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

February 2002

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

	COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
	Total Program Element (PE) Cost	26835	38496	45404	74754	83300	85758	86474
313	ADV ROTARYWING VEH TECH	12885	18129	30366	60429	52259	50506	50013
435	AIRCRAFT WEAPONS	2851	1778	2327	994	11541	10207	10758
436	ROTARYWING MEP INTEG	4462	9538	5857	6206	12064	16757	17019
447	ACFT DEMO ENGINES	6637	9051	6854	7125	7436	8288	8684

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 in support of the Objective Force and Joint Vision 2020. Based on the Army transformation, this PE has been refocused to demonstrate technologies applicable to unmanned systems and selected opportunities for manned systems. Unmanned rotary wing vehicles bring unprecedented agility, maneuverability, and lethality to the Objective Force while providing reduced signature and logistics. Within this PE, aviation technologies will be matured and integrated into realistic and robust prototype system demonstrations that meet a Technology Readiness Level of 6 or better. Emphasis will be placed on maturing unmanned combat, reconnaissance, and communications relay capability. Technologies that enable the autonomous flight, higher aerodynamic airframe loads, and increased maneuverability possible with unmanned aerial vehicles will be demonstrated. This PE provides technical support and technology transition to Unmanned Aerial Vehicles (UAV) and RAH-66 Comanche. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance for which the Army is the lead service for the maturation of rotorcraft science and technology. Related applied research is conducted under PE 0602211A (Aviation 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). The program element contains no duplication with any effort within the Military Departments. Work in this PE is performed by the Aviation and Missile Research, Development and Engineering Center, Redstone Arsenal, AL. This PE supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

B. Program Change Summary	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	28545	44843	45028
Appropriated Value	28810	38843	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-347	0
b. SBIR / STTR	-796	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-915	0	0
e. Rescissions	-264	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	376
Current Budget Submit (FY 2003 PB)	26835	38496	45404

Change Summary Explanation:

Significant Change:
FY02 (-$6000) Congressional reduction.

FY02 - Congressional adds:

($1500) Aviation Advanced Technology, Project 436 for Airborne Manned/Unmanned System Technology Radio Frequency network.

($3500) Aviation Advanced Technology, Project 447 for Unmanned Aerial Vehicle turboshaft engine.

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
313	ADV ROTARYWING VEH TECH	12885	18129	30366	60429	52259	50506	50013

A. Mission Description and Budget Item Justification: The Advanced Rotary Wing Vehicle (RWV) Technology project matures and demonstrates rotary wing unmanned and manned platform technologies for the Objective Force. It is envisioned that the Objective Force will need unmanned and manned rotorcraft systems that have significantly increased/improved lift, range and survivability with an overall reduction in logistics. Key to this effort is the demonstration of a vertical takeoff and landing (VTOL) UAVs for the Objective Force. The critical technologies to support these capabilities will be matured through Technology Demonstrations (TDs) of prototype UAVs, rotors, active controls, structures, drive train, and threat protection. The near term demonstration of unmanned, VTOL UAVs will focus on the A-160 Hummingbird UAV and the Organic Air Vehicle (OAV), to include the Micro Air Vehicle variant, for Reconnaissance, Surveillance and Target Acquisition (RSTA) capability. These demonstrations will focus on military operations and the application of military specification on these maturing systems. The Survivable, Affordable, Repairable Airframe Program (SARAP) and Full Spectrum Threat Protection (FSTP) TDs will reduce weight and increase the survivability for manned and unmanned systems. The Rotorcraft Drive Systems for the 21st Century (RDS21) TD will provide a 35% increase in power-to-weight ratio, 20% reduction in both production and operating and support costs and a 15 decibel (dB) reduction in noise for advanced drive-systems. The Helicopter Active Control Technology (HACT) TD will contribute to a 50-100% increase in payload, 100-200% increase in range and 50-65% improvement in maneuverability / agility when integrated with the RWV system. Work in this project is performed by contractors including: Boeing Company, Mesa, AZ and Philadelphia, PA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Lockheed Martin, Atlanta, GA; Sikorsky Aircraft Corporation, Stratford, CT; Raytheon Company, Arlington, VA; and United Technologies Research Center, Hartford, CT. This system supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6991 - Conducted detailed design of active flight control system. Integrate hardware and software into test rotorcraft.
  - Conducted flight control subsystems flight tests.
  - Refined helicopter active flight controls engineering models and simulation.
- 5519 - Prepared detailed design and fabrication of tooling for exit criteria demonstration of test articles.
  - Conducted full-scale static testing of rotary wing structural fuselage sections affirming weight, cost and development cycle time reductions.
- 375 - Conducted RDS21 preliminary design for 35% increase in power-to-weight, -15dB noise reduction, 2X increase in durability and 25% reduction in production cost.

