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

DATE: February 1999

BUDGET ACTIVITY: 2 - Applied Research

PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

	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	55,734	64,063	43,898	47,142	54,016	61,289	64,970	67,136	Continuing	Continuing
2401	Structures	14,939	17,407	16,728	16,959	16,876	18,703	20,407	17,448	Continuing	Continuing
2402	Vehicle Equipment	9,787	11,682	3,759	4,848	5,566	7,016	9,549	8,896	Continuing	Continuing
2403	Flight Controls and Pilot-Vehicle Interface	15,808	17,492	10,592	11,740	12,531	14,955	14,731	15,947	Continuing	Continuing
2404	Aeromechanics and Integration	14,736	16,123	11,372	12,306	18,352	18,392	18,122	22,402	Continuing	Continuing
4397	Air Base Technology	464	1,359	1,447	1,289	691	2,223	2,161	2,443	Continuing	Continuing
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

(U) A. Mission Description: This Applied Research program determines the technical feasibility of aerospace vehicle technologies in aeromechanics, structures, flight control, air vehicle-pilot interface, vehicle subsystems, and air base technologies to reduce life cycle costs and improve the performance of existing and future manned and unmanned aerospace vehicles, and the maintenance and survivability of air bases. The payoffs from these technology programs include: decreased vulnerability, and increased affordability, reliability, maintainability, and supportability for aerospace vehicles and subsystems; improved air base operations; and safe aerospace vehicle all-weather operations. Note: In FYs 1999 and out, additional emphasis has been placed on aerospace flight dynamics technologies that can be applied to prolonging the life of our aging aircraft fleet.

(U) B. Budget Activity Justification: This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary aerospace vehicle technologies.

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(U) C. Program Change Summary ($ in Thousands):

	FY 1998	FY 1999	FY 2000	FY 2001	Total Cost
(U) Previous President's Budget/FY 1999 PB	57,446	64,932	63,212	63,305	Cont
(U) Appropriated Value	60,509	64,932			
(U) Adjustments to Appropriated Value					
a. Congressional/General Reductions	-2,461	-869			
b. SBIR	-698				
c. Omnibus/Other Above Threshold Reprogrammings	-1,695				
d. Below Threshold Reprogrammings	79				
(U) Adjustments to Budget Year Since FY 1999 PB			-19,314	-16,163	
(U) Current Budget Submit/FY 2000 PB	55,734	64,063	43,898	47,142	Cont

(U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: $696 identified as a source for SBIR

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE: February 1999
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics	PROJECT: 2401

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
2401 Structures	14,939	17,407	16,728	16,959	16,876	18,703	20,407	17,448	Continuing	Continuing

(U) A. Mission Description: This project develops advanced aerospace structures; investigates new structural concepts and design techniques which exploit new materials and fabrication processes to strengthen and extend the life of manned and unmanned aerospace vehicle structures while reducing weight and cost; and develops adaptive structures that will improve operability and maintainability of aerospace vehicles.

(U) FY 1998 ($ in Thousands):

- (U) $609 Designed, developed, and tested advanced structures that incorporated distributed vibration suppression technologies for life extension and exploit wing warping, camber shaping, and adaptive structures technologies that enhance aerospace vehicle performance. These technologies included distributed vibration suppression techniques and adaptive structural concepts.
- (U) $2,288 Developed advanced structural design methods that enhanced affordability and decreased vulnerability for upgraded, derivative, and future aircraft. Design methods included assessment of advanced composite structures technologies and analytical techniques to provide design guidance for active aeroelastic wings.
- (U) $11,040 Extended usable structural lives and/or reduced costs of aging aircraft through techniques that accounted for life, risk, repairs, and dynamic loads. Technology development consisted of assessment of widespread fatigue damage and assessment of weapon bay acoustic suppression techniques.
- (U) $1,002 Improved durability for existing and future stealth vehicles structures operating in extreme environments such as temperature, noise, and vibration caused by engine exhaust which resulted in increased life and decreased cost. Improved durability resulted from assessment of high performance ceramic matrix composite technology and through active structural control concepts.
- (U) $14,939 Total

(U) FY 1999 ($ in Thousands):

- (U) $875 Continue design, development, and test of advanced structures that incorporate distributed vibration suppression technologies for life extension and exploit wing warping, camber shaping, and adaptive structures technologies that enhance air vehicle performance. Technologies under development include distributed vibration suppression techniques, and evaluation and assessment of wing twisting and control surface warping.
- (U) $1,601 Develop composite structures that enhance affordability and survivability of future aircraft. Develop fail safe design criteria for translaminar reinforced composite structures to reduce inspection and repair costs. Integrate aerodynamics, flight control, and electromagnetics (radar/infrared) analyses into multi-disciplinary structural design methods to reduce design costs and improve accuracy.

