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

June 2001

BUDGET ACTIVITY
3 - ADV TECHNOLOGY DEV

PE NUMBER AND TITLE
0603003A - Aviation Advanced Technology

COST (In Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		30739	28545	44843	0	0	0	0	0	0	0
313	ADV ROTARYWING VEH TECH	20870	14501	28102	0	0	0	0	0	0	0
435	AIRCRAFT WEAPONS	1078	3643	1794	0	0	0	0	0	0	0
436	ROTARYWING MEP INTEG	2034	3566	8120	0	0	0	0	0	0	0
447	ACFT DEMO ENGINES	6757	6835	6827	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification:

PLEASE NOTE: This administration has not addressed FY2003-2007 requirements. All FY 2003-2007 budget estimates included in this book are notional only and subject to change.

The Aviation Advanced Technology program element (PE) provides mature technology through design, fabrication, and test of advanced rotary wing platform and mission equipment integration technologies, advanced technology engines, and integrated components to validate achievable improved performance levels for current and future DoD rotary wing vehicles (RWVs) emphasizing Army unique requirements. This PE supports the Objective Force and Joint Vision 2020. The Objective Force will require rotorcraft systems that have significantly increased/improved lift, range and survivability with an overall reduction in logistics. The critical technologies to support these capabilities will be matured through Technology Demonstrations (TDs) of rotors, active controls, structures, drive train, and threat protection. The Army Aviation Science and Technology program's functional organization, supported by the National Aeronautics and Space Administration (NASA) at three co-located activities, is the focal point for US efforts in rotorcraft technology. Technology areas for maturation/validation include: aeromechanics; aerodynamics; structures; propulsion; reliability and maintainability; safety and survivability; mission support equipment integration; aircraft subsystems; advanced helicopter rotors and flight control, flight simulation; aircrew-aircraft system integration; aircraft weapons integration for air-to-air / air-to-ground; aircraft avionics integration and architecture for command and control; communications, controls and displays; digital avionics; nap-of-the-earth (NOE) navigation; mission planning; and air traffic management. These technologies are continuously being authenticated for applications that will improve and correct deficiencies in current Army / DoD RWV systems, and to improve the capabilities of future rotorcraft. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, the DoD Technology Area Plans, DoD Warfighting Science and Technology Master Plan, DoD Reliance Agreements (for which the Army is the lead service for the rotorcraft technology maturation) and a coordinated government/industry/academia national RWV Technology Development Approach. This program adheres to DoD Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary Wing). Technology demonstrated in this PE supports current and future rotorcraft for the Objective Force. Upgrade activities of Army systems such as the AH-64 Apache, RAH-66 Comanche, UH-60 Black Hawk, CH-47 Chinook, Navy SH-60 Seahawk and USMC AH-1 Cobra are supported as well. 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). In addition, this PE's deliverables provide technical support and technology transition to RAH-66 Comanche, Longbow, and Aircraft Modifications/Product Improvements.

B. Program Change Summary	FY 2000	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2001 PB)	33921	28810	41666	0
Appropriated Value	34167	28810	0	
Adjustments to Appropriated Value	0	0	0	
a. Congressional General Reductions	0	0	0	
b. SBIR / STTR	-871	0	0	
c. Omnibus or Other Above Threshold Reductions	-133	0	0	
d. Below Threshold Reprogramming	-2311	0	0	
e. Rescissions	-113	-265	0	
Adjustments to Budget Years Since FY2001 PB	0	0	3177	
Current Budget Submit (FY 2002/2003 PB)	30739	28545	44843	0

