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PE NUMBER: 0603211F

PE TITLE: Aerospace Technology Dev/Demo

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2004
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BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo
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Cost (\$ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	27.767	47.610	29.145	27.199	26.019	29.009	30.500	Continuing	TBD
486U Advanced Aerospace Structures	8.687	15.535	3.682	5.847	5.964	6.064	6.162	Continuing	TBD
4920 Flight Vehicle Tech Integration	19.080	32.075	25.463	21.352	20.055	22.945	24.338	Continuing	TBD
5099 National Aerospace Initiative	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	TBD

(U) A. Mission Description and Budget Item Justification

This program demonstrates advanced aerospace vehicle technologies. Advanced aerospace structures are demonstrated to sustain and enhance the capability of current and future aerospace vehicles, such as a next generation bomber. Flight vehicle technology integration is accomplished through system level integration of various technologies to include avionics, advanced propulsion, and weapon systems for demonstration in near-realistic operational environments. Note: In FY 2004, Congress added \$6.2 million for advanced aluminum aerostructures, \$2.4 million for bias woven preforms, \$1.3 million for unmanned aerial vehicles (UAV) composites, \$2.0 million for fly-by-light avionics for unmanned combat air vehicle (UCAV), \$0.9 million for MEDLINK global response, and \$3.4 million for sensorcraft unmanned aerial vehicle.

This program is in the Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing aerospace vehicle system upgrades and/or new system developments that have military utility and address warfighter needs.

(U) B. Program Change Summary (\$ in Millions)

	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
(U) Previous President's Budget	29.002	73.416	31.427
(U) Current PBR/President's Budget	27.767	47.610	29.145
(U) Total Adjustments	-1.235	-25.806	
(U) Congressional Program Reductions		-42.298	
Congressional Rescissions		-0.408	
Congressional Increases		16.900	
Reprogrammings	-0.408		
SBIR/STTR Transfer	-0.827		

(U) Significant Program Changes:

Changes to this program since the previous President's Budget are due to higher Air Force priorities.

Exhibit R-2a, RDT&E Project Justification							DATE February 2004			
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)			PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo				PROJECT NUMBER AND TITLE 486U Advanced Aerospace Structures			
Cost (\$ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total	
486U Advanced Aerospace Structures	8.687	15.535	3.682	5.847	5.964	6.064	6.162	Continuing	TBD	
Quantity of RDT&E Articles	0	0	0	0	0	0	0			

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates affordable aerospace vehicle technologies to sustain the existing fleet, reduce the cost of aircraft ownership, and enhance the capability of current and future aerospace vehicles. Sustainment of the existing fleet through extended operational service life with innovative technology application will lead to reduced operations and support costs, and increased operational readiness. Analytical certification will reduce the cost associated with component replacement by allowing and certifying new designs under reduced test requirements. Development of capability enhancing technologies will expand the operational envelope and increase survivability in high threat environments. Demonstration of these technologies will restore structural integrity, extend structural life, enhance the capability, and reduce the life cycle costs of fielded aircraft.

(U) B. Accomplishments/Planned Program (\$ in Millions)

	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
(U) MAJOR THRUST: Develop technologies to improve traditional sustainment methods of current and future aircraft.	1.949	2.917	0.000
(U) In FY 2003: Continued improvements in sustainment technologies for existing aging aircraft and future aerospace vehicle structures for reduced operations and support costs and to extend usable structural lives. Continued the development of technology required for full implementation of bonded composite repair of thick and complex structures. Continued development of new analytical methods and techniques to expand bonded composite repair capabilities to thick and complex geometry structures enabling repair in lieu of replacement of primary load carrying structural components.			
(U) In FY 2004: Develop improvements in sustainment technologies for existing aging aircraft and future air vehicle structures for reduced operations and support costs and to extend the usable structural lives. Continue the development of new analytical methods and techniques to extend bonded composite repair capability to thick and complex geometry structures enabling repairs in lieu of replacement of primary load carrying structural components.			
(U) In FY 2005: Not Applicable. Changes to this program are due to higher Air Force priorities.			
(U)			
(U) MAJOR THRUST: Develop non-traditional sustainment methods, and diagnostic/prognostic monitoring capabilities for future aircraft.	2.806	2.406	0.115
(U) In FY 2003: Developed improved non-traditional sustainment technologies that will extend aircraft life, increase aircraft availability, and reduce operations and support costs. Continued development of unitized composite structures to replace mechanically fastened built up components that are highly susceptible to damage from dynamic in-service usage in elimination of maintenance actions due to loose fasteners and fastener hole damage.			
(U) In FY 2004: Develop innovative non-traditional sustainment technologies that will extend aircraft life, increase			

