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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

	COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	48,870	53,183	97,465	64,274	67,114	66,933	68,931	70,921	Continuing	TBD
2401	Structures	22,635	49,035	32,998	23,329	24,433	24,411	25,170	25,905	Continuing	TBD
2402	Vehicle Equipment	3,744	0	0	0	0	0	0	0	Continuing	TBD
2403	Flight Controls and Pilot-Vehicle Interface	12,213	0	34,711	21,190	22,221	22,132	22,775	23,429	Continuing	TBD
2404	Aeromechanics and Integration	8,837	0	29,756	19,755	20,460	20,390	20,986	21,587	Continuing	TBD
4397	Air Base Technology	1,441	4,148	0	0	0	0	0	0	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: In FY 2001, Projects 2402, 2403, and 2404 were combined into Project 2401. Beginning in FY 2002, selected efforts from Project 2401 have moved into Projects 2403 and 2404. Beginning in FY 2002, Project 4397 has moved into PE 0602102F, Project 4915. FY 2003 - FY 2007 budget numbers do not reflect the DoD strategy review results.

(U) A. Mission Description

This program investigates, develops, and analyzes aerospace vehicle technologies in the three primary areas of structures, controls, and aeromechanics. First, advanced structures concepts are explored and developed to exploit new materials, fabrication processes, and design techniques. Second, flight control technologies are developed and simulated for both manned and unmanned aerospace vehicles. Third, the aeromechanics of advanced aerodynamic vehicle configurations are developed and analyzed through simulations, experiments, and multidisciplinary analysis. Resulting technologies reduce life cycle costs and improve the performance of existing and future manned and unmanned aerospace vehicles. Note: In FY 2001, Congress added $2.0 million for aeronautical research, and $2.9 million for weapon systems logistics, deployed base systems technology, and force protection.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

(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.

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

		FY 2000	FY 2001	FY 2002	Total Cost
(U)	Previous President's Budget (FY 2001 PBR)	45,594	48,775	55,436	
(U)	Appropriated Value	45,718	53,675		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions				
	b. Small Business Innovative Research				
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	3,360			
	e. Rescissions	-208	-492		
(U)	Adjustments to Budget Years Since FY 2001 PBR			42,029	
(U)	Current Budget Submit/FY 2002 PBR	48,870	53,183	97,465	TBD

(U) Significant Program Changes:

Changes to this program since the previous President's Budget are due to the recent DoD strategy review which increased funding for technologies in space lift and next generation aerospace vehicles for long range strike.

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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

PROJECT: 2401

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2401 Structures	22,635	49,035	32,998	23,329	24,433	24,411	25,170	25,905	Continuing	TBD

Note: In FY 2001, Projects 2402, 2403, and 2404 were combined into Project 2401. Beginning in FY 2002, selected efforts from Project 2401 have moved into Projects 2403 and 2404.

(U) A. Mission Description

This project develops advanced structures concepts to exploit new materials and fabrication processes and investigates new structural concepts and design techniques. Resulting technologies strengthen and extend the life of current and future manned and unmanned aerospace vehicle structures. Payoffs to the warfighter include reduced weight and cost, as well as improved operability and maintainability of aerospace vehicles. Note: In FY 2001, Congress added $2.0 million for aeronautical research.

(U) FY 2000 ($ in Thousands)

(U) $1,566 Continued 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. Continued development of distributed vibration suppression techniques, and the evaluation and assessment of wing twisting and control surface warping of manned and unmanned aerospace vehicles.

(U) $2,091 Developed unitized composite and metallic concepts that reduce manufacturing costs of future aerospace vehicles. Verified design criteria for translaminar reinforced composites to reduce inspection and repair costs. Developed integrated multidisciplinary design methods to reduce design time.

(U) $1,579 Continued development of multifunctional structures that tailor structural response, and integrated subsystem functionality to reduce system level manufacturing costs and increase tactical performance of future aerospace vehicles. Tested advanced airframe structural integration concepts to detect widespread fatigue and corrosion.

(U) $3,393 Continued 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. Developed turbine engine nozzles that are structurally integrated with the airframe for future aerospace operating vehicles.

(U) $12,302 Extended usable structural lives and/or reduced costs of aging aircraft and unmanned aerospace vehicles with technologies that account for structural life, risk assessment, repairs, and dynamic loads. Structural lives can be extended by development of bonded composite repairs of

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics	PROJECT 2401

(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

metallic structures and evaluation of techniques to assess risk of failure of structural components. Dynamic loads can be reduced through active suppression techniques.

