ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2004

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603003A - AVIATION ADVANCED TECHNOLOGY

	COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	42388	84966	69549	90566	106966	118762	122530
313	ADV ROTARYWING VEH TECH	22875	55044	52500	76537	92390	89416	85886
435	AIRCRAFT WEAPONS	2153	965	4051	4073	3316	4099	5035
436	ROTARYWING MEP INTEG	6948	4790	5841	1997	2931	16742	22908
447	ACFT DEMO ENGINES	6364	6832	7157	7959	8329	8505	8701
B97	A/C AVIONICS EQUIPMENT	4048	4395	0	0	0	0	0
BA7	AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)	0	7902	0	0	0	0	0
BA8	VECTORED THRUST DUCTED PROPELLER (CA)	0	5038	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 in support of the Future Force and Joint Vision 2020, and, where feasible, exploits opportunities to enhance Current Force capabilities. Based on the Army transformation, this PE is focused to investigate technologies applicable to unmanned systems, while providing opportunities for technology insertion into Current Force manned system. Unmanned rotary wing vehicles bring unprecedented agility, maneuverability, and lethality to the Future Force while providing improved survivability and reduced sustainment costs. Within this PE, aviation technologies will be matured and integrated into realistic and robust demonstrations. Emphasis will be placed on maturing unmanned attack, reconnaissance, and lift capabilities and teaming them with Future Force manned systems. Technologies that enable increased 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. This PE provides technical support and technology transition to Unmanned Aerial Vehicles (UAVs), to include the A-160 Hummingbird, the Unmanned Combat Armed Rotorcraft (UCAR), the Organic Air Vehicle (OAV), and the Micro Air Vehicle (MAV). This PE also supports Future Force manned aviation systems. 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). 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 2003	FY 2004	FY 2005
Previous President's Budget (FY 2004)	41924	72083	70327
Current Budget (FY 2005 PB)	42388	84966	69549
Total Adjustments	464	12883	-778
Congressional program reductions		-5346	
Congressional rescissions			
Congressional increases		18550	
Reprogrammings	464	-321	
SBIR/STTR Transfer			
Adjustments to Budget Years			-778

Significant Change Explanation.
FY04 - Seven FY04 Congressional adds totaling $18550 were added to this PE.

FY04 Congressional Adds with no R-2As:
($4267) Radar Surveillance and Assimilation Network, Project B97: The purpose of this one year Congressional add is to mature airborne situational awareness for unmanned and manned air platforms through an integrated system for the assimilation of data from multiple sources to track, de-conflict, or intercept UAV and other airborne targets. No additional funding is required to complete this project.

($958) Broad Area Unmanned Responsive Re-Supply Operations, Project BA7: The purpose of this one year Congressional add is to demonstrate the utility of UAV for logistics operations, through the flight demonstration of the optionally piloted Kaman BURRO helicopter. No additional funding is required to complete this project.

($2398) Locust USA Heavy Fuel Burning Engines for UAV's, Project BA7: The purpose of this one year Congressional add is to mature a small heavy fuel engine for UAV application and to further address scalability of the design. No additional funding is required to complete this project.

($1630) Reconfiguration Tooling System, Project BA7: The purpose of this one year Congressional add is to demonstrate a reconfigurable tooling system capable of delivering a complete composite repair system that incorporates tool creation and composite curing for rapid repair and replacement

of mission critical parts at the depot level. No additional funding is required to complete this project.

($2685) UAV and Micro Air Vehicle Dynamometer, Project BA7: The purpose of this one year Congressional add is to modify the current air dynamometer designs to enable testing of UAV engines on the Army's existing equipment and to explore alternative compression systems for dynamometer / engine applications. No additional funding is required to complete this project.

($4891) Vectored Thrust Ducted Propeller Compound Helo, Project BA8: The purpose of this one year Congressional add is to assess the potential for a VTDP helicopter to improve the speed, range and survivability of a UH-60 Black Hawk helicopter while reducing ownership cost. No additional funding is required to complete this project.