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2004	
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo	PROJECT NUMBER AND TITLE 486U Advanced Aerospace Structures	
aircraft availability, and reduce operations and support costs. Complete development of unitized composite structures concepts for repair or replacement of mechanically fastened built up components that are highly susceptible to loose fasteners and fastener hole damage from dynamic in-service usage, thereby providing a reduction in maintenance actions.			
(U) In FY 2005: Develop innovative non-traditional sustainment technologies that will extend aircraft life, increase aircraft availability, and reduce operations and support costs. Develop real-time diagnostic and prognostics health monitoring tools of thermal protection systems, fuel tanks, structure, and subsystems to enable high temperature operations and allowing rapid turn around for high-speed vehicles.			
(U) MAJOR THRUST: Develop and demonstrate technologies related to improved munitions separation enhancement and acoustic reduction in current and future aircraft. Note: Prior to FY 2005, this effort was funded in project 4920, in the improved performance of unmanned platform thrust.	0.000	0.000	3.567
(U) In FY 2003: Not Applicable.			
(U) In FY 2004: Not Applicable.			
(U) In FY 2005: Develop active flow control devices to significantly increase and expand the separation envelope for miniature munitions and reduce weapon bay acoustics to minimize damage at speeds in excess of Mach 1.			
(U)			
(U) CONGRESSIONAL ADD: Advanced Aluminum Aerostructures Initiatives (A3I).	3.472	6.345	0.000
(U) In FY 2003: Initiated Congressionally-directed effort for advanced aluminum aerostructures.			
(U) In FY 2004: Continued Congressionally-directed effort for advanced aluminum aerostructures. Note: In FY 2004, two Congressional Adds were made for this effort; both are being managed as a single effort.			
(U) In FY 2005: Not Applicable.			
(U)			
(U) CONGRESSIONAL ADD: Composites.	0.460	1.388	0.000
(U) In FY 2003: Initiated Congressionally-directed efforts for ultra-lightweight composites.			
(U) In FY 2004: Continued Congressionally-directed effort for unmanned aerial vehicle (UAV) composites.			
(U) In FY 2005: Not Applicable.			
(U)			
(U) CONGRESSIONAL ADD: Three-Dimensional Bias Woven Preforms Development Program.	0.000	2.479	0.000
(U) In FY 2003: Not Applicable. No FY 2003 funds.			
(U) In FY 2004: Continue Congressionally-directed effort for Three-Dimensional Bias Woven Preforms Development Program begun with FY 2002 Congressional Add.			
(U) In FY 2005: Not Applicable.			
(U) Total Cost	8.687	15.535	3.682
Project 486U	R-1 Shopping List - Item No. 19-4 of 19-11	Exhibit R-2a (PE 0603211F)	

Exhibit R-2a, RDT&E Project Justification

DATE

February 2004

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603211F Aerospace Technology
Dev/Demo

PROJECT NUMBER AND TITLE

486U Advanced Aerospace Structures

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

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification	DATE February 2004
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BUDGET ACTIVITY 03 Advanced Technology Development (ATD)				PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo			PROJECT NUMBER AND TITLE 4920 Flight Vehicle Tech Integration			
Cost (\$ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total	
4920 Flight Vehicle Tech Integration	19.080	32.075	25.463	21.352	20.055	22.945	24.338	Continuing	TBD	
Quantity of RDT&E Articles	0	0	0	0	0	0	0			

(U) **A. Mission Description and Budget Item Justification**

This project integrates and demonstrates advanced flight vehicle technologies that will improve the performance and supportability of existing and future manned and unmanned aerospace vehicles. System level integration brings together the aerospace vehicle technologies along with avionics, propulsion, and weapon systems for demonstration in a near-realistic operational environment. Integration and technology demonstrations reduce the risk and time required to transition technologies into operational aircraft. This program provides proven aerospace vehicle technologies for all-weather, day/night operations with improved performance and affordability.

