributed, collaborative environment. Helmet-mounted trackers and displays will incorporate advanced technology for target detection, identification, sighting, and weapons firing. Improved helmet-mounted night vision device capabilities and laser eye protection capabilities will be incorporated to address the operational limitations of fighting at night and in hazardous laser environments. Note: In FY 2000, Congress added \$1.5 million for Panoramic Night Vision Goggles, \$3.0 million for High-Brightness Helmet-Mounted Visual Systems Components and Mini-Cathode Ray Tube, and \$12.0 million for Ejection Seats, which explains the perceived decrease in FY 2001 and out.

(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.

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(U) <u>C. Program Change Summary (\$ in Thousands)</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>Total Cost</u>
(U) Previous President's Budget (FY 2000 PBR)	29,818	14,841	15,276	TBD
(U) Appropriated Value	30,053	31,341		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-235	-11		
b. Small Business Innovative Research	-977			
c. Omnibus or Other Above Threshold Reprogram		-170		
d. Below Threshold Reprogram	-310			
e. Rescissions	-159	-207		
f. Other				TBD
(U) Adjustments to Budget Years Since FY 2000 PBR			-2,797	
(U) Current Budget Submit/FY 2001 PBR	28,372	30,953	12,479	TBD
(U) <u>Significant Program Changes:</u>				
Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.				

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							DATE February 2000			
BUDGET ACTIVITY 03 - Advanced Technology Development				PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology				PROJECT 632830		
COST (\$ in Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
632830	Crewstations, Life Support, and Escape	11,404	20,057	5,841	6,884	8,298	8,435	8,671	Continuing	TBD
<p>(U) <u>A. Mission Description</u> This project provides technology to improve operator combat performance; develop rigorous, traceable human-centered design tools; protect aircrews from physiological stresses such as high altitude, high G-forces, high temperature, and aerodynamic forces; and reduce aircrew fatalities and major injuries in emergency ejections at high-speed and at low-altitude, adverse-attitude flight conditions, while improving supportability, affordability, and accommodating the full range of the pilot population.</p> <p>(U) <u>FY 1999 (\$ in Thousands)</u></p> <p>(U) \$1,820 Continued to develop a simulation-based testbed to quantify crew performance requirements, streamline design, and reduce cost/risk of crew system acquisition. Began to develop a human performance model linking crew performance with predicted mission outcome.</p> <p>(U) \$7,820 Developed and demonstrated subsystems to protect the aircrew member during emergency ejections in current and future high performance fighter aircraft, including reducing the science and technology risks associated with adapting the Russian K-36D-3.5A lightweight ejection seat to U.S. aircraft.</p> <p>(U) \$1,764 Completed development and demonstration of advanced hybrid oxygen technologies for aeromedical applications and finalized design of multi-mission oxygen system technology for transport aircraft.</p> <p>(U) \$11,404 Total</p> <p>(U) <u>FY 2000 (\$ in Thousands)</u></p> <p>(U) \$1,854 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 clear accountability in design. Begin to integrate simulation software combining a human operator model with a representative weapon system simulation. Demonstrate the ability to quantify crew system requirements for a tactical attack mission by comparing measured man-in-the-loop performance data with model projections.</p> <p>(U) \$1,910 Develop and demonstrate subsystems to protect the aircrew member during emergency ejection in current and future high performance fighter aircraft. Provide improved head and neck protection by demonstrating a modification to both the Air Force and Navy helmet and/or visor that will allow the current inventory HGU-55/P and HGU-85/P helmets to be safely retained up to 600 knots equivalent airspeed (KEAS) and demonstrate the effectiveness of the design in ejection seat tests.</p>										
Project 632830			Page 3 of 8 Pages				Exhibit R-2A (PE 0603231F)			

