ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**

	COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
	Total Program Element (PE) Cost	92788	106577	64654	80406	90682	92838	92778
313	ADV ROTARYWING VEH TECH	47004	34331	49994	52027	55858	55165	56360
435	AIRCRAFT WEAPONS	3879	3860	3335	2931	3207	3744	2672
436	ROTARYWING MEP INTEG	5616	1894	2948	16875	22914	24036	23484
447	ACFT DEMO ENGINES	6873	7544	8377	8573	8703	9893	10262
BA7	AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	25680	55498	0	0	0	0	0
BA8	VECTORED THRUST DUCTED PROPELLER (CA)	3736	3450	0	0	0	0	0

A. Mission Description and Budget Item Justification: The Aviation Advanced Technology Development program element (PE) matures and demonstrates manned and unmanned rotary wing vehicle (RWV) technologies and systems in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. Within this PE, aviation technologies will be matured and integrated into realistic and robust demonstrations. Emphasis will be placed on maturing manned and unmanned teaming in combat and combat support operations for attack, reconnaissance, air assault, survivability, and command and control missions. Components and subsystems that enable increased system survivability, platform lift, maneuverability, agility, and endurance; autonomous flight; common mission equipment architecture; full spectrum effects; team-based intelligent mission operations; and manned / unmanned battlespace integration will be demonstrated. Major efforts within this PE include component maturation and flight demonstrations; manned-unmanned system teaming demonstrations; manned-unmanned common architecture maturation; joint heavy lift concept exploration and full-spectrum aircraft survivability. This PE also supports the maturation and demonstration of major aviation subsystems in propulsion, drive-trains, aeromechanics and flight controls for future force manned and unmanned aviation systems in accordance with the Army Aviation Transformation Plan. Projects BA7 and BA8 fund Congressional interest items. Upgrade activities for Department of Defense (DoD) systems such as the AH-64 Apache, UH-60 Black Hawk, CH-47 Chinook; the U.S. Navy SH-60 Seahawk; and U.S. Marine Corps V-22 Osprey, AH-1 Cobra and CH-53 Super Stallion are supported by this PE. Related applied research is conducted under PE 0602211A (Aviation Technology). Aircraft survivability efforts in this PE are coordinated with PE 0603313A (Missile and Rocket Advanced Technology) and PE 0603270A (Electronic Warfare Technology). Efforts under this PE transition to programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). This PE does not duplicate any efforts within the Military Departments and supports Project Reliance for which the Army is the lead service for the maturation of rotorcraft science and technology. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this PE is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	96465	48318	67154
Current BES/President's Budget (FY 2007)	92788	106577	64654
Total Adjustments	-3677	58259	-2500
Congressional Program Reductions		-467	
Congressional Rescissions		-1074	
Congressional Increases		59800	
Reprogrammings	-3677		
SBIR/STTR Transfer			
Adjustments to Budget Years			-2500

Twenty Five FY06 Congressional adds totaling $59800 were added to this PE.

FY06 Congressional adds with no R-2A (appropriated amount is shown):
($1000) Advanced Performance for Military Helicopters
($1500) Army/Joint Aviation Technical Data Integration (JADTI)
($1000) Cutting Tools for Aerospace Materials
($800) Electromagnetic Weapons Systems for UAV Payloads
($6900) Excalibur Unmanned Combat Aerial Vehicle
($3500) Fuel Cells for Mobile Robotics System Projects
($1000) Helicopter Nanocrystaline Diamond Rotor Blade Leading Edge Protection
($1500) Helicopter Situational Awareness Enhancement in Zero Visibility Conditions
($4900) Improved VAROC/Unmanned Aerial Vehicle Compression System Development
($1500) Integrated Oil Debris and Condition Sensor for Condition-Based Maintenance
($2800) Joint Ground Forces Interoperability
($3700) Locust USA Heavy Fuel Burning Engines for UAVs
($2100) Mission Execution Technology Implementation
($1000) Multilayered Sacrificial Film Laminates for Helicopter Windscreens
($1000) Portable Reconfigurable Tooling System
($6000) Process Technologies for Replacement Part Production
($1400) Reconfigurable Tooling Systems
($500) Remotely Piloted Airship Testbed
($1400) UAV Guided Dispenser Unit
($2000) Universal Control - Full Authority Digital Engine Control(FADEC)