(U) $1,704 Developed an advanced technology assessment capability which serves Air Force leadership in identifying, prioritizing, developing, and demonstrating next-generation aerospace vehicle concepts. Facilitated web-based design environment process by bringing the best ideas to a design without the constraint of time and space.

(U) $22,635 Total

(U) FY 2001 ($ in Thousands)

(U) $3,742 Develop methods to predict and to suppress structural damage due to high cycle fatigue that reduce operations and support costs and provide higher aircraft availability. Continue development of durability patches for structures experiencing premature failure due to high cycle fatigue. Continue technology improvements of airframe structural vibration suppression techniques which delay the onset of high cycle fatigue failures.

(U) $5,448 Develop and demonstrate new control techniques to enable safe, highly autonomous mixed-fleet and multi-unmanned air vehicle operations for increased combat effectiveness. Continue unmanned aerospace vehicle development to ensure safe operation and allow precision close operations of mixed manned and unmanned air vehicles. Develop adaptive flight control algorithms for autonomous vehicle operations. Initiate development of advanced system for automatic Unmanned Air Vehcile (UAV) in-flight refueling.

(U) $1,828 Continue development of composite and metallic concepts that reduce manufacturing costs of future air vehicles. Initiate development of Analytical Certification Methodologies for unitized structures to ensure transition of advanced concepts and manufacturing processes to future airframe designs. Continue development of integrated multidisciplinary design methodologies that enhance affordability and decrease vulnerability of future aerospace vehicles.

(U) $3,163 Develop new flight control design methods and criteria that provide air combat advantage by increasing performance and decreasing vulnerability and cost. Initiate development of new intelligent/learning reconfigurable controller to enable continued air vehicle operation in event of damage or failure, and develop a new air vehicle flight control learning concept.

(U) $3,343 Develop advanced flight control technology to enable aircraft-like operations for affordable on-demand military access to space. Develop technology concepts for integration of vehicle management system with vehicle health management/prognostics. Complete aerospace vehicle requirements definition study and conceptual design.

(U) $2,879 Continue development of a signature-compatible, integrated high lift device that will improve aerodynamic performance and survivability with lower cost of ownership than conventional flight control devices. Perform analytical design of subscale aerospace vehicle model for future powered testing and analysis.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics	PROJECT 2401

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U)	$3,786	Develop computational tools and techniques for predicting and optimizing aerodynamic and structural performance of advanced manned and unmanned aerospace vehicles. Continue development of next generation, multi-disciplinary optimization computer design code integrating aerodynamics, structures, thermal mangement, signatures, and flight controls. Complete development of fully associative object-oriented multi-disciplinary design architecture and demonstrate capability to employ high fidelity analyses earlier in aircraft design to rapidly synthesize and evaluate cost of advanced configurations for unmanned air vehicles.
(U)	$5,107	Develop and demonstrate affordable aerospace vehicle aerodynamic technologies that increase aerospace vehicle peformance. Initiate investigation into techniques to generate and control plasma flow field over hypersonic vehicles. This will improve hypersonic maneuverability of transatmospheric vehicles and save weight over traditional reaction control and aerodynamic control surface approaches.
(U)	$2,698	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. Initiate development of full wing span structurally integrated with a low frequency multifunctional antenna to increase radio frequency performance and reduce weight.
(U)	$3,155	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 and metallic aerospace vehicle structures.
(U)	$8,890	Investigate modification and repair techniques to retrofit fail-safety into aging aircraft to increase availability and reduce operations and support costs. Develop composite and metallic bonded repair techniques which provide for damage tolerance where none now exists. Investigate low-cost structural modifications to aging systems which provide fail-safety in critical areas of the aircraft.
(U)	$2,996	Develop advanced analytical methods for analysis of unitized structures and certification of structural components which reduce development time and cost of aircraft. Initiate exploration of damage initiation and propagation models for unitized metallic structure. Develop analytical methods for certification of aging aircraft repairs and structural modifications.
(U)	$2,000	Expand aeronautical research efforts to focus on developing technologies for integrated design solutions for optimal signature, aerodynamics, and sensor performance of future aircraft.
(U)	$49,035	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics	PROJECT: 2401

