

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1999
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology
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COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	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	28,052	29,818	14,841	15,276	14,661	15,033	15,317	17,658	Continuing	Continuing
2830 Crew Workstations, Life Support, and Escape	12,667	12,086	8,312	8,590	8,165	8,372	8,517	8,764	Continuing	Continuing
3257 Helmet-Mounted Sensory Technologies	15,385	17,732	6,529	6,686	6,496	6,661	6,800	8,894	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

(U) A. Mission Description: This Advanced Technology Development program develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments. Specific projects within this PE advance and integrate human factors technologies into crew workstation, 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). Improves life support technologies principally focused 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. Technology for an advanced on-board oxygen generation system for transport aircraft will be demonstrated to alleviate the logistics burden of current liquid oxygen systems that require ground-based oxygen generation plants. Technologies improve the ability to quantify crew system automation and information cognition requirements through data from constructive analysis and real-time distributed simulation. Models of human perception and knowledge of cognitive function are developed and applied to improve operator performance in high workload environments. Technologies will be developed that will incorporate advanced helmet-mounted capability tracker and displays for target detection, identification, sighting, and weapons firing. Improved helmet-mounted night vision device capability and laser eye protection capability will be incorporated to address the operational limitations of fighting at night and in hazardous laser environments. Note: Congress added \$13.45 million in FY 1999 for ejection seat technology (\$2 million), helmet display technology (\$5 million), panoramic night vision goggles (\$2.2 million), and laser-eye protection (\$4.25 million), which explains the perceived decrease in FY 2000 and out.

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BUDGET ACTIVITY 3 - Advanced Technology Development			PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology																																																														
<p>(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.</p> <p>(U) C. Program Change Summary (\$ in Thousands):</p> <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:40%;"></th> <th style="text-align: right;"><u>FY 1998</u></th> <th style="text-align: right;"><u>FY 1999</u></th> <th style="text-align: right;"><u>FY 2000</u></th> <th style="text-align: right;"><u>FY 2001</u></th> <th style="text-align: right;"><u>Total</u></th> </tr> </thead> <tbody> <tr> <td>(U) Previous President's Budget /FY 1999 PB</td> <td style="text-align: right;">24,881</td> <td style="text-align: right;">16,603</td> <td style="text-align: right;">17,356</td> <td style="text-align: right;">18,267</td> <td style="text-align: right;">Cont</td> </tr> <tr> <td>(U) Appropriated Value</td> <td style="text-align: right;">26,204</td> <td style="text-align: right;">30,053</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(U) Adjustments to Appropriated Value</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td> a. Congressional/General Reductions</td> <td style="text-align: right;">-959</td> <td style="text-align: right;">-235</td> <td></td> <td></td> <td></td> </tr> <tr> <td> b. SBIR</td> <td style="text-align: right;">-649</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td> c. Omnibus/Other Above Threshold Reprogrammings</td> <td style="text-align: right;">4,732</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td> d. Below Threshold Reprogrammings</td> <td style="text-align: right;">-1,276</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>(U) Adjustments to Budget Year Since FY 1999 PB</td> <td></td> <td></td> <td style="text-align: right;">-2,515</td> <td style="text-align: right;">-2,991</td> <td></td> </tr> <tr> <td>(U) Current Budget Submit/FY 2000 PB</td> <td style="text-align: right;">28,052</td> <td style="text-align: right;">29,818</td> <td style="text-align: right;">14,841</td> <td style="text-align: right;">15,276</td> <td style="text-align: right;">Cont</td> </tr> </tbody> </table> <p>(U) Significant Program Changes: The Above Threshold Reprogramming in FY 1998 is for a Congressional add for the Wallace-Kettering Neurosciences Institute. Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.</p> <p>FY 1999: \$977 identified as a source for SBIR.</p>							<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>Total</u>	(U) Previous President's Budget /FY 1999 PB	24,881	16,603	17,356	18,267	Cont	(U) Appropriated Value	26,204	30,053				(U) Adjustments to Appropriated Value						a. Congressional/General Reductions	-959	-235				b. SBIR	-649					c. Omnibus/Other Above Threshold Reprogrammings	4,732					d. Below Threshold Reprogrammings	-1,276					(U) Adjustments to Budget Year Since FY 1999 PB			-2,515	-2,991		(U) Current Budget Submit/FY 2000 PB	28,052	29,818	14,841	15,276	Cont