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603003A - Aviation Advanced Technology**	**313**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
313 ADV ROTARYWING VEH TECH	20870	14501	28102	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The Advanced Rotary Wing Vehicle (RWV) Technology project matures and validates rotary wing platform technologies for the Objective Force. The Objective Force will require rotorcraft systems that have significantly increased/improved lift, range and survivability with an overall reduction in logistics. Key to this effort is to address the lift requirement of 10-20 tons for the Future Combat Systems. The critical technologies to support these capabilities will be matured through Technology Demonstrations (TDs) of rotors, active controls, structures, drive train, and threat protection. The Rotary Wing Structures Technology (RWST), Survivable, Affordable, Repairable Airframe Program (SARAP) and Full Spectrum Threat Protection (FSTP) TDs will increase the survivability and reduce weight, manufacturing and operational costs of the rotorcraft fuselages and wing subsystems. The Advanced Rotorcraft Transmission Phase II (ART-II) and Rotorcraft Drive Systems for the 21st Century (RDS21) TDs will provide a 25-35% reduction in weight and 15 decibel (dB) reduction in noise for advanced drive-systems. The Helicopter Active Control Technology (HACT) and Variable Geometry Advanced Rotor Demonstration (VGARD) TDs 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. These programs will focus on the maturation and transition of advanced technology for Objective Force rotorcraft. The funding profile supports these TD's that have been approved in Army modernization plans for rotorcraft. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 9544 - Conducted preliminary design of active flight control system.
  - Matured active flight control engineering models, and piloted and hardware in-the-loop simulation to support flight demonstration.
  - Determined reduction in flight control design and development costs.
- 6326 - Completed screening of candidate materials, structural concepts, manufacturing processes, and design tools for weight and cost reduction.
  - Completed risk mitigation testing and preliminary design efforts for technology demonstration articles (RAH-66 Comanche forward fuselage and AH-64 Apache center fuselage).
  - Determined high probability of meeting 15% weight reduction and 25% manufacturing labor reduction exit criteria.
- 5000 - Conducted component testing of ART-II positive engagement overrunning clutch.

FY 2000 Accomplishments (Continued)

- Completed initial assembly of ART-II demonstrator hardware and conducted maturation tests consisting of fit and function, oil management, gear tooth and bearing pattern verification, split torque path load sharing assessment, 50 hour endurance run, and gear tooth scoring testing for initial performance and cost assessment.
- Completed fabrication of diamond-like carbon coated gears, ring gear isolation, low noise bevel pinion, advanced bearing materials, heat exchangers, and seal hardware for reduced weight and increased durability when applied to upgraded UH-60 Black Hawk and AH-64 Apache helicopter transmissions.

Total 20870

FY 2001 Planned Program

- 8218 - Conduct detailed design of active flight control system. Integrate hardware and software into test rotorcraft.
  - Conduct flight control subsystems flight tests.
  - Refine helicopter active flight controls engineering models and simulation.
- 5519 - Prepare detailed design of test articles and fabrication of tooling and hardware.
  - Conduct full-scale static testing of rotary wing structural fuselage sections affirming weight, cost and development cycle time reductions.
- 375 - Conduct RDS21 preliminary design for 35% increase in power-to-weight, -15dB noise reduction, 2X increase in durability and 25% reduction in production cost.
- 389 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 14501

FY 2002 Planned Program

- 10491 - Down-select core concept technology mix for VGARD.
  - Prepare full-scale rotor preliminary design for VGARD.
  - Conduct rotor scaling and testing to evaluate technical risk.
  - Conduct small scale wind tunnel testing of rotor blade actuation concepts.

FY 2002 Planned Program (Continued)

- 6361 - Conduct RDS21 detailed design and analysis.
- 6300 - Perform helicopter active control system flight test. Analyze test results using metrics developed to quantify system improvements. Conduct HACT flight control system flight testing.
- 3251 - 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.
- 1699 - Conduct lab testing of candidate signature reduction hardware and active countermeasure devices for incorporation into the FSTP test platform. Design FSTP demonstrator.

Total 28102

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603003A - Aviation Advanced Technology**	**435**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
435 AIRCRAFT WEAPONS	1078	3643	1794	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The Aircraft Weapons project matures and affirms rotorcraft weaponization technologies for air-to-ground and air-to-air application. This project supports the Objective Force and Joint Vision 2020 by providing mature technology to focus combat power on multiple targets. The technology 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 directed energy weapons, including non-lethal capabilities, are evaluated and tested on rotorcraft platforms to assure compatibility of the weapon system with the rotorcraft. Technology integration issues with on-board systems, vehicle flight characteristics and weapon system are investigated and evaluated. The project will integrate 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. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 1078 - Conducted LCPK Advanced Technology Demonstration (ATD) AH-64D preliminary aircraft integration system analyses and design through a contract award to Boeing.