(U) **B. Accomplishments/Planned Program (\$ in Millions)**

	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
(U) MAJOR THRUST: Develop of autonomous flight controls for safe flight operations between manned and unmanned air platforms.	4.484	13.490	9.482
(U) In FY 2003: Developed and demonstrated key control automation techniques and algorithms to enable the safe and interoperable application of unmanned and manned vehicle systems. Continued development of hardware and algorithms for automated air collision avoidance. Flight demonstrated intelligent-agent based algorithms and modular software system architecture for cooperative control of unmanned vehicles. Continued demonstration of hardware and algorithms for automatic air collision avoidance.			
(U) In FY 2004: Develop and demonstrate key control automation techniques and algorithms to enable the safe and interoperable application of unmanned vehicle systems. Continue development of an integrated control technology suite combining compact, low-cost hardware with adaptive, fault tolerant inner-loop control and autonomous, trajectory-generating outer-loop control to provide significantly increased reliability and mission effectiveness for unmanned vehicle systems. Develop and demonstrate control component technologies for systems integration. Develop automated aerial refueling algorithms and system design concepts for unmanned and manned systems to eliminate need for forward staging areas, extend range, shorten response time, and enable in-theater force projection with fewer assets.			
(U) In FY 2005: Continue development and demonstration of control automation techniques, components, and algorithms to enable the safe and interoperable application of unmanned vehicle systems. Complete the integration and test of key autonomous control component technologies. Demonstrate fully integrated, adaptive, fault tolerant, autonomous control system suite to provide significantly increased reliability and mission effectiveness for unmanned vehicle systems. Demonstrate key photonic sensing and control elements for flight critical control.			
(U) MAJOR THRUST: Develop an Automated Aerial Refueling capability for unmanned and manned air platforms.	0.000	0.000	5.167

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2004	
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo	PROJECT NUMBER AND TITLE 4920 Flight Vehicle Tech Integration	
<p>Note: In FY 2004, Automated Aerial Refueling efforts described in the above thrust area were broken out to allow for increased visibility for this effort.</p>			
(U) In FY 2003: Not Applicable.			
(U) In FY 2004: Not Applicable.			
(U) In FY 2005: Complete development of automated aerial refueling sensing, communication, and control algorithm components. Complete integration, simulation, and analysis verifying safe autonomous operation in proximity of manned tankers. Begin flight demonstrations of initial automated aerial refueling capability for unmanned aerial vehicles using existing fleet tankers, operational procedures, and unmanned combat air vehicles.			
(U) MAJOR THRUST: Develop and demonstrate integrated technologies to improve the performance of unmanned platforms.	3.716	2.863	3.464
(U) In FY 2003: Developed an integrated control technology suite to provide increased reliability and mission effectiveness for unmanned vehicle systems. Completed baseline systems architecture combining compact, low-cost hardware with adaptive, fault tolerant inner-loop control and autonomous, trajectory-generating outer-loop control. Developed, tested, and verified component technologies for systems integration.			
(U) In FY 2004: Develop advanced aerodynamic/structural integration concepts to enable increased system performance at reduced cost. Continue development and producibility demonstration of system hardware for an actively controlled conformal inlet system enabling increased installed propulsion system performance at reduced weight and size. Develop and demonstrate active flow control devices to increase and enhance the separation envelope for miniature munitions and reduce weapon bay acoustics to minimize damage susceptibility of sensitive commercial subsystem electronics.			
(U) In FY 2005: Develop advanced aerodynamic/structural integration concepts to enable increased system performance at reduced cost. Demonstrate an actively controlled conformal inlet system for increased propulsion system performance for unmanned air vehicles.			
(U) MAJOR THRUST: Develop analytical certification methods and capability to reduce the need for physical testing in the certification of structural components resulting in reduced acquisition cost for new systems and reduced support costs for future and legacy systems.	0.409	1.735	0.577
(U) In FY 2003: Demonstrated and validated advanced control mechanization technologies to provide highly reliable operation for manned and unmanned systems at significantly reduced size, weight, and cost. Completed advanced development and demonstration of direct optical control and interfacing of vehicle management and more-electric subsystems. Transferred technology to unmanned air vehicle control integration efforts.			
(U) In FY 2004: Develop advanced structural concepts and design methods for future aerospace vehicle airframes for enhanced affordability and higher performance. Complete demonstration of advanced of low-cost bonded composite			
Project 4920	R-1 Shopping List - Item No. 19-7 of 19-11	Exhibit R-2a (PE 0603211F)	

