ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

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

	COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
	Total Program Element (PE) Cost	93880	98899	57277	69597	66132	77532	82521
313	ADV ROTARYWING VEH TECH	30274	42205	45949	56040	51530	56914	59132
435	AIRCRAFT WEAPONS	1853	2889	2688	3723	2659		
436	ROTARYWING MEP INTEG	2637				1743	10190	12727
447	ACFT DEMO ENGINES	8051	8453	8640	9834	10200	10428	10662
BA7	AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	44618	41376					
BA8	VECTORED THRUST DUCTED PROPELLER (CA)	3147	3976					
BA9	PIAC VECTORED THRUST HELICOPTER	3300						

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 are matured and integrated into realistic and robust demonstrations. Work includes maturing manned and unmanned teaming in combat and combat support operations for attack, reconnaissance, air assault, and command and control missions. Integrated unmanned operations are advanced through autonomous collaboration and maturation of advanced unmanned technologies such as components and subsystems that enable increased system survivability and crew protection, platform lift, maneuverability, agility and endurance, autonomous flight, common mission equipment architecture, team-based intelligent mission operations, manned / unmanned battle space integration, and/or improved operational availability and reduced maintenance are matured and demonstrated. Major efforts within this PE include component maturation and flight demonstrations; manned-unmanned system teaming demonstrations; operation and support cost reduction applications; joint concept exploration including multi-role rotorcraft and integrated 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. This PE also matures manned and unmanned rotorcraft sensor and weaponization technologies for air-to-air and air-to-ground application. Projects BA7 and BA8 fund congressional interest items. Department of Defense (DoD) systems such as the US Army AH-64 Apache, UH-60 Black Hawk, CH-47 Chinook, Armed Reconnaissance Helicopter, Light Utility Helicopter; the US Navy SH-60 Seahawk; and the US Marine Corps V-22 Osprey, AH-1 Cobra, and CH-53 Super Stallion benefit and are supported directly or indirectly 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. The Army is the executive agent for the maturation of rotorcraft science and technology on behalf of all Service needs. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. Work in this PE is performed by the Aviation and Missile Research, Development, and Engineering Center with facilities located at Redstone Arsenal, AL; Fort Eustis, VA; and Moffett Field, CA.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2008

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

B. Program Change Summary	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2008/2009)	96575	53890	57615
Current BES/President's Budget (FY 2009)	93880	98899	57277
Total Adjustments	-2695	45009	-338
Congressional Program Reductions		-631	
Congressional Rescissions			
Congressional Increases		45640	
Reprogrammings	-103		
SBIR/STTR Transfer	-2592		
Adjustments to Budget Years			-338

Eighteen FY08 congressional adds totaling $45640 were added to this PE.

($800) Power Dense Rotorcraft Transmission
($1200) Night Vision Goggle Compatible Electrostatically Conductive Windscreen Laminates for use on Acrylic/polycarbonate Windscreens on Helicopters
($1600) Enhanced Rapid Tactical Integration and Fielding of Systems
($1600) Helmet Mounted Display/Visor Projection for Army Helicopters
($1600) Quick-MEDS Automated Release Pod
($2000) UAV Resupply (BURRO)
($2240) Alternate Payload Bomb Live Unit Munition
($2400) Autonomous Cargo Acquisition for Rotorcraft Unmanned Aerial Vehicles
($2400) Drive System Composite Structural Component Risk - Reduction Program
($2400) Excalibur
($2400) Fuel Cells for Mobile Robotic Systems Project
($2400) Improved VAROC/UAV Compression System Development
($3000) Universal Control Full Authority Digital Engine Control
($3600) Parts-on-Demand for CONUS Operations
($4000) Inter Turbine Burner for Turbo Shaft Engines
($4000) Joint Technical Data Integration-Wide Intelligent Content Enhancements
($4000) Technologies for Military Equipment Replenishment
($4000) Vectored Thrust Ducted Propeller Compound Helo

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

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

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
313 ADV ROTARYWING VEH TECH	30274	42205	45949	56040	51530	56914	59132

