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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)								DATE February 2000	
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602784A Military Engineering Technology					
COST (In Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	51203	47639	42344	44571	46161	48292	50832	Continuing	Continuing
A855 Topography, Image Intelligence, and Space Technology	8742	9448	9699	10272	10696	11336	11933	Continuing	Continuing
AH71 Atmospheric Investigations	5598	6259	6362	6755	7262	7795	8159	Continuing	Continuing
AT40 Mobility & Weapons Effects Technology	12532	14870	15535	16276	16418	16760	17643	Continuing	Continuing
AT41 Military Facilities Engineering Technology	3966	4154	4204	4493	4683	4959	5245	Continuing	Continuing
AT42 Cold Regions Engineering Technology	4618	4935	3747	3930	4106	4248	4480	Continuing	Continuing
AT45 Energy Technology Applied to Military Facilities	2276	2578	2797	2845	2996	3194	3372	Continuing	Continuing
AT46 Climate Change Fuel Cell Technology	2877	2452	0	0	0	0	0	0	5329
AT49 University Partnering for Operational Support	2890	2943	0	0	0	0	0	0	5833
AT50 Enhanced Geographic Synthetic Aperture	7704	0	0	0	0	0	0	0	7704

**A. Mission Description and Budget Item Justification:** The applied research conducted in this program provides technology in direct support of critical warfighter functions of mobility, countermobility, survivability, sustainment engineering, and topography needed to win on the modern battlefield. Research is conducted that supports the special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Key operational science & technology is provided to Army units under program element 0603734A (Military Engineering Advanced Technology). Results are tailored to support the material development, test, and acquisition community in evaluating the impacts of weather, terrain, and atmospheric obscurants on military operations. Research provides and exploits a wide range of innovative technologies and applies them to Defense unique planning, acquisition, revitalization, and sustainment processes. The goal of this research is to improve the efficiency and cost effectiveness as it relates to supporting the training/readiness/force projection missions in garrison and force sustainment missions in theaters of operation. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Defense Reliance Agreements on Civil Engineering and Battlespace Environments with oversight provided by the Joint Directors of Laboratories and Joint Engineers.

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<b>B. Program Change Summary</b>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
Previous President's Budget (FY 2000/2001 PB)	52074	41085	42820
Appropriated Value	52688	47885	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-614		
b. SBIR / STTR	-567		
c. Omnibus or Other Above Threshold Reductions		-90	
d. Below Threshold Reprogramming	-96		
e. Rescissions	-208	-156	
Adjustments to Budget Years Since FY 2000/2001 PB			-476
Current Budget Submit (FY 2001 PB)	51203	47639	42344

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)							DATE February 2000			
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602784A Military Engineering Technology				PROJECT A855		
COST (In Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A855 Topography, Image Intelligence, and Space Technology		8742	9448	9699	10272	10696	11336	11933	Continuing	Continuing
<p><b>Mission Description and Justification:</b> This project funds technology that will help those who move, shoot, and communicate on the battlefield to "fight smarter" through superior knowledge of the total battlefield terrain and environment. Development efforts will enable the commander to locate and position enemy and friendly forces in day/night all-weather conditions, provide crucial terrain data for command and control systems (C2) as well as modeling and simulation systems, and enhance the speed and accuracy of maneuver and weapon systems. The technology being developed will enhance the tactical commander's ability to exploit his knowledge of combat relevant intelligence as a force multiplier to conduct and win Force XXI operations. Information dominance is a key enabler for Army/Joint Vision 2010 concepts. Using tactical/strategic/space sensor data, together with terrain data bases as input, the technology program emphasizes automating the processes of detecting change on the battlefield, identifying battle significant features, exploiting space-based/remote sensing information (especially for deep operations and over denied areas), and integrating the impacts of the battlefield environment to significantly improve combat planning and operations. Work in this project significantly enhances the Army's geospatial data management and dissemination capabilities by providing advanced technologies for storing, transforming, updating and disseminating extremely large volumes of terrain data at, or near, real-time. Weather/atmospheric effects data is provided for this project by the Army Research Laboratory Project AH71 in this PE. This project is managed by the U.S. Army Engineer Research and Development Center.</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 8742 - Tested and evaluated initial spectral imagery and synthetic aperture radar automated feature extraction capabilities. <ul style="list-style-type: none"> <li>- Developed software to improve transportation network analysis using multi-source feature data; demonstrated advanced management, dissemination, and integration of multi-source geospatial data.