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	PROJECT 2401

– (U) $1,723 Develop multifunctional adaptive structures that sense aeromechanical loads, control structural response, and integrate subsystem functionality to reduce system level manufacturing costs and increase tactical performance of aerospace vehicles.

– (U) $11,669 Extend usable structural lives and/or reduce costs of aging aircraft with technologies that account for life, risk, repairs, and dynamic loads. Structural lives can be extended by development of bonded composite repairs of metallic structures and evaluation of techniques to assess risk of failure of structural components due to corrosion and widespread fatigue damage**.**

– (U) $1,350 Improve durability for existing and future aerospace vehicle structures by developing technologies that incorporate advanced materials as well as passive and active cooling to withstand the extreme environments of high temperatures, vibrations, and acoustic noise to reduce cost and increase life of aerospace vehicle structures. Durability technologies include advanced thermal protection systems and an integrated thermal energy management/structure design.

– (U) $ 189 Identified as a source for SBIR

– (U) $17,407 Total

(U) FY 2000 ($ in Thousands):

– (U) $840 Continue design, development, and test of advanced structures that incorporate distributed vibration suppression technologies for life extension and exploit wing warping, camber shaping, and adaptive structures technologies that enhance aerospace vehicle performance. Technologies under development include distributed vibration suppression techniques, and evaluation and assessment of wing twisting and control surface warping of manned and unmanned aerospace vehicles.

– (U) $1,511 Develop unitized composite and metallic concepts that reduce manufacturing costs of future aerospace vehicles. Verify design criteria for translaminar reinforced composites to reduce inspection and repair costs. Develop integrated multidisciplinary design methods to reduce design time.

– (U) $1,679 Continue development of multifunctional structures that tailor structural response, and integrate subsystem functionality to reduce system level manufacturing costs and increase tactical performance of future aerospace vehicles.

– (U) $10,851 Extend usable structural lives and/or reduce costs of aging aircraft, and unmanned aerospace vehicles with technologies that account for life, risk, repairs, and dynamic loads. Structural lives can be extended by development of bonded composite repairs of metallic structures and evaluation of techniques to assess risk of failure of structural components. Dynamic loads can be reduced through active suppression techniques.

– (U) $1,847 Continue durability improvements for existing and future aerospace structures by developing concepts that incorporate advanced materials as well as passive and active cooling to withstand the extreme environments of high temperatures, cryogenic temperatures, vibrations, and acoustic noise to reduce cost and increase life of aerospace vehicle structures. Durability technologies include advanced thermal protection systems, high temperature composite structures, and integrated thermal subsystems/structures.

– (U) $16,728 Total

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(U) FY 2001 ($ in Thousands):

- (U) $849 Evaluate the design of advanced structures/concepts that incorporate distributed vibration suppression technologies for life extension and exploit wing warping, camber shaping, and adaptive structures technologies that enhance aerospace vehicle performance.
- (U) $1,528 Continue development of unitized structural concepts and multidisciplinary optimization methodologies that enhance affordability and decrease vulnerability for future aerospace vehicles. Develop integrated design architecture to reduce design time and improve performance.
- (U) $1,698 Evaluate the integration of multifunctional structures that tailor structural response, and integrate subsystem functionality to reduce system level manufacturing costs and increase tactical performance of future aerospace vehicles.
- (U) $11,018 Extend usable structural lives and/or reduce costs of aging aircraft and unmanned aerospace vehicles with technologies that account for life, risk, repairs, and dynamic loads. Structural lives can be extended by development of bonded composite repairs of metallic structures, and evaluation of techniques to assess risk of failure of structural components. Dynamic loads can be reduced through active suppression techniques.
- (U) $1,866 Improve durability of existing and future aerospace vehicle structures by developing technologies that incorporate advanced materials as well as passive and active cooling to withstand the extreme environments of high temperatures, vibrations, and acoustic noise to reduce cost and increase life of aerospace vehicle structures. Concepts under development consist of design, fabrication, and assessment of high temperature composite aerospace vehicle structures.
- (U) $16,959 Total