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. The Army Aviation Transformation Plan requires 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 are matured through the demonstration of key subsystems such as rotors, active controls, structures, drive-train, integrated threat protection technologies, as well as prototype Unmanned Aerial Systems (UAS). The integration of technology into UAS and manned teaming operations involves the merging of a common operating architecture and incorporates team survivability. The Enhanced Rotorcraft Drive System program provides a 40 percent increase in power-to-weight ratio, 30 percent reduction in both production and Operating and Support (O&S) costs and a 15 decibel (dB) reduction in noise for the drive-systems of both manned and unmanned rotorcraft. These technologies are a significant contributor to Future Force capability and enable a 40 percent increase in payload for the AH-64 Apache, a 20 percent increase in range for the UH-60 Black Hawk, and over a 25 percent increase in range for the CH-47 Chinook over their respective baselines. The Rotorcraft Survivability program reduces Infra-Red (IR) signatures by up to 50 percent, incorporates innovative directional IR jamming, hostile fire warning sensors to detect small arms and Rocket Propelled Grenades (RPG), threat location cueing and eye-safe visual dazzler components to improve aircraft survivability by at least 50 percent against small arms, RPG and Man-Portable Air Defense Systems (MANPADS) threats. The Intelligent Decision-aiding for Aircraft Survivability (IDAS) program integrates an eye-safe visual laser jammer and laser obstacle avoidance capability into a low cost, lightweight laser missile jammer to reduce system cost by 50 percent and system weight by 50 percent. IDAS also integrates an in-cockpit Survivability Planner function which provides enhanced situational awareness/understanding of the tactical threat situation to the manned-unmanned team and develops and displays recommended courses of action. This project also supported the Concept Exploration of a Joint Heavy Lift rotorcraft platform. This effort assesses the technologies and system design trades to enable vertical mounted maneuver and Naval sea-basing. The Capability-Based Operations and Support Technologies (COST) program improves operational availability and reduces maintenance time by providing 50 percent reduction in inspections per flight hour, 12 percent reduction in maintenance labor, and 15% increase in component time on wing by 2013 for critical mechanical/electrical components and providing prognostic capability for long lead-time airframe and propulsion components, resulting in timely delivery of flight-critical parts. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. 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 2007	FY 2008	FY 2009
UAS Technology Demonstration: In FY07, flew the A-160 Hummingbird-based UAS testbed with turboshaft engine installed. Evaluated the aircraft in a ground testing environment by performing ground runs for 250 hours to increase operational hours and experience in order to mitigate risk during flight operations. Conducted approximately 35 hours of flight tests to step towards program performance goals of range, endurance (18-20 hours), hover-out-of-ground-effect altitude (15,000 feet) and speed (140 knots). Have demonstrated 12 hours endurance (with 500 lbs. of payload) and program goals of 140 knots and 1000 lbs. payload for 1000 kilometers. Flew at gross weights up to nearly 5000 lbs.	14407		
Robotics Collaboration: In FY07, completed system integration and trial runs for the Unmanned Autonomous Collaborative Operations	2760		