Total 12885

FY 2002 Planned Program

•	4717	- Establish Hardware in the Loop (HWIL) simulations for small UAVs: Micro Air Vehicle (MAV) and Organic Air Vehicle (OAV)
		- Refine Wind Tunnel parameters for UAV unique tests.
		- Conduct demonstration of RSTA VTOL UAV (A-160 Hummingbird) with DARPA.
		- Refine open source software for autonomous operation.
		- Conduct lethality evaluations on UAVs.
•	3361	- Conduct RDS21 detailed design.
		- Conduct analysis of RDS21 design parameters.
		- Perform rig testing of face gears for durability and strength
•	7000	- Perform helicopter active control system flight test.
		- Analyze test results using metrics developed to quantify system improvements.
		- Conduct HACT flight control system flight testing.
•	1951	- Identify and screen candidate technologies with potential to meet SARAP program goals of 25% weight and 40% manufacturing labor reductions compared to 1994 baseline.
		- Identify unique issues associated with large airframe affordability/survivability/reparability.
•	1000	- Conduct lab testing of candidate signature reduction hardware and active countermeasure devices for incorporation into the FSTP test platform.
•	100	- Personnel Recovery Extraction Survivability aided by Smart Sensors (PRESS) Advanced Concept Technology Demonstration (ACTD).
Total	18129	

FY 2003 Planned Program

- 16786 - Conduct HWIL UAV simulations for small UAVs (MAV and OAV) and medium sized UAV (A-160 Hummingbird and UCAR).
  - Conduct wind tunnel testing for small and medium UAVs
  - Conduct autonomous operations and evaluations.
  - Conduct small heavy fuel engine UAV demonstration.
  - Conduct Smart Structures UAV demonstration.
  - Conduct adaptive sensors UAV demonstration.
  - Conduct airspace management demonstration.
- 5280 - Complete RDS-21 preliminary design and analysis.
  - Complete laboratory validation of RDS21 components.
  - Begin fabrication of RDS21 demonstrator hardware.
- 3300 - Design, fabricate and test component level risk reduction specimens that supports SARAP program goals.
  - Conduct preliminary design phase for test articles in FY 2004.
- 5000 - Conduct validation laboratory test results and follow-on lab testing of candidate signature reduction hardware and active countermeasure devices for incorporation into the FSTP test platform.
  - Fabricate FSTP test aircraft.

Total 30366

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
435	AIRCRAFT WEAPONS	2851	1778	2327	994	11541	10207	10758

A. Mission Description and Budget Item Justification: The Aircraft Weapons project matures manned and unmanned rotorcraft sensor and weaponization technologies for air-to-ground and air-to-air application. This project supports the Objective Force and Joint Vision 2020 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. Integration of advanced missiles (Air-to-Air / Air-to-Ground), rockets, guns, fire control, advanced target acquisition and pilotage sensors, and directed energy weapons, including non-lethal capabilities, are evaluated and on rotorcraft platforms to assure compatibility of the weapon system with the rotorcraft system. Technology integration issues with on-board systems, vehicle flight characteristics and weapon system are matured and demonstrated. The project will mature Low Cost Precision Kill (LCPK) rocket system using a 2.75-inch rocket with a laser seeker sensor and the project will evaluate other technologies for providing rotorcraft combat enhancements. Work in this project is performed by contractors including: Boeing Company, Mesa, AZ and Philadelphia, PA; Lockheed Martin, Atlanta, GA; and Raytheon Company, Arlington, VA. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 2851 - Finalized LCPK ATD AH-64D aircraft integration system analyses and design.
  - Built flight hardware for Apache Longbow to support airborne evaluation of the LCPK guided rocket
  - Investigated LCPK aircraft integration common areas with Army, Marine, and Special Operations Aviation (SOA) aircraft.
  - Conducted integration of LCPK with an unmanned aerial vehicle to address manned-unmanned aviation platform teaming issues and weapons/sensor integration issues.

Total 2851

FY 2002 Planned Program

•	1778	- Conduct LCPK Advanced Technology Demonstration AH-64D aircraft. integration
		- Perform airborne evaluation of the LCPK guided rocket.
Total	1778	

FY 2003 Planned Program

•	1327	- Conduct AH-64D airborne evaluation of the LCPK guided rocket.
•	1000	- Provide technical support to Loitering Electronic Warfare Killer Advanced Concept Technology Demonstration.
Total	2327	

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

February 2002

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
436 ROTARYWING MEP INTEG	4462	9538	5857	6206	12064	16757	17019