(U) B. Project Change Summary - Description of Significant Changes: Not Applicable.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602102F, Materials.
- (U) PE 0602269F, Hypersonic Technology Development.
- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603112F, Advanced Materials for Weapon 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: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics	PROJECT 2402

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
2402 Vehicle Equipment	9,787	11,682	3,759	4,848	5,566	7,016	9,549	8,896	Continuing	Continuing

(U) A. Mission Description: This project develops technologies to reduce subsystem and component life cycle costs in operational environments and improve subsystem performance for current and future manned and unmanned aerospace vehicles.

(U) FY 1998 ($ in Thousands):

- (U) $3,478 Developed and assessed component combat damage repair technologies, deflagration suppression techniques, hydrodynamic ram tolerance techniques, and critical component armoring techniques that decrease aerospace vehicle vulnerability. Assessed techniques including methodology for lightweight armoring of critical components and analytical models that predicted aerospace vehicle vulnerability.
- (U) $2,940 Developed and evaluated subsystem technologies that enhance aerospace vehicle protection. Developed technologies including a methodology that verified compliance of transparency designs and conducted dust erosion tests that predicted transparency coating performance.
- (U) $3,369 Developed and studied technologies for aircraft internal energy management systems which reduced aerospace vehicle size and weight. Fabricated full-scale advanced composite material heat exchanger and assessed aircraft subsystem energy interactions.
- (U) $9,787 Total

(U) FY 1999 ($ in Thousands):

- (U) $2,709 Develop and assess component combat damage repair technologies, deflagration suppression techniques, and hydrodynamic ram tolerance techniques, that decrease aerospace vehicle vulnerability. Techniques to be developed include analytical tools to define and reduce vulnerability to missile and ballistic threats on critical components. Develop and validate new criteria for selecting deflagration suppression techniques in internal munitions bays and engine nacelles.
- (U) $1,906 Develop and evaluate affordable subsystem technologies that enhance aerospace vehicle safety and reliability and reduce cost. Complete study to assess the feasibility of applying electric actuation to utility subsystems to reduce aircraft maintenance costs. Initiate program to develop technologies required to apply electric actuation to manned and unmanned aerospace vehicles.
- (U) $4,681 Develop and evaluate process for affordable structural life for an increase in maintenance/durability of existing and future aerospace vehicles. Process includes, but is not limited to, noise suppression techniques as well as development of composite repair process for damaged or cracked components.
- (U) $2,259 Develop and assess technologies for aerospace vehicle internal energy management systems to reduce cost and weight. Complete development of a full-scale advanced composite material heat exchanger to demonstrate a 50% reduction in heat exchanger weight.
- (U) $ 127 Identified as a source for SBIR.

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– (U) $11,682 Total

(U) FY 2000 ($ in Thousands):

– (U) $1,035 Develop and assess component combat damage repair technologies, deflagration suppression techniques, and hydrodynamic ram tolerance techniques that decrease aerospace vehicle vulnerability. Techniques to be developed include analytical tools to define and model hydrodynamic ram effects on composite fuel tanks.

– (U) $767 Develop and evaluate process for affordable structural life for an increase in maintenance/durability of existing and future aerospace vehicles. Process includes noise suppression techniques as well as development of a composite repair process for damaged or cracked components.

– (U) $153 Develop and assess affordable subsystem technologies that enhance aerospace vehicle safety and reliability and reduce cost. Continue to develop and assess technologies required to apply electric actuation to manned and unmanned aerospace vehicles.

– (U) $1,804 Develop and assess technologies for aerospace vehicle energy management systems and components to reduce vehicle size and weight by developing high efficiency, lightweight thermal energy components and advanced heat transport techniques.

– (U) $3,759 Total

(U) FY 2001 ($ in Thousands):

– (U) $1,607 Develop and assess component combat damage repair technologies, deflagration suppression techniques, and hydrodynamic ram tolerance techniques that decrease aerospace vehicle vulnerability. Techniques to be developed include rapid repair methods for combat damaged low-observable aerospace vehicles which allow swift return of combat assets to the commander for use without restriction.

– (U) $183 Develop and assess affordable subsystem technologies that enhance aerospace vehicle safety and reliability and reduce cost. Continue to develop technologies required to apply electric actuation to manned and unmanned aerospace vehicles through full-scale hardware development and testing.