final demonstrations that included three RMAX UAS and two UGVs. Concluded program with final demonstration of Air-Ground Cooperative Engagement using Soldiers commanding this unmanned team from a High Mobility Multipurpose Wheeled Vehicle (HMMWV) mounted Control Unit or alternately a hand-held display device at the McKenna MOUT Range at Ft. Benning, GA. Work on this effort is also being accomplished under PE 0602716A, project H70; PE 0602211A, project 47A; PE 0603005A, project 497; and PE 0603005A, project 515.			
Rotorcraft Survivability: In FY07, continued the maturation of aircraft IR signature technologies, inclusive of engine exhaust suppression, and tailored IR coating systems. Conducted multiple risk reduction flight tests to refine hostile fire indication (HFI) algorithm false alarm rejection characteristics. Refined subsystem integration activities and executed initial simulation lab checkout of the integrated subsystem and system level communication and control. Integrated the eye-safe visual disruption laser into the visual targeting disruption system. Initiated fabrication of aircraft installation hardware required for the UH-60 Black Hawk installation. In FY08, integrate a suite of candidate survivability technologies on a Black Hawk helicopter and perform flight tests to quantify the increase in threat detection range as well as the reduction in the threats' lock-on range and targeting accuracy. Develop a fully-integrated team-based aircraft self-protection suite for defeating current MANPADS threats, small arms and rocket propelled grenades, anti-tank guided missiles, and radar threats, utilizing multi-function threat detection and threat countermeasures for reduced system weight and cost. In FY09, will begin integration of cognitive decision aiding technologies (developed earlier under the Survivability Planner Associate Rerouter/Manned-Unmanned Rotorcraft Enhanced Survivability effort) into a demonstrator aircraft. Work on this effort is also being accomplished under PE 0602270A, project 442 and PE 0603270A, project K16.	7684	8777	7234
Enhanced Rotorcraft Drive System (ERDS): In FY07, completed design and analysis for the composite gearbox housing; completed analytical tools for helical face-gear manufacturing and profile/mesh development; started surface durability testing of advanced gear materials in helical face-gear configuration; fabricated support system components for the demonstrator transmission; generated failure mode analysis and diagnostic algorithms for face-gear applications; and conducted detailed design and fabrication of tooling for integral composite coupling/shaft. In FY08, begin fabrication of the helical face gears, gears for the enhanced power density tail rotor gearbox, and composite shafts. Conduct demonstration testing of the composite gearbox housing. In FY09, will complete fabrication of components; will conduct endurance testing of the helical face gear design; will perform demonstration tests of the composite shaft/coupling, composite main rotor drive shaft, and tail rotor enhanced power density gears. Will validate diagnostic algorithms as part of the demonstration tests.	2358	4119	5000
Joint Heavy Lift (JHL): In FY07, completed the final Concept Refinement Design Review; completed Concept Design and Analysis including an Independent Government performance and risk assessment; completed a preliminary Joint Concept Analysis of Alternatives; and developed a draft Capabilities Development Document.	3065		
High Altitude Long Endurance (HALE) Platforms: In FY08, conduct first flight and begin expansion of envelope to demonstrate endurance, durability, maintainability, and structural life. Evaluate manning schemes to determine optimum ground personnel support requirements. In FY09, will refine flight characteristics and demonstrate air vehicle endurance, foot-print and turn time (time to prepare vehicle for next mission). Will demonstrate payload performance and data assimilation and storage. Will validate military utility of air vehicle in concert with ground control station and military operators. Work on this effort is done in coordination with PE's 1160401BB; 1160428BB; 0604857F; 0603160BR; and 0207434F during execution of the Global Observer Joint Capability Technology Demonstration.		5000	7500
Rotor Design and Capabilities: In FY08, mature and demonstrate passive and active control methods for improving rotorcraft performance in a heavy vibration environment. Determine benefit, design implications and limitations of the Optimum Speed Rotor technology when applied to rotorcraft of different classes and mission types. Evaluate high lift technologies that provide rotor systems		16595	18108

with improved aero performance, while enhancing damage tolerance. Characterize advanced main rotor hub concepts compatible with on-blade rotor control systems leading to increased rotorcraft performance. Evaluate applicability of candidate technologies to current airframes. In FY09, will characterize rotor system performance across the flight envelope, under a wide variety of flight conditions and mission types through rigorous flight testing. Will optimize the design of lightweight active rotor technology intended to improved aerodynamic efficiencies and maximize air vehicle performance. Will demonstrate enhanced rotor durability and performance technologies to assess contribution to aircraft maintenance and performance. Will mature leading concepts in passive and active technology arena to provide enhanced aerodynamic performance with optimized active and passive technology implementation.			
Capability-Based Operations and Sustainment Technologies (COST): In FY08, expand the existing engine diagnostic models to include continuous on-board power availability calculations, prognostic models, and advanced control models to: allow the pilot to continuously know the engine power available; allow calculation of engine component efficiencies during flight to predict remaining life of components and scheduling of maintenance; and enable the modification of the engine control laws to optimize engine performance. Refine state-awareness algorithms for aircraft parameters such as Center of Gravity (CG) to enable accurate usage monitoring, thus preventing early retirement of components (as current component life is determined by an assumed worse-case application of CG and operating weight). Integrate rotor/swash-plate bearing, pitch rods, flight controls, and hanger bearing algorithms into a health monitoring system. Develop and validate diagnostic/prognostic algorithms for electrical subsystems to detect health and degradation rates of generators, power converters and batteries resulting in proactive maintenance and reduced mission aborts. In FY09, will validate and refine engine software algorithms by testing a engine in a controlled, instrumented test cell. Will perform full-scale rig testing of rotor head, flight controls, and bearings to verify/validate the newly developed algorithms. Will initiate regression testing of software (which is when, during a bench test, the algorithms' functionality and interoperability with other software and sensor inputs is evaluated using simulated flight test data) in preparation for system integration and flight testing. Will perform full-scale testing of electrical system algorithms using aircraft components. Will begin testing of corrosion monitoring sensors and algorithms, reducing time intensive inspections. Will demonstrate prognostication of remaining service life in damage tolerant airframe components.		6600	8107
Small Business Innovative Research/Small Business Technology Transfer Programs		1114	
Total	30274	42205	45949