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2004	
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo	PROJECT NUMBER AND TITLE 4920 Flight Vehicle Tech Integration	
<p>structures concepts enabled by new analysis, manufacturing and assembly processes, which will reduce life cycle costs of current and future aerospace vehicles by maximizing the use of composite structures. Develop approaches to reliably use virtual and analytical methods to substantially reduce the need for physical testing in the certification of structural components resulting in reduced acquisition cost for new systems and reduced support costs for legacy systems.</p>			
<p>(U) In FY 2005: Develop improved sustainment technologies for existing aging aircraft and future aerospace vehicle structures to reduce operations and support costs and extend usable structural lives. Develop real-time diagnostic and prognostics health monitoring tools of thermal protection systems, tanks, structures, and subsystems to enable rapid turn around and high temperature operations. Complete the demonstration of approaches to reliably use virtual and analytical methods to substantially reduce the need for physical testing in the certification of structural components resulting in reduced acquisition cost for new systems and reduced support costs for legacy systems.</p>			
(U) MAJOR THRUST: Develop aircraft structures that have embedded components, which have previously been separate components that were attached to the air platforms.	1.909	4.174	4.175
<p>(U) In FY 2003: Developed multi-functional integrated structures to reduce acquisition costs, support costs, weight, and volume, while increasing the performance of air vehicles. Continued development of concepts with embedded high frequency multi-element antenna arrays in load bearing structure to enable increased antenna performance and new capabilities at reduced cost, weight, and volume. Developed highly efficient and durable multi-function structures with embedded electrical conductors and data cabling, health monitoring networks, fuel handling and sensing, and thermal management to minimize vehicle weight, volume, and acquisition and support costs.</p>			
<p>(U) In FY 2004: Develop multi-functional integrated structures to reduce acquisition cost, support costs, weight, and volume and increase performance of air vehicles. Continue development of concepts with embedded high and low frequency multi-element antenna arrays in load bearing structure for antenna performance improvement and reduced vehicle weight and volume. Develop highly efficient and durable structures with embedded electrical conductors and data cabling, health monitoring networks, fuel handling and sensing, and thermal management to minimize vehicle weight, volume, and acquisition and support costs.</p>			
<p>(U) In FY 2005: Continue development of multi-functional integrated structures to reduce acquisition and support costs, weight, and volume and increase performance of air vehicles. Complete demonstration of concepts with high multi-element antenna arrays embedded in load-bearing structure to increase antenna performance improvement and reduced vehicle weight, cost, and volume. Continue development of concepts of very large, low frequency antenna arrays embedded in load-bearing structure to enable new antenna capabilities and increased performance, while reducing vehicle weight, cost, and volume.</p>			
(U) MAJOR THRUST: Develop aircraft designs and technologies that improve the overall performance of propulsion	1.806	0.000	0.000
Project 4920	R-1 Shopping List - Item No. 19-8 of 19-11	Exhibit R-2a (PE 0603211F)	