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

February 2004

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

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
313	ADV ROTARYWING VEH TECH	22875	55044	52500	76537	92390	89416	85886

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 Future Force, and, where feasible, exploits opportunities to enhance Current Force capabilities. It is envisioned that the Future Force will need unmanned and manned rotorcraft systems that have significantly increased / improved lift, range, survivability, and mission capability with an overall reduction in logistics and cost of operation. Key to this effort is the demonstration of vertical takeoff and landing (VTOL) UAVs for the Future Force. The critical technologies to support these capabilities will be matured through Technology Demonstrations (TDs) of prototype UAVs, rotors, active controls, structures, drive train, integrated architecture and threat protection. The near-term demonstration of VTOL UAVs will focus on the A-160 Hummingbird and the Organic Air Vehicle (OAV), to include the Micro Air Vehicle variant, for Reconnaissance, Surveillance and Target Acquisition (RSTA) capability. The far-term demonstrations will focus on the Unmanned Combat Armed Rotorcraft (UCAR) teamed with manned and other unmanned airframes. UCAR is a joint program--cost shared 50/50--with the Defense Advanced Research Projects Agency (DARPA) and is planned to transition to Program Executive Officer Aviation at the completion of its 6.3 funded phases. These demonstrations will focus on military operations and the application of military specification on these maturing systems. 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 team to use 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 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 (O&S) costs and a 12 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 will enable a 40% increase in payload for the AH-64 Apache, a 20% increase in range for the UH-60 Black Hawk, and over a 25% increase in range for the CH-47 Chinook. 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 2003	FY 2004	FY 2005
Integrated UAV Operations – [Includes Airborne Manned Unmanned System Technology (AMUST), Manned Unmanned Common Architecture Program (MCAP), and Unmanned Aerial Vehicle Autonomous Collaborative Operations (UACO).] - In FY03, integrated architecture on Lot 7 AH-64D Longbow Apache and Army Airborne Command and Control System (A2C2S) UH-60 Black Hawk. Conducted hot bench test to ensure proper function on operational processors and with aircraft communications system. Designed embedded mission avionics architecture for use on manned and unmanned rotorcraft based on market driven commercial-off-the-shelf electronics and well-supported open systems specifications and standards. Conducted simulations of airborne UAV control capability to obtain user feedback. In FY04, complete architecture detailed designs and system integration tests, and initiate flight-test of the manned-unmanned architecture on both the AH-64D Longbow Apache and A2C2S UH-60 Black Hawk, individually and jointly. Conduct system level demonstration of common architecture between manned and unmanned rotorcraft. Conduct data analysis of demonstration results. Complete development of UAV control capability in the Longbow Apache and A2C2S Black Hawk and conduct flight tests. In FY05, will complete flight tests and data analysis, will publish systems architectures, and will coordinate updates to the Joint Technical Architecture-Army as appropriate. Will start development of advanced autonomy and collaboration algorithms for UAVs.	9389	12853	7475
A-160 Hummingbird - In FY03, conducted initial A-160 functional and environmental ground-test of Phase I subsystems. Performed continuous flight tests with first two (Phase 0) A-160s. In FY04, conduct system flight-testing to test-fix-test of airframe and components at gross weights up to 4,000 pounds and altitudes up to 20,000 feet. Conduct environmental testing in ice, sand and salt. Review A-160 flight test results, including initial mission equipment package (MEP) integration with electro-optic/infra-red (EO/IR) sub-systems. Conduct functional and environmental ground-test results for Phase I subsystems and Ground Control Station. Validate baseline Phase I configuration and capabilities. In FY05, will conduct continuous air vehicle system flight tests at gross weights up to 5,000 pounds, altitudes up to 30,000 feet, and rotor speeds up to 100%. Will refine the Ground Control Station, airframe and mission equipment packages, to include EO/IR flight demonstration with four A-160s (two Phase 0 and two Phase I). Will validate revised Phase I configuration and capabilities.	5000	10000	15000