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

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

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
435 AIRCRAFT WEAPONS	1853	2889	2688	3723	2659		

A. Mission Description and Budget Item Justification: The Aircraft Weapons project matures and integrates 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 provides mature technologies to focus combat power on multiple targets. The technologies 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 ensure 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 systems will be matured and demonstrated. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy and the Army Science and Technology Master Plan. 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 2007	FY 2008	FY 2009
Aviation Multi-Platform Munition: In FY07, Aerial Delivery of Effects from Lightweight Aircraft (ADELA) demonstrated the integration of low cost sensors and weapons (0.338 cal rifle) on a Class III Unmanned Aerial System (UAS) to provide a precision engagement capability. ADELA concluded with a demonstration of tactical fire control, human-in-the-loop protocols and collaborative, team-based weapons and precision targeting to show how small UAS can provide an airborne sniper capability in support of ground troops in a Military Operations in Urban Terrain (MOUT) environment. In FY08, conduct a Concepts Based Analysis in concert with the User community to identify technologies (such as launcher interface, weapon seeker and weapon motor) and approaches for improving sensor to shooter synergies across Army aviation operations. Mature the requirements definition for a new, lightweight weapon system for both manned and unmanned aviation platforms. In FY09, will finalize requirements documentation for a lightweight weapons system. Will mature design of weapon system components to support platform integration efforts for both manned and unmanned aviation platforms. Will evaluate application of this weapon system to other than aviation platforms such as Unmanned Ground Systems.	1853	2822	2688
Small Business Innovative Research/Small Business Technology Transfer Programs		67	
Total	1853	2889	2688

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2008

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

COST (In Thousands)	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
447 ACFT DEMO ENGINES	8051	8453	8640	9834	10200	10428	10662

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 demonstrating mature technologies for lighter turbine engines that provide more power, can go farther, and are easier for the warfighter to maintain and sustain. These attributes improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The Small Heavy Fuel Engine (SHFE) and Advanced Affordable Turbine Engine (AATE) efforts are 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 and AATE provide significantly increased range and payload capabilities for future manned and unmanned rotorcraft and sustainment upgrades for current engines. This includes significant Operation and Support cost savings and a significantly reduced logistics footprint. The SHFE effort focuses on maturing and demonstrating advanced, affordable turbine engine technology in the 700 horsepower (HP) class engine and AATE addresses needs in the 3000 HP class. The SHFE provides significant improvements in SFC and P/W ratio that enable a heavy fuel (JP-8) engine capability for applications such as the UAS Testbed, Armed Reconnaissance Helicopter (ARH), AH/MH-6 Mission Enhanced Little Bird, and other future ground and aerial vehicles. The AATE effort enables enhanced operational capability that is applicable to UH-60 Black hawk and AH-64 Apache. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy and the Army Science and Technology Master Plan. 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 2007	FY 2008	FY 2009
UAS Technology Demonstrations - Small Heavy Fuel (Turbine) Engine (SHFE): In FY07, completed engine and rig testing of optimized components consisting of a combustor, controls, and associated mechanical systems; completed the fabrication and installation of the final components into the complete engine build; and conducted final engine ground stand testing to demonstrate program goal achievement.	8051		
Advanced Affordable Turbine Engine (AATE) Tech: In FY08, complete preliminary design, detailed design, and component fabrication of the initial build of an advanced 3000 horsepower-class turboshaft engine demonstrator, building on knowledge gained in the Small Heavy Fuel Engine effort and the DOD Versatile Affordable Advanced Turbine engine effort. Design activity includes 2-D and 3-D mechanical and aerothermal efforts to evaluate the inlet particle separator, compressor, combustor, gas generator turbine, power turbine, bearings, seals, shafts, controls, and accessories. Fabrication efforts include component hardware and rig support hardware for initial component rig tests. In FY09, will complete initial rig-tests for several engine components (e.g. compressor, turbine, combustor, mechanical systems) to validate design aerodynamic performance and mechanical integrity prior to integrating these technologies into a gas generator for a full engine test. Will use results from initial component rig-tests to complete / refine hardware fabrication efforts as appropriate for first engine build. Will analyze component rig-test results to support redesign efforts as required for future engine builds.		8240	8640
Small Business Innovative Research/Small Business Technology Transfer Programs		213	
Total	8051	8453	8640