</li> <li>- Investigated capabilities to support weapon selection by applying physics-based models to simulate applications and visualization capabilities.</li> <li>- Developed and explored processes to utilize a disparate array of geospatial information to support a family of common geospatial information representations.</li> <li>- Completed competitive government selection of automated terrain-reasoning analytic solution for inclusion in USAF C4 systems.</li> <li>- Completed "The Future Positioning/Navigation (POS/NAV) Technologies Study" which projected a cost, weight/size and performance improvements timeline for different POS/NAV sensors and supporting technologies that will be used to guide future POS/NAV development projects.</li> </ul> </li> </ul> <p>Total 8742</p> <p><b>FY 2000 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 9286 -Incorporate automated feature extraction techniques from spectral, synthetic aperture radar and electro-optical sources into the digital stereo photogrammetric workstation. <ul style="list-style-type: none"> <li>- Demonstrate a capability to manage, disseminate and integrate topographic point, line and area feature data using advanced on-line warehouse technology.</li> <li>- Extend physics-based models and visualization capability to passive and active millimeter wave.</li> </ul> </li> </ul>										
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		PROJECT <b>A855</b>
<p><b>FY 2000 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Complete design of a concept model for a low cost wheeled vehicle tactical navigator.</li> <li>- Identify performance baseline criteria and complete initial design of appropriate spectral/spatial algorithms.</li> <li>- Develop and implement a thorough test and evaluation protocol for algorithms used to generate slope information from elevation data.</li> <li>- Deliver validated terrain analytics to Joint Terrain Analysis Tool (JTAT) and reengineered tactical decision aids to Combat Terrain Information System (CTIS).</li> </ul> <p>162 Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)</p> <p>Total 9448</p> <p><b>FY 2001 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 9699 - Develop capability for automated feature attribution using knowledge based rules. <ul style="list-style-type: none"> <li>-Extend advanced geospatial data management technology to support rapid update of terrain information using best available sources.</li> <li>- Integrate model derived from infrared and millimeter wave sensor performance overlays into 3D visualization.</li> <li>- Develop the design for hardware and software for future land navigation capability.</li> <li>- Complete implementation of spectral/spatial algorithms for detection and identification.</li> <li>- Develop and test prototype model of low-cost wheeled vehicle tactical navigator.</li> <li>- Extend the spatial analysis tool to support course of action analysis for ground order of battle.</li> <li>- Deliver enhanced analytical terrain-reasoning tools to Army Battle Command Systems ASAS (All-Source Analysis System) and CTIS (Combat Terrain Information System).</li> <li>- Build concept model of a low cost wheeled vehicle tactical navigator and assess when available.</li> </ul> </li> </ul> <p>Total 9699</p>		
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BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602784A Military Engineering Technology				PROJECT AH71		
COST (In Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AH71 Atmospheric Investigations		5598	6259	6362	6755	7262	7795	8159	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project performs the applied research for tactical weather and atmospheric effects algorithms, and for the integration of battlefield atmospheric environments into simulations. It accomplishes this mission by transitioning technology to the Project Director Integrated Meteorological System (PD-IMETS), through support to the Program Manager for Night Vision/Reconnaissance Surveillance and Target Acquisition (PM-NV/RSTA) for field artillery systems, and to the DoD modeling community. It provides weather decision aids for the digital battlefield commander by applying advanced computer techniques; incorporating new technology in meteorological sensor and system designs; researching data fusion techniques to horizontally integrate data from advanced weather sensors and non-weather sensors into decision aids for enhanced combat power on the battlefield and enhanced effectiveness of field artillery and deep attack assets. This project supports Defense Technology Objectives, Weather/Atmospheric Impacts on Sensor Systems, and On-Scene Weather Sensing and Prediction Capability.</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 3305 - Established a capability for the Integrated Meteorological System (IMETS) to ingest Air Force MM5 meteorological forecasts and improved the Battlescale Forecast Model's (BFM) ability to provide higher resolution weather forecasts and decision aids for Army situation awareness and mission planning. <ul style="list-style-type: none"> <li>- Integrated the IMETS Integrated Weather Effects Decision Aids (IWEDA) into the joint service, rule-based tactical weather decision aid that includes Air Force and Navy systems, rules and critical weather values.</li> <li>- Enhanced weather forecaster decision aids with improved algorithms for the prediction of icing, turbulence, visibility, low cloud, and precipitation to provide the commander with improved tactical forecasts of hazardous weather conditions.</li> <li>- Implemented existing and new meteorological satellite data extraction algorithms for soil moisture, surface state, precipitation and surface temperature into algorithms for use in weather intelligence applications.