Total 1078

FY 2001 Planned Program

- 3539 - Finalize LCPK ATD AH-64D aircraft integration system analyses and design. Build flight hardware for Apache Longbow to support airborne evaluation of the LCPK guided rocket. Investigate LCPK aircraft integration common areas with Army, Marine, and Special Operations Aviation (SOA) aircraft.

- 104 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 3643

FY 2002 Planned Program

- 1794 - Conduct LCPK Advanced Technology Demonstration AH-64D aircraft integration and initiate airborne evaluation of the LCPK guided rocket.

Total 1794

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603003A - Aviation Advanced Technology**	**436**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
436 ROTARYWING MEP INTEG	2034	3566	8120	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The Rotory Wing Mission Equipment Package Integration project matures and affirms man-machine integration and mission equipment technology to provide enhanced helicopter pilotage capability, to improve crew workload distribution and to improve overall mission execution. This project supports the Objective Force and Joint Vision 2020 by providing mature technology to enhance near-real time situational awareness for rotary wing vehicles. This project provides for the maturation of rotorcraft crew stations utilizing knowledge-based information systems to mature Cognitive Decision Aiding (CDA) for crews. 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. 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 program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 2034 - Matured and affirmed Manned-Unmanned teaming with an AH-64D exercising payload and waypoint navigation control of a Hunter Unmanned Aerial Vehicle (UAV).

  - Defined draft configuration and interface functional specs for manned (AH-64D and other manned systems) and unmanned (family of military UAVs) teams.

Total 2034

FY 2001 Planned Program

•	3462	- Refine AMUST functional and interface specs to support critical operational functions.
		- Perform initial integration of CDA and AMUST technologies.
		- Conduct knowledge acquisition for scout / attack and Special Operations aviation forces' mission teams composed of manned and unmanned platoons.
		- Perform compatibility study with the Navy Tactical Control System (TCS).
•	104	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	3566	

FY 2002 Planned Program

•	8120	- 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).
		- Develop, with user, tactics, techniques, and procedures for HSKT.
		- Develop, with user, training concepts for HSKT System of Systems.
Total	8120	

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603003A - Aviation Advanced Technology**	**447**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
447 ACFT DEMO ENGINES	6757	6835	6827	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This Aircraft Demonstration Engines project matures power system technology through competitively performed design, fabrication and test of advanced technology, engines and integrated components to affirm achievable improved performance levels for current and future DoD rotary wing vehicles emphasizing Army unique requirements. This project supports the Objective Force and Joint Vision 2020 by providing mature technology to improve tactical mobility, reduce the logistics footprint, and increase survivability for rotary wing vehicles. The current/planned 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 current fleet upgrades and for future new rotorcraft with significant Operation and Support cost savings. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 6757 - Demonstrated, via testing of the initial build which includes a splittered rotor (rotor with a set of full blades and a set of half blades to improve efficiency), Rich-Quench-Lean (RQL) Lycolite combustor, high work turbine, and hybrid ceramic bearings, progress towards meeting JTAGG II goals of 80% increase in shaft horsepower to weight ratio, 30% decrease in SFC and 20% reduction in production and maintenance costs.

  - Completed detail design of engine components for initial gas generator build of JTAGG III program.

Total 6757

FY 2001 Planned Program

- 6636 - Affirm in testing of the final core engine build, which introduces the High Effectiveness Affordable Turbine (HEAT) blades into the turbine for full life (6000 hours), 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 initial JTAGG III gas generator hardware and complete initial JTAGG III build component testing.

- 199 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 6835

FY 2002 Planned Program

•	6827	- Conduct testing of JTAGG III initial gas generator build, which includes a forward swept splittered rotor, a split-inducer impeller, a ceramic matrix composite combustor liner and uncooled ceramic low pressure turbine blades. - Conduct testing of JTAGG III second gas generator build which introduces a ceramic matrix composite turbine nozzle and cooled ceramic turbine blades in the high pressure turbine.
Total	6827	