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BUDGET ACTIVITY 03 - Advanced Technology Development		PROJECT 632830
PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology		
(U)	<u>A. Mission Description Continued</u>	
(U)	<u>FY 2000 (\$ in Thousands) Continued</u>	
(U)	\$3,950	Develop and demonstrate subsystems to reduce the science and technology risks associated with adapting the Russian K-36D-3.5A lightweight ejection seat for potential use in future high performance fighter aircraft. Complete redesign of energetics and electronics using U.S. sources and conduct verification tests. Conduct fighter aircraft integration risk reduction study.
(U)	\$11,849	Develop a set of common ejection seat characteristics and qualification criteria consistent with joint Air Force/Navy requirements. Initiate a program to lead to the development of fully qualified ejection seats that can compete for installation into fighter aircraft and other current/future aircraft.
(U)	\$494	Develop and demonstrate advanced, user-tailored information management and portrayal technologies that enhance battlespace situational awareness for global-level and MAJCOM-level information operation centers to reduce decision-making bottlenecks. Perform task analysis of information operations center and develop measures of performance and effectiveness. Begin to develop visualizations promoting battlespace situational awareness.
(U)	\$20,057	Total
(U)	<u>FY 2001 (\$ in Thousands)</u>	
(U)	\$1,958	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 clear accountability in design. Complete development of simulation software and demonstrate integration with human operator models using the High-Level Architecture. Complete a functional specification for using the modeling technology in a simulation-based testbed that supports establishing objective, performance-based crew system requirements.
(U)	\$3,133	Develop and demonstrate subsystems to protect the aircrew member during combat and emergency operations in current and future aircraft. Demonstrate life support technologies to address specific deficiencies observed in recent combat operations. Decrease risk of major injuries and fatalities for crewmembers, regardless of gender, ejecting at higher airspeeds while wearing Helmet Mounted Devices (HMD) by developing head, neck, and eye protection for HMD technology during high-speed escape to 700 Knots Equivalent Air Speed.
(U)	\$750	Develop and demonstrate advanced, user-tailored information management and portrayal technologies that enhance battlespace situational awareness for global-level and MAJCOM-level information operation centers to reduce decision-making bottlenecks. Continue to develop user-tailored visualizations promoting battlespace situational awareness. Demonstrate the capability for effective, time-critical information exchange operations between MAJCOM Network Operations and Security Centers.
(U)	\$5,841	Total
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BUDGET ACTIVITY

03 - Advanced Technology Development

PE NUMBER AND TITLE

0603231F Crew Systems and Personnel Protection
Technology

PROJECT

632830

(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 0604703F, Aeromedical/Casualty Care Systems Development.

(U) PE 0604706F, Life Support Systems.