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$2,859	Develop economic service life analysis for current and future aircraft, enhancing capability, component replacement, and technology direction. Continue development of unitized structural concepts and multidisciplinary optimization methodologies that enhance affordability and decrease vulnerability for current and future aerospace vehicles. Incorporate newly developed analysis tools into life prediction and failure analysis software.
(U)	$5,080	Develop analytical certification methodologies for the incorporation of advanced methods, concepts, and manufacturing technologies into legacy aircraft components and future airframe designs. Improve the air-worthiness certification process for aircraft subjected to dynamic aeroelastic loads with high fidelity models.
(U)	$6,941	Continue development of structural concepts and design and analysis methods that enable the integration of structure with other airframe functions to reduce cost and increase the survivability of future systems. Concepts include adaptive structures for varying moldline, subsystems hardware, and antennae contained within loadbearing structure.
(U)	$18,118	Develop technologies that incorporate advanced materials as well as passive and active cooling to withstand extreme flight environments. Technologies will improve durability of existing and future aerospace vehicle structures resulting in reduced cost and increased life. Concepts include advanced, durable, all-weather thermal protection systems, attachment techniques, vehicle health monitoring and health management, integrated thermal protection systems, hot primary structures, hybrid structures, unitized structures, joining concepts, and cryogenic/non-cryogenic tank structures.
(U)	$32,998	Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:
(U) PE 0602102F, Materials
(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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics	PROJECT: 2401

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

PROJECT: 2402

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2402 Vehicle Equipment	3,744	0	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2001, Project 2402 was moved to Project 2401.

(U) A. Mission Description

This project develops technologies to reduce subsystem and component life cycle costs in operational environments and improves subsystem performance for current and future manned and unmanned aerospace vehicles.

(U) FY 2000 ($ in Thousands)

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

(U) $767 Developed and evaluated 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) $158 Developed and assessed affordable subsystem technologies that enhance aerospace vehicle safety and reliability, and reduce cost. Continued to develop and assess technologies required to apply electric actuation to manned and unmanned aerospace vehicles.

(U) $1,784 Developed and assessed 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) $3,744 Total

(U) FY 2001 ($ in Thousands)

(U) $0 Effort moved to Project 2401.

(U) $0 Total

(U) FY 2002 ($ in Thousands)

(U) $0 Effort moved to Project 2401.

(U) $0 Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics	PROJECT: 2402

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

(U) Related Activities:

(U) PE 0603106F, Logistics Systems Technology.

(U) PE 0603211F, Aerospace Structures.

(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.

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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

PROJECT: 2403

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2403	Flight Controls and Pilot-Vehicle Interface	12,213	0	34,711	21,190	22,221	22,132	22,775	23,429	Continuing	TBD

Note: In FY 2001, Projects 2402, 2403, and 2404 were combined into Project 2401. Beginning in FY 2002, selected efforts from Project 622401 have been moved into Projects 2403 and 2404.

(U) A. Mission Description

This project develops technology to enable maximum affordable capability from manned and unmanned aerospace vehicles. Advanced flight control technologies are developed for maximum vehicle performance throughout the flight envelope and simulated in virtual environments. Resulting technologies contribute significantly towards the development of reliable autonomous unmanned air vehicles, space access systems with aircraft-like operations, and extended-life legacy aircraft. Payoffs to the warfighter include enhanced mission effectiveness; optimized flight safety; increased survivability; improved maintenance; and decreased size, weight, and cost. Leverages a network of synthetic environments for evaluation of advanced concepts.

(U) FY 2000 ($ in Thousands)

(U) $3,197 Developed and demonstrated 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. Completed flight demonstration of optical air data system and transitioned the capability to the user. Continued development of advanced vehicle management system architecture concepts and identified key component demonstrations.

(U) $2,813 Developed new flight control design methods and criteria that provide air combat advantage by increasing performance and decreasing vulnerability and cost. Completed algorithm development for on-board pilot-induced oscillation prevention.

(U) $2,470 Developed capabilities to evaluate technologies for increased aerospace vehicle performance and decreased vulnerability and cost, and improved probability of mission success. Conducted mission technology assessments for manned vehicles and unmanned aerospace vehicles; determined design guides for effective mission management systems. Conducted aerospace vehicle technology simulations and identified controllability boundaries for safe aerospace vehicles flight.

(U) $3,733 Continued to develop control technology for the autonomous maneuvering of unmanned aerospace vehicles in the terminal area to improve flight safety and combat effectiveness. Developed and integrated high integrity, four-dimensional precision trajectory generation and control algorithms. Continued autonomous flight control research in automated air collision avoidance, key laboratory demonstrations of lightweight photonic technologies, and identification of transatmospheric and aerospace vehicle control technologies for aircraft-like operations.