($3750) Unmanned Aerial Vehicle - Resupply
($2400) Versatile Affordable Advanced Turbine Engine (VAATE)
($2250) Vertical Takeoff and Landing Unmanned Aerial Vehicle
($3500) VTDP Compound Helicopter Technology Flight Demonstration
($2400) Wiring Traceout for Joint Aviation Technical Data Integration

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February 2006

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**313**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
313 ADV ROTARYWING VEH TECH	47004	34331	49994	52027	55858	55165	56360

A. Mission Description and Budget Item Justification: The Advanced Rotary Wing Vehicle (RWV) Technology project matures and demonstrates rotary wing manned and unmanned platform technologies for the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. It is envisioned that the Future Force will require rotorcraft systems that have significantly increased / improved lift, range, survivability, and mission capability with an overall reduction in logistics and cost of operation. The critical technologies to support these capabilities will be matured through demonstration of prototype Unmanned Aerial Vehicles (UAVs), rotors, active controls, structures, drive-train, integrated architecture and threat protection. The near-term demonstration of Vertical Take Off and Landing (VTOL) UAVs will focus on the A-160 Hummingbird for Reconnaissance, Surveillance and Target Acquisition (RSTA) capability. The integration of technology into UAV and manned teaming operations will be demonstrated through the merging of common operating architecture and team survivability. The Manned Unmanned Common Architecture Program (MCAP) will enable the manned and unmanned teams to use low cost modular, commercial-off-the-shelf electronics and open systems interface standards for advanced mission processing. The Survivable, Affordable, Reparable Airframe Program (SARAP) will reduce weight and increase the survivability for both manned and unmanned systems. This technology is a significant contributor to Future Force capability and will enable an increase in range for the UH-60 Black Hawk. The Rotorcraft Survivability program will reduce infrared (IR) signatures by up to 50%, incorporate innovative directional IR jamming, small arms and Rocket Propelled Grenades (RPG) hostile fire warning, threat location cueing and eye-safe visual dazzler components to improve aircraft survivability by at least 50% against small arms, RPG and Man-Portable Air Defense Systems (MANPADS) threats. This project also supports Concept Exploration of a Joint Heavy Lift platform. This effort will assess the technologies and system design trades to enable Future Combat System (FCS) vertical maneuver and Naval sea-basing. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Integrated UAV Operations - [Includes the Manned Unmanned Common Architecture Program (MCAP) and part of the Unmanned Autonomous Collaborative Operations (UACO) program]. MCAP - In FY05, completed software development environment, fabrication of mission processing architecture, development of an avionics integration laboratory at the contractor facility, on-aircraft ground tests, and flight tests on an AH-64D Apache Longbow; completed hardware/software architecture designs and development; conducted laboratory tests of the UAV embedded mission processing architecture on a Shadow 200 UAV; and investigated software application re-use between manned and unmanned mission processing architectures. UACO - In FY05, completed advanced development of software enabling air and ground vehicle autonomy and collaboration and completed integrated mission equipment hardware and software subsystems. In FY06, complete systems integration, checkout and preliminary flight validation for unmanned team of multiple autonomous UAVs. In FY07, will conduct final demonstrations of Air-Ground Cooperative Engagement using XFOR combat trained soldiers commanding unmanned teams consisting of multiple autonomous UAVs and UGVs at the McKenna MOUT site.	7475	6135	2874
UAV Systems Demonstration - In FY05, conducted flight tests using a test-fix-test approach to validate performance predictions; demonstrated ability to deliver payload via payload pod or sling load; conducted integration efforts for a turboshaft engine by developing a compatible transmission and accomplishing preliminary engine testing; and developed an indoor ground test facility where the testbed can be tested at full power. In FY06, continue ground and flight testing of several Phase I air vehicles with increasing operational tempo	15000	16696	30740