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection					PROJECT 2830	
				Technology						
<i>COST (\$ In Thousands)</i>	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2830 Crew Workstations, Life Support, and Escape	12,667	12,086	8,312	8,590	8,165	8,372	8,517	8,764	Continuing	Continuing
<p>(U) A. Mission Description: 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) FY 1998 (\$ in Thousands):</p> <ul style="list-style-type: none"> - (U) \$ 1,245 Developed concept for quantifying future crew system performance requirements with a simulation-based testbed to streamline design and reduce cost/risk of crew system acquisition. - (U) \$ 9,873 Demonstrated advanced escape technologies to reduce aircrew fatalities and major injuries in emergency ejections during high-speed and low altitude, adverse attitude flight conditions, including reducing the science and technology risks associated with adapting the Russian K-36D-3.5A lightweight ejection seat to U.S. aircraft. - (U) \$ 1,304 Demonstrated advanced hybrid oxygen technologies for aeromedical operations. - (U) \$ 245 Developed and demonstrated custom oxygen mask advanced technology for high-G and high altitude operations. - (U) \$12,667 Total <p>(U) FY 1999 (\$ in Thousands):</p> <ul style="list-style-type: none"> - (U) \$ 1,882 Continue to develop a simulation-based testbed to quantify crew performance requirements, streamline design, and reduce cost/risk of crew system acquisition. Begin to develop a human performance model linking crew performance with predicted mission outcome. - (U) \$ 7,808 Develop and demonstrate 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. - (U) \$ 2,000 Finalize design of advanced hybrid oxygen technologies for transport aircraft. - (U) \$ 396 Identified as a source for SBIR. - (U) \$12,086 Total 										
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology	PROJECT 2830
<p>(U) <u>FY 2000 (\$ in Thousands):</u></p> <ul style="list-style-type: none"> - (U) \$ 1,872 Continue to develop a simulation-based testbed to quantify crew performance requirements, streamline design, reduce cost/risk of crew system acquisition, demonstrate the ability to quantify crew performance requirements for a tactical attack mission, and analyze the potential for space support missions. - (U) \$ 2,440 Develop and demonstrate subsystems to protect the aircrew member during emergency ejection in current and future high performance fighter aircraft. - (U) \$ 4,000 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. - (U) \$ 8,312 Total <p>(U) <u>FY 2001 (\$ in Thousands):</u></p> <ul style="list-style-type: none"> - (U) \$ 1,717 Complete functional specification for a simulation-based testbed to quantify crew performance requirements, streamline design, and reduce cost/risk of crew system acquisition. Demonstrate the ability to quantify crew performance requirements for space support missions. - (U) \$ 2,573 Continue to demonstrate subsystems to protect the aircrew member during emergency ejections in current and future high performance fighter aircraft. - (U) \$ 4,300 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. - (U) \$ 8,590 Total 		
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced Technology Development	0603231F Crew Systems & Personnel Protection Technology	2830
<p>(U) B. <u>Project Change Summary - Description of Significant 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.</p> <p>(U) C. <u>Other Program Funding Summary:</u></p> <p>(U) <u>Related Activities:</u></p> <ul style="list-style-type: none">- (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. <p>(U) D. <u>Acquisition Strategy:</u> Not Applicable.</p> <p>(U) E. <u>Schedule Profile:</u> Not Applicable.</p>		
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BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Protection Technology					PROJECT 3257	
<i>COST (\$ In Thousands)</i>	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3257 Helmet-Mounted Sensory Technologies	15,385	17,732	6,529	6,686	6,496	6,661	6,800	8,894	Continuing	Continuing