Exhibit R-2a, RDT&E Project Justification		DATE February 2004	
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo	PROJECT NUMBER AND TITLE 4920 Flight Vehicle Tech Integration	
systems, which are embedded inside current and future aircraft.			
(U) In FY 2003: Developed integral airframe technologies to enable increased propulsion system performance. Successfully completed demonstration of inlet duct concepts with advanced aerodynamic technologies that enable structural integration, enhanced performance, survivability, and increased propulsion system performance. Developed conformal inlet concepts with advanced aerodynamic technologies that enable higher efficiency of propulsion systems.			
(U) In FY 2004: Not Applicable. Changes to this program are due to higher Air Force priorities.			
(U) In FY 2005: Not Applicable. Changes to this program are due to higher Air Force priorities.			
(U)			
(U) MAJOR THRUST: Develop advanced structural concept designs.		1.717	0.000
(U) In FY 2003: Developed advanced structural concepts and design methods to enhance affordability and increase the performance of current and future aerospace vehicles. Continued development of new analysis methods, design concepts, and design criteria to enable low-cost unitized composite structures. Continued development of demonstration articles for test verification of analyses methods, design concepts, and design criteria.			
(U) In FY 2004: Not Applicable. Changes to this program are due to higher Air Force priorities.			
(U) In FY 2005: Not Applicable. Changes to this program are due to higher Air Force priorities.			
(U)			
(U) MAJOR THRUST: Develop adaptive structures to provide in-flight modifications offering improved performance over a wide range of flight conditions and mission profiles.		2.155	3.269
(U) In FY 2003: Developed affordable advanced aero-structural concepts and design methods to enable new performance capabilities for future aerospace vehicles. Continued flight test demonstration of the increased high-speed control authority of an active aeroelastic wing. Developed concepts for applying continuous moldline technologies to reduce aerodynamic drag and electromagnetic signature for reconfigurable structures to enable maximum warfighting capability and versatility in a single platform. Developed highly efficient wing concepts integrating active aeroelastic design concepts, adaptive structures, and aerodynamic flow control technologies to enable new capabilities for long-range air vehicles and long-endurance vehicles.			
(U) In FY 2004: Develop advanced aero-structural concepts and design methods for enhanced affordability, higher performance, and survivability for future aerospace vehicles. Complete flight test demonstrating increased high-speed control authority enable by an active aeroelastic wing. Complete demonstration of reconfigurable continuous moldline structure concepts to reduce aerodynamic drag and electromagnetic signature to enable platform adaptation as mission requirements change and thus maximize its versatility. Continue development of highly efficient wing concepts integrating active aeroelastic design concepts, adaptive structures, and aerodynamic flow control technologies to enable viable long-range and long-endurance air vehicle concepts			
(U) In FY 2005: Develop integrated thermal airframe structures, including thermal protection systems, attachments, seals,			
Project 4920	R-1 Shopping List - Item No. 19-9 of 19-11		Exhibit R-2a (PE 0603211F)

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification	DATE February 2004
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BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603211F Aerospace Technology Dev/Demo	PROJECT NUMBER AND TITLE 4920 Flight Vehicle Tech Integration
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joining technologies, hot primary structure, and structural health monitoring for high speed vehicle applications.			
(U)			
(U) CONGRESSIONAL ADD: Sensorcraft.		2.884	3.470
(U) In FY 2003: Initiated Congressionally-directed effort for sensorcraft unmanned aerial vehicle.			0.000
(U) In FY 2004: Continued Congressionally-directed effort for sensorcraft unmanned aerial vehicle.			
(U) In FY 2005: Not Applicable.			
(U)			
(U) CONGRESSIONAL ADD: Fly-by-light Avionics for Unmanned Combat Air Vehicle (UCAV).		0.000	2.082
(U) In FY 2003: Not Applicable.			0.000
(U) In FY 2004: Initiate Congressionally-directed effort for fly-by-light Avionics for Unmanned Combat Air Vehicle (UCAV).			
(U) In FY 2005: Not Applicable.			
(U)			
(U) Congressional Add: Medlink Global Response.		0.000	0.992
(U) In FY 2003: Not Applicable.			0.000
(U) In FY 2004: Initiate Congressionally-directed effort for establishing round the clock in-flight telemedicine access to emergency physicians for assistance in managing in-flight medical emergencies.			
(U) In FY 2005: Not Applicable.			
(U) Total Cost		19.080	32.075
			25.463

(U) C. Other Program Funding Summary (\$ in Millions)									
	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
(U) Related Activities:									
(U) PE 0602201F, Aerospace Vehicle Technologies.									
(U) PE 0603333F, Unmanned Air Vehicle Dev/Demo.									
(U) PE 0604731F, Unmanned Combat Air Vehicle.									
(U) PE 0604105F, Next Generation Bomber.									
(U) This project has been coordinated through the									

Exhibit R-2a, RDT&E Project Justification

DATE

February 2004

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603211F Aerospace Technology
Dev/Demo

PROJECT NUMBER AND TITLE

4920 Flight Vehicle Tech Integration

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

Reliance process to harmonize
efforts and eliminate
duplication.

(U) **D. Acquisition Strategy**

Not Applicable.