– (U) $3,058 Develop and assess technologies for manned and unmanned aerospace vehicle energy management systems and components to reduce vehicle size and weight by integrating previously developed advanced heat transfer techniques and materials, and developing enabling technologies for storable thermal management systems.

– (U) $4,848 Total

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	PROJECT 2402

(U) B. Project Change Summary - Description of Significant Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

(U) C. Other Program Funding Summary:

(U) Related Activities:
- (U) PE 0603106F, Logistics System Technology.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603245F, Flight Vehicle Technology Integration.
- (U) PE 0604212F, Aircraft Equipment Development.
- (U) PE 0604609F, Reliability and Maintainability Technology Insertion Program.
- (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: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE: February 1999
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics	PROJECT: 2403

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
2403 Flight Controls and Pilot-Vehicle Interface	15,808	17,492	10,592	11,740	12,531	14,955	14,731	15,947	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification: This project develops technology to enable the pilot to obtain maximum performance from aerospace vehicles under all conditions, provide the pilot with the display of information from on-board subsystems and off-board intelligence sources for increased situational awareness leading to enhanced mission performance and flight safety, provide robust capability to control aircraft after damage and failures, and network synthetic environments for evaluation of advanced concepts. This project develops flight control technologies for both manned and unmanned aerospace vehicles.

(U) FY 1998 ($ in Thousands):

- (U) $5,011 Developed and evaluated advanced flight control techniques which provided air combat advantage with increased performance and decreased vulnerability with decreased cost and air vehicle supportability requirements. Specific developments included strategies that enabled interactive flights of manned and unmanned aircraft and global operational analyses for advanced optical air data sensors.
- (U) $4,010 Studied and developed new flight control design methods and criteria that provided air combat advantage with increased performance and decreased vulnerability and cost. Improved methodology including criteria and standards for flight control systems that prevented pilot-induced control problems; also developed technologies for global range transport aircraft.
- (U) $1,999 Developed enhanced pilot-vehicle surface integration technologies for improved overall weapon systems performance and exploited real-time on-board/off-board data for enabling human-machine interface technologies.
- (U) $3,111 Developed control integration technologies and simulations for the ability to deploy unmanned combat air vehicles in combat environments, as well as developed display requirements for integrated in-flight mission planning.
- (U) $1,677 Developed capabilities to evaluate ways for increased aerospace vehicle performance through high angle of attack air combat.
- (U) $15,808 Total

(U) FY 1999 ($ in Thousands):

- (U) $4,470 Develop and demonstrate advanced flight control techniques for manned and unmanned aerospace vehicles to provide air combat advantage by increasing performance while decreasing vulnerability, cost, and supportability requirements. Continue to develop flight test hardware of optical air data system that eliminates need for non-stealthy, expensive air data probes, vanes, and ports. Initiate development of advanced vehicle management system that exploits photonics to improve manned and unmanned aerospace vehicles subsystem communication data rates and life cycle upgrade potential.

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	PROJECT 2403

- (U) $4,467 Develop new flight control design methods and criteria that provide air combat advantage by increasing performance and decreasing vulnerability and cost. Complete algorithm development for battle-damage resistant flight control system for manned and unmanned aerospace vehicles and initiate development of unsteady aerodynamic modeling techniques for use in flight control system design.
- (U) $2,058 Develop enhanced vehicle-pilot integration technologies to improve overall weapon systems performance and exploit real-time on-board/off-board data for human-machine technology interface. Specific technologies include advanced pilot air-to-air situation awareness and integrated technologies for in-flight mission planning and automated low-level flight.
- (U) $3,475 Develop capabilities to evaluate technologies for increased aerospace vehicle performance and decreased vulnerability and cost and improving probability of mission success. Initiate simulations to assess new unmanned aerospace vehicle technologies and confirm mission effectiveness and flight safety.
- (U) $2,832 Initiate control technology development that addresses the automatic maneuvering of unmanned aerospace vehicles in the terminal area to improve flight safety and combat effectiveness.
- (U) $ 190 Identified as a source for SBIR.
- (U) $17,492 Total

(U) FY 2000 ($ in Thousands):