<p>(U) A. Mission Description: 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. Technologies are also developed to provide protection against lasers and methods to evaluate the biological effects of laser weapons.</p> <p>(U) FY 1998 (\$ in Thousands):</p> <ul style="list-style-type: none"> – (U) \$ 3,320 Developed and demonstrated HMT/D and subsystem technologies, assessed color symbology, and evaluated eye tracker technologies. Flight demonstrated and transitioned enhanced uplook and upper aiming reticles to provide pilots with an exclusive kill zone, and demonstrated high luminance Cathode Ray Tube. – (U) \$ 2,610 To improve night operations, completed design for panoramic night vision goggle having dynamic symbol overlay and evaluated the state-of-the-art for image intensifier tube technology for NVGs. – (U) \$ 1,555 Advanced the state-of-art for advanced laser eye protection (LEP) technologies and laser susceptibility models, completed version 2 of a Laser Threat Analysis System to evaluate ground-based laser threat, completed flight test of dielectric stack technology, and evaluated technology for protection from airborne laser threats. – (U) \$ 3,000 Developed a passive matrix, high luminance, miniature, flat-panel image source technology for use in HMT/Ds. – (U) \$ 4,900 Conducted Advanced Neuroscience Interface Research program focused on advanced magnetic resonance imaging visualization and segmentation, next generation neuro-navigation, and Positron Emission Tomography (PET) biochemical imaging. All projects are collaborative research efforts focused on maximizing the effectiveness of human performance in both clinical and military settings. – (U) \$15,385 Total 										
Project 3257			<i>Page 6 of 8 Pages</i>				Exhibit R-2A (PE 0603231F)			

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3 - Advanced Technology Development	0603231F Crew Systems & Personnel Protection Technology	3257
<p>(U) <u>FY 1999 (\$ in Thousands):</u></p> <ul style="list-style-type: none"> - (U) \$ 8,019 Continue to develop and demonstrate helmet-mounted tracker and display (HMT/D) and subsystem technologies including color symbology, conduct risk reduction for the Joint Helmet-Mounted Cueing System (JHMCS) program, and document advanced air-to-air capabilities for HMT/D with High Off-Boresight Angle (HOBA) missiles. - (U) \$ 3,340 Demonstrate the operational potential of panoramic night vision goggles (PNVGs) with symbology overlay. - (U) \$ 5,792 Continue to develop and demonstrate laser eye protection (LEP) technologies and susceptibility models, and begin to integrate a Laser Threat Analysis System (LTAS) into a distributed simulation to evaluate laser, directed energy, and broadband optical threats. Develop reflectivity analysis tool to evaluate high-energy laser hazard. Complete flight test of dielectric stack technology. - (U) \$ 581 Identified as a source for SBIR. - (U) \$17,732 Total <p>(U) <u>FY 2000 (\$ in Thousands):</u></p> <ul style="list-style-type: none"> - (U) \$ 3,608 Continue to develop and demonstrate HMT/D and subsystem technologies including color symbology, pre-planned product improvement technologies for JHMCS, HMT/D with LEP visors and spectacles, and inertial head-mounted tracker. - (U) \$ 1,615 Continue to evaluate the operational potential of PNVGs with imaging sensor overlay and symbology overlay. - (U) \$ 1,306 Continue to integrate a LTAS into a distributed simulation to evaluate laser, directed energy, and broadband optical threats. Begin human factors evaluation of optical materials for frequency-agile laser eye protection. Develop Laser Range Safety Tool for high energy laser. - (U) \$ 6,529 Total <p>(U) <u>FY 2001 (\$ in Thousands):</u></p> <ul style="list-style-type: none"> - (U) \$ 4,247 Continue to develop and demonstrate HMT/D and subsystem technologies including color symbology, retrofit miniature flat displays to replace cathode ray tubes in HMT/Ds, and demonstrate HMT/D for air-to-ground missions. - (U) \$ 1,103 Evaluate LEP visors integrated with PNVGs. - (U) \$ 1,336 Deliver certified Laser Range Safety Tool for high energy lasers to flight test ranges to support airborne laser testing. Deliver laser eye protection to support airborne laser testing. Begin initial integration of LTAS with Laser Warning Receivers. Continue human factors evaluation of optical materials for frequency-agile laser eye protection. - (U) \$ 6,686 Total 		
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<p>(U) B. <u>Project Change Summary - Description of Significant 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.</p> <p>(U) C. <u>Other Program Funding Summary:</u></p> <p>(U) <u>Related Activities:</u></p> <ul style="list-style-type: none">- (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>(U) D. <u>Acquisition Strategy:</u> Not Applicable.</p> <p>(U) E. <u>Schedule Profile:</u> Not Applicable.</p>		
Project 3257	Page 8 of 8 Pages	Exhibit R-2A (PE 0603231F)