(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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BUDGET ACTIVITY 03 - Advanced Technology Development				PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology				PROJECT 633257		
COST (\$ in Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
633257	Helmet-Mounted Sensory Technologies	16,968	10,896	6,638	6,273	6,603	6,735	8,799	Continuing	TBD
<p>(U) <u>A. Mission Description</u> This project develops and demonstrates advanced helmet-mounted subsystem technologies to improve mission effectiveness and pilot situational awareness during day and night missions in all-weather conditions. Through the development of advanced helmet-mounted tracker and display (HMT/D) technologies, pilots will be able to detect, identify, target, and launch weapons faster and more accurately. This project develops technology for improved aircrew night vision goggles (NVG) to enhance aerial combat capabilities at night. It also develops technologies to protect against lasers and methods to evaluate the biological effects of laser weapons and high-energy laser systems.</p> <p>(U) <u>FY 1999 (\$ in Thousands)</u></p> <p>(U) \$8,374 Developed and demonstrated HMT/D and subsystem technologies. Demonstrated uncoated visor technologies to reduce life cycle costs of HMT/Ds, initiated design of inertial head tracker, demonstrated high-resolution miniature flat image source to replace CRT, and developed and evaluated improved symbology stabilization algorithm for Joint Helmet Mounted Cueing System (JHMCS).</p> <p>(U) \$3,321 Initiated operational utility evaluation of panoramic night vision goggles (PNVGs) with symbology overlay on fighter aircraft for night time air-to-air and strike missions.</p> <p>(U) \$5,273 Continued to develop and demonstrate laser eye protection (LEP) technologies and susceptibility models, completed flight test of dielectric stack technology and incorporated real-time atmospheric models into Laser Threat Analysis System to provide more accurate threat and hazard projection. Delivered LEP prototype for airborne laser program, developed reflectivity analysis tool to evaluate high-energy laser hazard, and initiated Laser Range Safety Tool verification and validation.</p> <p>(U) \$16,968 Total</p> <p>(U) <u>FY 2000 (\$ in Thousands)</u></p> <p>(U) \$5,624 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 launch weapons faster and more accurately. Integrate and demonstrate HMT/D with LEP visors and spectacles. Continue to develop and demonstrate Fighter Data Link symbology on HMT/D, and pre-planned product improvement technologies for JHMCS. Continue to develop and demonstrate a high-luminance, high-resolution, low-voltage Active Matrix Organic Light Emitting Diode image source, color symbology, and an inertial head-mounted tracker.</p> <p>(U) \$3,982 Develop and demonstrate technologies for improved aircrew night vision goggles to increase mission effectiveness and enhance air operations by</p>										
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BUDGET ACTIVITY 03 - Advanced Technology Development		PROJECT 633257
PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology		
(U)	<u>A. Mission Description Continued</u>	
(U)	<u>FY 2000 (\$ in Thousands) Continued</u>	
	allowing the pilot to perform daytime tactics at night. Continue to develop miniature image sources and smaller format filmless image intensifier tubes, to afford aircrew members a wider field-of-view, improved low-light level resolution, and reduced halo. Continue to evaluate the operational utility of panoramic night vision goggles (PNVGs) with symbology overlay. Demonstrate insertion of imagery into the PNVG in the laboratory.	
(U)	\$1,290	Develop and demonstrate technologies that counter the laser threat, and permit the deployment and use of high-energy laser weapons. Evaluate the biological effects of laser weapons and high-energy laser systems. Complete human factors evaluation of dielectric stack and dye/dielectric stack technologies for laser eye protection against infrared and selected visible laser wavelengths. Develop automated laser eye protection device evaluation system for economically validating reproducibility of manufacturing processes. Continue integration of Laser Threat Analysis System with Air Force mission support system. Initiate development of Laser Range Safety Tool for missile Test Range to support flight test of airborne laser and other high-energy laser systems.
(U)	\$10,896	Total
(U)	<u>FY 2001 (\$ in Thousands)</u>	
(U)	\$3,129	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 launch weapons faster and more accurately. Develop and demonstrate the utility of color symbology on HMT/D. Integrate and demonstrate a miniature flat display to replace cathode ray tubes in HMT/Ds. Integrate an HMT/D into the air-to-ground strike mission.
(U)	\$2,183	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. Continue to develop 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. Integrate and evaluate laser eye protection technologies with PNVG. Demonstrate imagery insertion on PNVG in flight test.
(U)	\$1,326	Develop and demonstrate technologies that counter the laser threat, and permit the deployment and use of high-energy laser weapons. Continue to evaluate the biological effects of laser weapons and high-energy laser systems. Initiate human factors evaluation of rugate, and hologram technologies for infrared and visible laser eye protection. Begin integration of Laser Threat Analysis System with Laser Warning Receiver technologies, and incorporate Laser Threat Module into Air Force Mission Support System. Deliver Laser Range Safety Tool to missile test ranges to support flight testing of airborne laser and other high-energy laser systems.
(U)	\$6,638	Total
Project 633257		

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems and Personnel Protection Technology	PROJECT 633257
<p>(U) <u>B. Project Change Summary</u> Not Applicable.</p> <p>(U) <u>C. Other Program Funding Summary (\$ in Thousands)</u> (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. (U) PE 0604706F, Life Support Systems. (U) PE 0604201F, Common Avionics Planning/Development. (U) PE 0207130F, F-15 Squadrons. (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> <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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