- (U) $3,197 Develop and demonstrate advanced flight control techniques for manned and unmanned aerospace vehicles to provide air combat advantage by increasing performance while decreasing vulnerability, cost, and supportability requirements. Complete flight demonstration of optical air data system and transition the capability to user. Continue development of advanced vehicle management system architecture concepts and identify key component demonstrations.
- (U) $2,813 Develop new flight control design methods and criteria that provide air combat advantage by increasing performance and decreasing vulnerability and cost. Complete algorithm development for on-board pilot-induced oscillation prevention.
- (U) $2,451 Develop capabilities to evaluate technologies for increased aerospace vehicle performance and decreased vulnerability and cost, and improved probability of mission success. Conduct mission technology assessments for manned vehicles and unmanned aerospace vehicles; determine design guides for effective mission management systems. Conduct aerospace vehicle technology simulations and identify controllability boundaries for safe aerospace vehicles flight.
- (U) $2,131 Continue to develop control technology for the autonomous maneuvering of unmanned aerospace vehicles in the terminal area to improve flight safety and combat effectiveness. Develop and integrate high integrity, four-dimensional precision trajectory generation and control algorithms.
- (U) $10,592 Total

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(U) FY 2001 ($ in Thousands):

- (U) $3,541 Develop and demonstrate advanced flight control techniques for manned and unmanned aerospace vehicles to provide air combat advantage by increasing performance while decreasing vulnerability, cost, and supportability requirements. Continue development of advanced vehicle management system architecture concepts and perform laboratory demonstrations of key individual components. Initiate investigation into verification and validation techniques of flight critical systems that employ adaptive control techniques to reduce software development cost.
- (U) $3,163 Develop new flight control design methods and criteria that provide air combat advantage by increasing performance and decreasing vulnerability and cost. Continue development of unsteady aerodynamic modeling techniques for use in flight control system design.
- (U) $2,693 Develop capabilities to evaluate technologies for increased aerospace vehicle performance and decreased vulnerability and cost, and improved probability for mission success. Complete unmanned aerospace vehicle technology assessments and confirm mission effectiveness of strike packages with manned and unmanned aerospace vehicles. Complete aerospace vehicle simulations; and transition flight safety and mission effectiveness criteria for new aerospace vehicles.
- (U) $2,343 Continue to develop control technology for the autonomous maneuvering of manned and unmanned aerospace vehicles in the terminal area to improve flight safety and combat effectiveness. Conduct simulations to evaluate control integration strategies and iterate to an acceptable solution.
- (U) $11,740 Total

(U) B. Project Change Summary - Description of Significant Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0602202F, Human Effectiveness Applied Research.
- (U) PE 0602204F, Aerospace Sensors.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603245F, Flight Vehicle Technology Integration.
- (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: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics	PROJECT 2404

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
2404 Aeromechanics and Integration	14,736	16,123	11,372	12,306	18,352	18,392	18,122	22,402	Continuing	Continuing

(U) A. Mission Description: This project develops aerodynamic design integration technologies for current and future manned and unmanned aerospace flight vehicles, focusing on speed regimes ranging from low to high Mach. These technologies have potential to reduce costs, improve range to yield enhanced global force projection, improve maneuverability, and reduce observability. This project evaluates and develops technologies for manned and unmanned aerospace vehicles and aerospace vehicle design assessment and analysis tools.

(U) FY 1998 ($ in Thousands):

- (U) $8,717 Developed affordable technologies that increased aerodynamic performance and decreased vulnerability with reduced drag, improved fuel fraction, enhanced maneuverability and control with high payoff aerodynamic concepts, and reduced signature through integrated compact inlet designs which resulted in improved aerospace aerodynamics.
- (U) $2,958 Developed numerical technologies which included mathematical models for aerodynamic and structural interactions that derived advanced aircraft designs such as tailless aerospace vehicle geometry for low cruise drag with increased performance and reduced signature for increased aerodynamic performance.
- (U) $3,061 Developed fixed wing aerospace vehicle advanced aerodynamic concepts, design, and analytical tools for the Air Force, Navy, and NASA.
- (U) $14,736 Total

(U) FY 1999 ($ in Thousands):