(OPTEMPO) to 20 flight hours per month, and gross weight up to 5,000 pounds. Testing includes approximately 250 flight test hours and 2,000 full power ground test runs. Complete integration and flight demonstration of a turbine engine and continue upgrading vehicle systems, as necessary, for improved reliability. In FY07, will fly UAV testbed in an OPTEMPO consistent with goals of 3 flights per week consisting of 8 hours per flight; will include approximately 700 flight test hours with multiple vehicles under single ground station control; will complete flight envelope expansion; will improve durability, damage tolerance and reliability and will characterize utility of system beyond Reconnaissance, Surveillance and Target Acquisition missions.			
Rotorcraft Survivability program - In FY05, designed and ground demonstrated, on a full-scale engine test stand, an adaptive IR suppressor system that reduces engine signatures by 50% while providing an additional 3% increase in engine performance relative to current IR suppressor systems. A 3% power increase on an AH-64 Apache helicopter translates into approximately 225 lbs. of additional lift capability. In FY06, integrate and flight demonstrate adaptive IR suppressors, super lightweight thermal insulation and multi-spectral coatings to achieve up to 50% reduction in total aircraft IR signature. In FY07, will design and flight demonstrate an integrated hostile fire warning, visual cueing and visual dazzler system that reduce small arms and RPG pointing accuracy by 50%.	1254	4500	8000
Rotorcraft Structures - In FY05, fabricated component level building block hardware and validated virtual prototype models through ballistic and crash testing. In FY06, fabricate virtual prototype (full digital definition and simulations/models) validation hardware for ballistic, static, and crash testing and transition Survivable, Affordable, Repairable Airframe Program structural technologies, concepts, and methodologies to current and developmental manned and unmanned rotary wing systems such as UH-60 Black Hawk, CH-47 Chinook, and CH-53 Super Stallion.	4193	1000	0
Rotorcraft Drive System for the 21st Century (RDS21) - In FY05, conducted goal testing (weight/durability/noise) of RDS21 demonstrator; completed design, advanced materials research and manufacturing techniques evaluation; and selected RDS21 technologies for integration onto AH-64D Apache Block III.	6082	0	0
Enhanced Drive Train - In FY07, will develop baseline design of the Enhanced Rotorcraft Drive System applicable for upgrades to the Armed Reconnaissance Helicopter, UH-60 Black Hawk, the Mission Enhanced Little Bird and scaleable to Joint Heavy Lift aircraft, with goals of 40% increase in power to weight ratio, 15dB reduction in transmission noise, and 30% reduction in operating and sustainment costs.	0	0	2380
Joint Heavy Lift (JHL) - In FY05, initiated the Joint Concept Refinement activity to include the Aerial System Concept Design and Analysis; formed Joint Integrated Product Teams for programmatic, technology, and requirements support; explored five VTOL concepts across a wide spectrum of speed bands as a result of five contract awards to industry; and initiated the requirements analysis concept that encompasses conventional and compound helicopters as well as more advanced rotorcraft configurations. In FY06, advance these concept designs and assess their performance characteristics as part of the ongoing joint requirements refinement. Initiate a Joint Analysis of Alternatives (AoA). In FY07, will complete Concept Design and Analysis including an Independent Government performance and risk assessment; will complete the Joint Concept AoA; and will develop a draft Capabilities Development Document.	13000	6000	6000
Total	47004	34331	49994

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**435**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
435 AIRCRAFT WEAPONS	3879	3860	3335	2931	3207	3744	2672