(U) $12,213 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE June 2001
BUDGET ACTIVITY 02 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics	PROJECT 2403

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands)

(U)	$0	Effort moved to Project 2401.
(U)	$0	Total

(U) FY 2002 ($ in Thousands)

(U)	$3,982	Develop and assess advanced control mechanization technologies to provide highly reliable operation for manned and unmanned systems at significantly reduced size, weight, and cost. Complete laboratory demonstrations of fiber optic-based vehicle management system and optical air data system components. Develop validation and verification techniques for complex, adaptive, and autonomous control software. Assess control mechanization technologies for extending the effective life of legacy aircraft.
(U)	$8,938	Develop and assess control automation techniques and algorithms to enable the safe and interoperable application for formations of manned and unmanned vehicle systems. Concepts will also provide mission responsiveness and adaptability for improved operational effectiveness of manned and unmanned systems. Continue development and test of intelligent-agent software providing package-level coordination and health monitoring and management for aerospace vehicles. Continue the simulation analysis of automated aerial refueling system technologies. Complete analysis and specification of on-board sensor suite for safe operation of unmanned vehicles in proximity of other manned and unmanned air vehicles.
(U)	$6,657	Develop new flight control design methods and criteria that provide air combat advantage by increasing performance and decreasing vulnerability and cost. Continue development of new intelligent/learning reconfigurable controller to enable continued air vehicle operation in the event of damage or failure. Integrate with on-line route planner and systems diagnostics for unmanned vehicle fault tolerant, autonomous operations. Develop integrated adaptive guidance and control systems for high and ultra-high speed aerospace vehicles.
(U)	$6,199	Develop advanced flight control technology to enable aircraft-like operations for affordable on-demand military access to space. Continue development and analysis of affordable, lightweight vehicle/health monitoring and management systems, integrated with critical guidance and navigation algorithms for high and ultra-high speed aerospace vehicles. Develop parameters for health monitoring and management data collection, and develop prognostic algorithms.
(U)	$8,935	Assess the value of air vehicle technologies to future aerospace systems through the development and utilization of in-house tools, systems, and processes for simulation-based research and development. Continue development of virtual simulations for unmanned air vehicles (UAVs) used in validating autonomous control algorithms for mixed manned and UAV operations. Enhance simulation and analysis capabilities to project life cycle cost impacts. Develop the capability to virtually simulate mission utility of next generation aerospace vehicles for long range strike.
(U)	$34,711	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics	PROJECT: 2403

(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 0602204F, Aerospace Sensors.

(U) PE 0603211F, Aerospace Structures.

(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.

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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

PROJECT: 2404

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2404 Aeromechanics and Integration	8,837	0	29,756	19,755	20,460	20,390	20,986	21,587	Continuing	TBD

Note: In FY 2001, Projects 2402, 2403, and 2404 were combined into Project 2401. Beginning in FY 2002, selected efforts from Project 2401 have moved into Projects 2403 and 2404.

(U) A. Mission Description

This project develops aerodynamic configurations of a broad range of revolutionary, affordable air vehicles. It matures and applies modeling and numerical simulation methods for fast and affordable aerodynamics prediction; and integrates and demonstrates multidisciplinary advances in airframe-propulsion, airframe-weapon, and air vehicle control integration. Technologies developed will greatly enhance warfighter capability in aircraft, missiles, and high-speed aerospace vehicles. The payoffs from these technology programs include lower vehicle costs (both production, and operations and support costs), increased payload and range capability, and improved supportability, safety, and survivability of aerospace vehicles.

(U) FY 2000 ($ in Thousands)

(U) $1,344 Conducted aerodynamic design, analysis, test, and performance assessments of advanced tactical transport aircraft and aerospace vehicles consistent with signature and cost constraints.

(U) $3,386 Developed computational tools and techniques for predicting and optimizing aerodynamic and structural performance of advanced manned and unmanned aerospace vehicles. Completed development of computer design code addressing fluid/structural interactions. Continued development of next generation, multi-disciplinary optimization computer design code integrating aerodynamic, structural, signature, and other scientific disciplines

(U) $4,107 Developed and demonstrated affordable fixed-wing vehicle aerodynamic technologies to increase aerospace performance and decrease vulnerability. Continued development of aerodynamic and structural integration including flow control in payload bays.

(U) $8,837 Total

(U) FY 2001 ($ in Thousands)

(U) $0 Effort moved to Project 2401.