- (U) $4,580 Conduct aerodynamic design, analysis, test, and performance assessments of advanced manned and unmanned aerospace vehicles consistent with signature and cost constraints. Perform validation tests of innovative aerodynamic control concepts for low signature, manned and unmanned aerospace vehicles.
- (U) $3,944 Develop computational tools and techniques for predicting and optimizing aerodynamic and structural performance of advanced manned and unmanned aerospace vehicles. Continue development of computer design code addressing fluid/structural interactions. Initiate development of next generation, multi-disciplinary optimization computer design code integrating aerodynamic, structural, signature, and other scientific disciplines.
- (U) $4,644 Develop and demonstrate affordable fixed-wing vehicle aerodynamic technologies to increase aerospace vehicle performance and decreased vulnerability. Initiate development of aerodynamic and structural integration including flow control in payload bays.
- (U) $2,780 Develop conceptual designs and assess technologies to determine impacts of integrating directed energy systems such as high power microwaves, high energy lasers, and kinetic energy weapons into aerospace vehicles.
- (U) $ 175 Identified as a source for SBIR.
- (U) $16,123 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics — PROJECT: 2404

(U) FY 2000 ($ in Thousands):

- (U) $3,879 Conduct aerodynamic design, analysis, test, and performance assessments of advanced tactical transport aircraft and aerospace vehicles consistent with signature and cost constraints. Design and perform sub-scale component test of a signature compatible, powered lift system for a transport aircraft.
- (U) $3,386 Develop computational tools and techniques for predicting and optimizing aerodynamic and structural performance of advanced manned and unmanned aerospace vehicles. Complete development of computer design code addressing fluid/structural interactions. Continue development of next generation, multi-disciplinary optimization computer design code integrating aerodynamic, structural, signature, and other scientific disciplines.
- (U) $4,107 Develop and demonstrate affordable fixed-wing vehicle aerodynamic technologies to increase aerospace performance and decrease vulnerability. Continue development of aerodynamic and structural integration including flow control in payload bays.
- (U) $11,372 Total

(U) FY 2001 ($ in Thousands):

- (U) $4,224 Conduct aerodynamic design, analysis, test, and performance assessments of advanced tactical transport aircraft and aerospace vehicles consistent with signature and cost constraints. Perform sub-scale wind tunnel tests of powered lift system. Initiate aerodynamic and test diagnostic studies.
- (U) $3,674 Develop computational tools and techniques for predicting and optimizing aerodynamic and structural performance of advanced manned and unmanned aerospace vehicles. Complete development of next generation, multi-disciplinary optimization computer design code integrating aerodynamic, structural, signature, and other scientific disciplines.
- (U) $4,408 Develop and demonstrate affordable fixed-wing vehicle aerodynamic technologies to increase aerospace vehicle performance and decrease vulnerability. Continue development of aerodynamic and structural integration including flow control in payload bays.
- (U) $12,306 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics
	PROJECT 2404

(U) B. Project Change Summary - Description of Significant Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

(U) C. Other Program Funding Summary:

(U) Related Activities:
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603260F, Hypersonic Technology Development.
- (U) PE 0603245F, Flight Vehicle Technology Integration.
- (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: Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics	PROJECT 4397

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
4397 Air Base Technology	464	1,359	1,447	1,289	691	2,223	2,161	2,443	Continuing	Continuing

(U) A. Mission Description: This project develops technologies for fixed and bare base operations, including airfield pavements, energy systems, automation, air base survivability, air base recovery, protective systems, fire protection, and crash rescue.

(U) FY 1998 ($ in Thousands):
- (U) $464 Developed aircraft and air base fire fighting technologies (e.g., clean, environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems).
- (U) $464 Total

(U) FY 1999 ($ in Thousands):
- (U) $598 Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.
- (U) $568 Develop utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of Air Expeditionary Force (AEF) operations.
- (U) $178 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.
- (U) $ 15 Identified as a source for SBIR.
- (U) $1,359 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics
	PROJECT 4397

(U) FY 2000 ($ in Thousands):

- (U) $579 Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.
- (U) $550 Develop utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of Air Expeditionary Force (AEF) operations.
- (U) $318 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.
- (U) $1,447 Total

(U) FY 2001 ($ in Thousands):

- (U) $526 Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.
- (U) $475 Develop utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of AEF operations.
- (U) $288 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.
- (U) $1,289 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY: 2 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics — PROJECT: 4397

(U) B. Project Change Summary - Description of Significant Change: 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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(U) C. Other Program Funding Summary:

(U) Related Activities:

- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603231F, Crew Systems and Personnel Protection Technology.
- (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: Not Applicable.

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