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Unmanned Combat Armed Rotorcraft (UCAR) - The UCAR program goal is to demonstrate an armed VTOL UAV that is survivable; can identify targets at 6-10 km and can recognize dismounted infantry at 2-6 km; has a flyaway cost that is 20%-40% of Comanche; and has an operating and sustainment cost that is 20%-50% of Apache. Applied Research for UCAR was conducted in FY02 and FY03 in PE 0602211A Aviation Technology. In FY04, complete UCAR Phase II, Preliminary Design. Industry teams will identify best technical approach considering mission effectiveness, lethality, system performance, autonomous operations, and command and control. In FY05, will begin UCAR Phase III, Development and Test. Industry teams will conduct detailed design of best technical approach, and execute critical design review. Will conduct bench testing of critical systems/subsystems as identified in the Risk Management and Mitigation Plan. Will define design characteristics/attributes as required to satisfy system performance requirements. Will conduct bench testing and design support testing of critical UCAR system components. Will fabricate two full-scale system demonstrators. Will design and build an air or ground based control console. Will conduct UCAR ground and initial tie-down and light testing to demonstrate and characterize system performance.	0	14000	20000

Accomplishments/Planned Program (continued)	FY 2003	FY 2004	FY 2005
Rotorcraft Structures [Survivable, Affordable Repairable Airframe Program (SARAP)] - In FY03, incorporated advanced structures technologies into prototype manned and unmanned designs to improve rotary-wing airframe weight, cost, supportability, and survivability. Evaluated and selected non-destructive inspection and depot / field repair methods for advanced composite structures. Matured low-cost, lightweight structural concepts and drafted damage tolerance certification methodology for fatigue critical composite components. In FY04, conduct major effort of the SARAP with manned and unmanned rotary-wing virtual prototype models and simulations that reduce airframe weight by 25% and cost by 40%. Implement predictive risk management process to select highest payoff technologies for full-scale development and demonstration. Validate probabilistic building block qualification methodology. Model and simulate ballistic and rocket propelled grenade (RPG) threats and susceptable structure. Fabricate virtual prototype (full digital definition and simulations / models) validation hardware for ballistic, static, and crash testing. In FY05, will validate manned and unmanned virtual prototype models and simulations with full-scale hardware fabrication and test to improve weight, cost, supportability, and survivability. Will conduct full-scale hardware ballistic, static, fatigue, and crash testing to validate virtual prototype models and simulations. Will transition SARAP structural technologies, concepts, and methodologies to current and developmental manned and unmanned rotary wing systems such as H-60, H-47, H-53, A-160 and UCAR.	3600	9907	4083
Drive Train [Rotorcraft Drive System for the 21st Century (RDS21)] - In FY03, conducted rig testing to establish Face Gear design and durability of high speed clutch. In FY04, fabricate full-scale test hardware and full-scale RDS-21 split torque/face gear demonstration hardware and composite housing. In FY05, will conduct goal demonstration testing (weight/durability/noise) of RDS-21 demonstrator.	4886	4955	5942
Slowed Rotor Demonstration. In FY04, demonstrate the principle of a slowed main rotor that is optimized for minimum drag, utilizing a vertical takeoff and landing gyro-copter.	0	1780	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	1549	0
Totals	22875	55044	52500

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February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
435 AIRCRAFT WEAPONS	2153	965	4051	4073	3316	4099	5035

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 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, rockets, guns, fire control, advanced target acquisition and pilotage sensors, and directed energy weapons, including non-lethal capabilities. 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 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. 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 2003	FY 2004	FY 2005
Weapons Integration. Includes Low Cost Precision Kill (LCPK), a laser guided 70MM (2.75 inch) folding fin aerial rocket and Loitering Electronic Warfare Killer (LEWK). In FY03, conducted AH-64D airborne evaluation of the LCPK guided rocket. Provided technical support to LEWK ACTD. In FY04, provide support to Hunter Standoff Killer Team ACTD to mature an Integrated Operational Picture system architecture for actively tasking sensor platforms and weapons. In FY05, will investigate precision location of threat radar systems from UAVs. Will conduct initial prototype design of integrated, autonomous engagement systems. Will investigate unmanned teaming and cueing for collaborative engagements.	2153	937	4051
Small Business Innovative Research/Small Business Technology Transfer Programs	0	28	0
Totals	2153	965	4051

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February 2004

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

COST (In Thousands)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
436 ROTARYWING MEP INTEG	6948	4790	5841	1997	2931	16742	22908