(U) $0 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics	PROJECT: 2404

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$11,137	Develop and assess aeronautical technologies that enable broad use of unmanned air vehicles in future missions to reduce life cycle cost and decrease human risk. Complete development of tools and techniques for predicting and optimizing aerodynamic performance and survivability of long duration unmanned aerospace vehicles. Continue preliminary development of conformal inlet designs that improve airflow to engines while providing low signature for increased survivability. Continue development of signature compatible, high lift wings for long duration surveillance missions.
(U)	$3,794	Develop design tools that permit quicker and more affordable certification of aerodynamic enhancements to extend the operational life of the current fleet. Continue development of analysis tools to accelerate the aerodynamic integration of new and existing weapons with current aircraft to enhance their warfighting ability. Continue to enhance computer design and analysis code that reduces the need for expensive flight-testing.
(U)	$10,231	Develop and assess aerospace technologies that enable ultra-high speed flight and low-cost access to orbit to permit global reach. Complete comparative analyses of aerospace vehicle configurations for next generation long range strike to project global power from CONUS bases. Explore integrated airframe concepts for high-speed aerospace vehicles. Continue investigation into techniques to generate and control plasma flow field over high-speed vehicles to significantly reduce drag. Develop computational, multidisciplinary, experimental and analytical tools to simulate and control the flow fields around advanced concepts for ultra-high speed aerospace vehicles in extreme flight environments. Continue development of complex configurations that mitigate the extreme thermal environment under which high speed aerospace vehicles operate. Develop techniques to carry and deploy weapons from high speed aerospace vehicles.
(U)	$4,594	Develop and evaluate critical aeronautical technologies that enable directed energy weapons to be carried on future air vehicles to improve combat effectiveness. Complete analyses of integration of directed energy weapons on the total air vehicle system identifying impacts to the flight control system, secondary power subsystem, and aerodynamic configuration. Complete development of tools that establish the military impact of directed energy weapons when installed on viable air platforms on future engagements. Develop aircraft techniques to enhance energy beam transmission through the complex, turbulent aerodynamic environment surrounding aircraft enabling the use of directed energy weapons from high-speed, maneuvering aircraft.
(U)	$29,756	Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics
PROJECT: 2404	

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

(U) Related Activities:

(U) PE 0603211F, Aerospace Structures.

(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.

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

DATE: June 2001

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics

PROJECT: 4397

COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4397 Air Base Technology	1,441	4,148	0	0	0	0	0	0	Continuing	TBD

Note: Beginning in FY 2002, Project 4397 has moved into PE 0602102F, Project 4915.

(U) A. Mission Description

This project develops air base technologies for fixed and bare base operations, including airfield pavements, energy systems, air base survivability, air base recovery, protective shelter systems, airfield fire protection, and crash rescue. Payoffs include air base support operations that are affordable, easily transportable, and with increased survivability of personnel and facilities. Note: In FY 2001, Congress added $2.9 million for weapon systems logistics, deployed base systems technology, and force protection.

(U) FY 2000 ($ in Thousands)

(U) $579 Developed aircraft and air base fire fighting technologies to improve fire fighting rescue using infrared sensor technology. Tested safe fire fighting agents. Developed protective clothing, fire risk assessment technologies, and fire fighting training systems.

(U) $742 Developed utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements. Developed advanced waste management technologies that are lightweight and support Aerospace Expeditionary Force (AEF) operations.

(U) $120 Evaluated air transportable shelters that are lightweight and suitable for AEF operations. Developed air transportable shelter technologies for aircraft and flightline personnel.

(U) $1,441 Total

(U) FY 2001 ($ in Thousands)

(U) $526 Develop aircraft and air base fire fighting technologies to improve fire fighting rescue. Test new fire fighting agents that are non-corrosive and are not harmful to fire fighting personnel. Continue testing of advanced autonomous technologies for use in flightline fire fighting trucks.

(U) $634 Develop utilities, automation, and waste management technologies that reduce airlift requirements and improve air base operations and survivability for agile combat support. Begin evaluation of new ground power generation concepts that are highly efficient and lightweight.

(U) $88 Evaluate air transportable protective shelter technologies that are lightweight, structurally strong, and are affordable and suitable for AEF operations. Continue technology demonstration program for lightweight air inflatable shelters for aircraft and flightline personnel.

(U) $2,900 Initiate Congressionally-directed effort in weapon systems logistics, deployed base systems technology, and force protection.

(U) $4,148 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE June 2001
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602201F Aerospace Flight Dynamics
	PROJECT: 4397

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$0	Effort moved into PE 0602102F, Project 4915
(U)	$0	Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0603211F, Aerospace Structures.

(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

(U) Not Applicable.