A. Mission Description and Budget Item Justification: The Aircraft Weapons project matures manned and unmanned rotorcraft sensor and weaponization technologies for Future Force air-to-air and air-to-ground application and, where feasible, exploits opportunities to enhance Current Force capabilities. This project supports the Future Force by providing mature technologies to focus combat power on multiple targets. The technologies will provide precision engagement capabilities to meet the demands of Military Operations in Urban Terrain (MOUT), force protection, and other asymmetrical threats. This project includes integration of advanced missiles, rockets, guns, fire control, advanced target acquisition and pilotage sensors, and directed energy weapons, including non-lethal capabilities onto existing and developing airframes. These capabilities are evaluated to assure compatibility and demonstrate timely, precision engagement capabilities and the full spectrum effectiveness of the manned and unmanned team. Technology integration issues concerning on-board systems, vehicle flight characteristics and weapon system will be matured and demonstrated. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Weapons Integration - [Includes the Aerial Delivery of Effects from Lightweight Aircraft (ADELA) and Directed Energy Non-Lethal Weapons Integration programs] - In FY05, the Unmanned Light Armed Reconnaissance Testbed (ULART) program, a spin-off of the ADELA program, leveraged an industry program to convert a small, fielded helicopter (AH-6) into a robust Vertical Take Off and Landing (VTOL) Unmanned Aerial Vehicle (UAV) testbed with a lethal weapons suite while carrying an on-board pilot as a safety backup. The ULART program matured and demonstrated precision targeting and weapons delivery, limited coupling of weapon systems with vehicle management, understanding operator weapons interface issues, and manned/unmanned aircraft teaming. The ULART program demonstrated a precision weapons firing at Yuma Proving Ground. In FY06, mature ADELA unmanned teaming and cueing for collaborative engagements and demonstrate integration of a variety of existing low-cost, lightweight sensors and weapons on small UAV platforms to aid in the delivery of full spectrum of effects in complex terrain under close support conditions. In FY07, ADELA will demonstrate tactical fire control, human-in-the-loop protocols and collaborative, team-based weapons and precision targeting processes to demonstrate a Revenge Kill capability and an airborne sniper capability on small UAV platforms. In FY07, the Directed Energy Non-Lethal Weapons Integration program will address the application of directed energy (e.g., laser, Radio Frequency, acoustics) non-lethal weapons concepts to manned and unmanned aviation assets.	3879	2860	3335
Enhanced Rotorcraft Drive System program - In FY06, initiate design of the Enhanced Rotorcraft Drive System with goals of 40% increase in power-to-weight ratio, 15dB reduction in transmission noise, and 30% reduction in operating and sustainment costs. Work here is done in conjunction with this PE, Project 313 and Program Element 0602211, Project 47B.	0	1000	0
Total	3879	3860	3335

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**436**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
436 ROTARYWING MEP INTEG	5616	1894	2948	16875	22914	24036	23484

A. Mission Description and Budget Item Justification: The Rotary Wing Mission Equipment Package Integration project matures and validates man-machine integration and mission equipment technologies in support of the Future Force and, where feasible, exploits opportunities to enhance Current Force capabilities. This project improves the overall mission execution by demonstrating manned and unmanned system teaming, enhanced helicopter pilotage capability and improved crew workload distribution. This project supports the Future Force by providing mature technology to enhance near-real time situational awareness for manned and unmanned rotary wing vehicles. The manned / unmanned team will be capable of performing reconnaissance, surveillance, target acquisition and attack while maintaining constant tactical situational awareness. Integration of state-of-the-art approaches in artificial intelligence, intelligent agents, sensors, avionics, communications, pilot vehicle interfaces, and autonomous assistants will enable a manned / unmanned team that enhances Army aviation battlefield effectiveness. This project provides Cognitive Decision Aiding (CDA) tools for crews by maturing knowledge-based information systems. Advanced integration technology in information management, sensors, displays, and controls is optimized for combat helicopter mission effectiveness and survivability for day / night adverse weather operations. Virtual prototyping capability is used as the foundation for evaluating combined rotorcraft control and crew performance. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Airborne Manned and Unmanned System Technology (AMUST) [Includes the Hunter Standoff Killer Team (HSKT) Advanced Concepts Technology Demonstration (ACTD)] - In FY05, conducted flight tests of AMUST/HSKT system on AH-64D Longbow Apache, Army Airborne Command & Control System (A2C2S) UH-60 Black Hawk, and Hunter UAV in preparation for operational demonstration and military utility evaluation in FY06 under the HSKT ACTD.	5616	0	0
Integrated UAV System Demonstration - This program captures the results of the AMUST, Unmanned Autonomous Collaborative Operation (UACO), and the Manned-Unmanned Rotorcraft Enhanced Survivability (MURES) programs, TARDEC's Human Robot Interaction (HRI) and Armed Robotic Vehicle (ARV) Robotic Technologies (ART) programs and the Army Research Laboratory's Robotics Collaborative Technology Alliance (CTA) to develop, integrate and demonstrate the foundational technologies to enable UAVs to act as uninhabited wingmen. In FY06, assess contribution of technology and operational factors on safe separation of small UAVs and manned helicopters; mature and integrate systems for real-time and preplanned flight path deconfliction that are transparent to helicopter crew; and perform engineering validation flight tests of autonomy and collaboration technologies and simulation and evaluation of autonomous collaborative systems. In FY07, will flight test deconfliction systems and will begin maturing autonomy and human interface technologies to enable UAVs to provide overwatch and protection to moving and stationary ground forces by leveraging technologies from decision aiding, autonomy, collaboration, networking, and architecture programs.	0	1894	2948
Total	5616	1894	2948