A. Mission Description and Budget Item Justification: The Rotary Wing Mission Equipment Package Integration project matures and affirms man-machine integration and mission equipment technologies. This project improves the overall mission execution by demonstrating Unmanned/Manned System teaming, enhanced helicopter pilotage capability and improved crew workload distribution. This project supports the Objective Force and Joint Vision 2020 by providing mature technology to enhance near-real time situational awareness for unmanned and manned rotary wing vehicles. The Airborne Manned/Unmanned System Technology (AMUST) program integrates advanced technologies in sensors, displays, communication and controls necessary to team airborne manned and unmanned vehicles to maximize the teams' lethality, survivability, and operational tempo in support of the maneuver commander. The manned/unmanned team will be capable of performing scout and reconnaissance assignments and alerting manned rotorcraft of "just ahead" tactical situation awareness. State-of-the-art approaches in artificial intelligence, intelligent agents, sensors, avionics, communications, pilot vehicle interfaces, and autonomous assistants will result in an integrated 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 will be matured to maximize 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. Work in this project is performed by contractors including: Boeing Company, Mesa, AZ and Philadelphia, PA, Lockheed Martin, Atlanta, GA, and Raytheon Company, Arlington, VA. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 4462
  - Refined AMUST functional and interface specs to support critical operational functions.
  - Performed initial integration of CDA and AMUST technologies as part of the Hunter Standoff Killer Team (HSKT) Advanced Concept Technology Demonstration.
  - Conducted knowledge acquisition for Aviation scout / attack mission teams composed of manned and unmanned platoons.
  - Provided Manned-Unmanned Teaming capability to 101st Airborne Division for Joint Readiness Training Center (JRTC) training rotation.
  - Modified operational Longbow Apache. Line pilots from 101st controlled the Hunter Unmanned Aerial Vehicle and received video to increase situational awareness and survivability.
  - Performed compatibility study with the Navy Tactical Control System (TCS).

Total 4462

FY 2002 Planned Program

- 9538 - Integrate AMUST technology with the Navy Tactical Control System (TCS).
  - Integrate AMUST technology with Warfighter's Decision Aid.
  - Expand AMUST teaming technology to other tactical UAVs.
  - Perform transition study of AMUST teaming technology to Comanche.
  - Flight test AMUST teaming technology with Warfighter's Decision Aid equipped Longbow Apache and other tactical UAVs as part of Hunter Standoff Killer Team (HSKT) Advanced Concept Technology Demonstration.
  - Develop interface control documents to integrate HSKT hardware in a System of Systems Construct, (i.e. Apache, Hunter Unmanned Aerial Vehicle (UAV), UH-60 with Army Airborne Command and Control System, and F/A 18).
  - Mature, with user, tactics, techniques, and procedures for HSKT.
  - Mature, with user, training concepts for HSKT System of Systems.
  - Integrate alternative radio frequency wideband network.

Total 9538

FY 2003 Planned Program

- 5857 - Integrate AMUST technology into Army Airborne Command and Control System (A2C2S) and other manned platforms.
  - Flight test AMUST technology in A2C2S and other manned platforms.

Total 5857

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February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
447	ACFT DEMO ENGINES	6637	9051	6854	7125	7436	8288	8684

A. Mission Description and Budget Item Justification: The Aircraft Demonstration Engines project matures power system technologies through competitively performed design, fabrication and test of advanced material technologies, engines and integrated components. This project supports the Objective Force and Joint Vision 2020 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 Joint Turbine Advanced Gas Generator (JTAGG) efforts are all fully coordinated / aligned with the phases / goals of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) program and industry. IHPTET / JTAGG 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. This provides significantly increased range and payload capabilities for future unmanned and manned rotorcraft and sustainment upgrades for current engines, with significant Operation and Support cost savings. Work in this PE is performed by contractors including: General Electric Aircraft Engines, Lynn, MA; Honeywell, Phoenix, AZ; Rolls-Royce/Allison, Indianapolis, IN; and Pratt & Whitney, Hartford, CT. This project supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6637 - Performed fabrication of the final core engine build components including the High Effectiveness Affordable Turbine (HEAT) blades in preparation for final demonstration of program goals.
  - Fabricated initial JTAGG III gas generator hardware and conducted initial JTAGG III build component testing.

Total 6637

FY 2002 Planned Program

•	5551	- Conduct testing of JTAGG III initial gas generator build, which includes a forward swept rotor, a split-inducer impeller, a ceramic matrix composite combustor liner and un-cooled ceramic low pressure turbine blades. - Affirm in testing of the final core engine build the JTAGG II goals of 80% increase in shaft horsepower to weight ratio, 30% decrease in SFC and 20% reduction in production and maintenance costs. - Fabricate and test components in support of second JTAGG III gas generator build.
•	3500	- Design turboshaft engine for Unmanned Aerial Vehicles (UAV). - Conduct evaluation of UAV turboshaft engine.
Total	9051	

FY 2003 Planned Program

•	6854	- Conduct testing of JTAGG III second gas generator build which introduces a ceramic nozzle in the high pressure turbine. - Affirm in testing the JTAGG III goals of 120% increase in shaft horsepower to weight ratio, 40% decrease in Specific Fuel Consumption (SFC), and 35% reduction in production and maintenance costs with the addition of magnetic bearings and component aerodynamic improvements.
Total	6854	