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 Foce 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 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 and Unmanned System Technology (AMUST) program provides intelligent software and 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 reconnaissance, surveillance, target acquisition and attack while maintaining constant tactical situation awareness. Integration of state-of-the-art approaches in artificial intelligence, intelligent agents, sensors, avionics, communications, pilot vehicle interfaces, and autonomous assistants will enable an manned-unmanned team that enhances Army aviation battlefield effectiveness. This project supports the Hunter Standoff Killer Team (HSKT) Advanced Concepts Technology Demonstration (ACTD). 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. 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 2003	FY 2004	FY 2005
Airborne Manned and Unmanned System Technology (AMUST) [Includes UAV Network Teaming and Hunter Standoff Killer Team (HSKT) Advanced Concepts Technology Demonstration (ACTD).] - In FY03, integrated Tactical Common Data Link into manned and unmanned platforms to enable common control. Flight tested AMUST teaming technology on an AH-64D Longbow Apache, an A2C2S UH-60 Black Hawk, and a Hunter UAV as part of HSKT ACTD. Generated interface control documents to integrate HSKT hardware in a System of Systems construct for AH-64D Longbow Apache, A2C2S UH-60 Black Hawk, Hunter UAV, and F/A-18. With the user, matured tactics, techniques, and procedures (TTPs) and training concepts for HSKT System of Systems. Tested and evaluated wideband radio frequency network as possible airspace management aid. Enabled technology transition to Future Force systems. In FY04, mature an Integrated Operational Picture system architecture for actively tasking sensor platforms and systems to build and maintain an Integrated Operational Picture that supports targeting and situation awareness among commanders and warfighters. In FY05, will demonstrate, in simulation, the architecture and algorithms to build an Integrated Operational Picture. Will mature TTPs in simulation to formulate a sensor-to-shooter solution for time-critical targets at desired sensor resolution. Will support the Manned Unmanned Common Architecture Program to complete demonstration of common architecture between manned and unmanned rotorcraft. Will support the Survivable, Affordable, Repairable Airframe Program to validate manned and unmanned prototype models and to complete live fire, static, fatigue and crash testing to validate models.	5419	3706	5841
Airborne Manned/Unmmanned Systems Technology (AMUST) - The objective of this one year Congressional Add is to complete the development and testing of the RF network for the AMUST program. No additional funding is required to complete this project.	0	964	0
UAV Data Link. This one-year Congressional Add developed a Wideband Wireless Network to support AMUST. No additional funding is required to complete this project.	1529	0	0
Small Business Innovative Research/Small Business Technology Transfer Programs	0	120	0
Totals	6948	4790	5841

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3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**447**

COST (In Thousands)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
447	ACFT DEMO ENGINES	6364	6832	7157	7959	8329	8505	8701

A. Mission Description and Budget Item Justification: The Aircraft Demonstration Engines project matures 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, wherer feasible, exploits opportunities to enhance Current Force turbine engines. This project supports the Future 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. The Small Heavy Fuel Turbine Engine program is focusing on maturing and demonstrating advanced, affordable turbine engine technology in the 700 horsepower class. Significant improvements in specific fuel consumption and power-to-weight ratio will provide a heavy fuel engine capability for applications such as the A-160 and Future Combat Systems (FCS). 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.

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3 - Advanced technology development	**0603003A - AVIATION ADVANCED TECHNOLOGY**	**447**

Accomplishments/Planned Program	FY 2003	FY 2004	FY 2005
Joint Turbine Advanced Gas Generator (JTAGG) and Integrated High Performance Turbine Engine Technology (IHPTET) - In FY03, completed assembly of JTAGG III gas generator build, which includes a forward swept rotor, a split-inducer impeller and un-cooled ceramic low pressure turbine blades. Affirmed via component testing / analysis progress towards the JTAGG III goals of 120% increase in shaft horsepower to weight ratio, 40% decrease in SFC, and 35% reduction in production and maintenance costs. In FY04, complete fabrication of test hardware and perform integrated engine component demonstration for program goal achievement.	6364	200	0
Small Heavy Fuel Turbine Engine - In FY04, design a 700 horsepower engine demonstrator with goals of: -20% SFC, +50% horsepower to weight ratio, and 35% cost reduction. Begin engine component fabrication to support rig tests and full engine demonstration. In FY05, will build and test components of 700 horsepower heavy fuel turbine engine.	0	6451	7157
Small Business Innovative Research/Small Business Technology Transfer Programs	0	181	0
Totals	6364	6832	7157