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**447**

COST (In Thousands)	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
447 ACFT DEMO ENGINES	6873	7544	8377	8573	8703	9893	10262

A. Mission Description and Budget Item Justification: The Aircraft Demonstration Engines project matures and demonstrates power system technologies for use in the Future Force through competitively performed design, fabrication and test of advanced material technologies, engines and integrated components, and, wherever feasible, exploits opportunities to enhance Current Force turbine engines. This project supports the Future Force by providing mature technologies for lighter turbine engines that provide more power, can go farther, and are easier for the warfighter to maintain and sustain. This will improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The Small Heavy Fuel Engine (SHFE) program is fully aligned with the goals of the Department of Defense (DoD) Versatile Affordable Advanced Turbine Engine (VAATE) program. VAATE goals focus on reducing specific fuel consumption (SFC) and increasing the power-to-weight (P/W) ratio of turboshaft engines while decreasing production and maintenance costs. SHFE provides significantly increased range and payload capabilities for future manned and unmanned rotorcraft and sustainment upgrades for current engines. This will include significant Operation and Support cost savings and a significantly reduced logistics footprint. The SHFE program is focusing on maturing and demonstrating advanced, affordable turbine engine technology in the 700 horsepower (HP) class engine. The SHFE will result in significant improvements in SFC and P/W ratio that will enable a heavy fuel (JP-8) engine capability for applications such as the UAV Testbed, Armed Reconnaissance Helicopter (ARH), AH/MH-6 Mission Enhanced Little Bird, and Future Combat System (FCS) ground and aerial vehicles. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). Work in this project is performed by the Aviation Applied Technology Directorate of the Aviation and Missile Research, Development and Engineering Center located at Fort Eustis, VA.

Accomplishments/Planned Program	FY 2005	FY 2006	FY 2007
Small Heavy Fuel (Turbine) Engine (SHFE) - In FY05, procured parts, completed successful rig test of components of a 700 Horsepower engine, including the compressor, combustor, mechanical components, spin validation, and turbine validation and initiated Build 1 core testing. In FY06, complete Build 1A core and Build 1B engine testing; incorporate design improvements of the compressor, combustor, turbines, mechanical components, and control and accessories into Builds 2 and 3; complete the fabrication of redesigned components for engine Build 2; and conduct rig test on redesigned combustor and mechanical systems. In FY07, will complete engine testing of Build 2 and rig test optimized components consisting of a combustor, controls and associated mechanical systems; will complete the fabrication of components for engine Build 3; and will conduct final engine ground stand test for Build 3 to demonstrate program goal achievement.	6873	7544	8377
Total	6873	7544	8377