</li> <li>- Integrated flat earth acoustic detection algorithms to IMETS 3-D gridded meteorological data to compute weather effects on acoustic propagation as an initial step to integrating tactical acoustic forecasting into IMETS.</li> <li>- Integrated latest IMETS 3-D gridded meteorological database to a modeling and simulation interface to support weather effects in combat simulation and training using a tactical C4I weather system.</li> </ul> </li> <li>• 1464 - Delivered a beta version of Met Kernel to ARDEC to correct for met effects at the midpoint of the projectile trajectory. <ul style="list-style-type: none"> <li>- Compiled a retrieval coefficient database using selected climatic regions for the microwave radiometer to be used in the Mobile Meteorological System-Profiler (MMS-Profiler), thereby increasing accuracy of a trajectory forecast in multiple climatic regions.</li> <li>- Completed, evaluated, and transitioned the MMS-Profiler, algorithms, models, designs, and documentation to the Program Manager NV/RSTA in preparation for engineering and materiel development.</li> </ul> </li> <li>• 829 - Investigated visualization techniques for fusing multiple information sources into a unified visualization of weather with the rapid dynamic, 3-D battlefield environment/terrain visualization capabilities.</li> </ul>										
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<b>FY 1999 Accomplishments: (continued)</b>		
<ul style="list-style-type: none"> <li>- Completed Battlefield Acoustic Sensor Evaluator (BASE) for flat terrain; incorporated turbulence effects into BASE for enhanced acoustic target acquisition.</li> <li>- Augmented commercialized Electro-Optical Systems Atmospheric Effects Library (EOSAEL) model suite with a turbulence model (CN2MAR) with documentation for improved military analysis studies.</li> </ul>		
Total	5598	
<b>FY 2000 Planned Program:</b>		
•	3301	Develop improved numerical weather prediction and high resolution forecast modeling capabilities to enhance the assessment of environmental effects on operations. <ul style="list-style-type: none"> <li>-Integrate IMETS applications including weather data visualization, rule-based and physics-based weather impact models as client applications to provide interactive capability for Battlefield Functional Area C4I systems to retrieve data on demand from IMETS meteorological databases.</li> <li>- Use transient turbulence theory and other parameterizations to research a high resolution, complex terrain transport and dispersion model for hazard prediction that reduces the computational complexity to improve the near real-time capability.</li> <li>- Complete theory and software to link the 3-D atmospheric models to standard simulation interfaces, such as the Total Atmospheric and Oceans Server (TAOS), for enhanced DoD simulations, virtual testing and analysis.</li> <li>- Augment the commercialized EOSAEL model suite with an acoustics model, complete with documentation, for improved military analysis studies.</li> <li>- Evaluate algorithms and complete an aerosol scavenging by precipitation model for improved military smoke modeling for simulations, virtual testing, and analysis.</li> </ul>
•	1485	- Complete the preliminary neural network method for retrieval of wind profiles from met satellite sounder data that, when implemented, will allow near real time wind data to be obtained over target areas for more effective use of smart munitions and sub-munitions. <ul style="list-style-type: none"> <li>- Deliver Met Kernel with documentation to the ARDEC for enhanced fire support effectiveness.</li> <li>- Verify the capability of the Army's Battlescale Forecast Model (BFM) to forecast weather and hazards in the lowest levels of the atmosphere through inter-comparison with two university weather prediction models and with current Navy and Air Force larger scale models.</li> <li>- Complete a combined temperature retrieval method that uses data from a ground-based microwave radiometer and met satellite sounders for more accurate remotely sensed temperature soundings along a projectile trajectory.</li> </ul>
•	1435	- Incorporate limited terrain effects into the Battlefield Acoustic Sensor Evaluation (BASE) for enhanced acoustic target acquisition calculations. <ul style="list-style-type: none"> <li>-Incorporate turbulent scattering into scanning acoustic wave propagation models for enhanced acoustic target acquisition.</li> <li>-Incorporate BASE output over a 3-D terrain to enhance acoustic target acquisition calculations.</li> </ul>
Total	38	Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	6259	

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<p><b>FY 2001 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3487 -Integrate joint weather impacts into decision aids for First Digitized Division weather capability.              -Upgrade Weather Impact Decision Aid models with the characteristics and the impacts of weather on threat platforms, weapons, sensors and operations to forecast the deltas between threat and friendly systems.              -Implement a capability for IMETS to participate with both live and synthetic weather scenarios in live, virtual and constructive simulation exercises supporting the First Digitized Corps.</li> <li>• -Establish a weather data server for distributing gridded meteorological data and weather impacts for Battle Command clients at lower echelons providing additional reach back weather support.              - Complete a 3-D atmospheric propagation and simulation model that includes the effects of absorption, scattering, and radiative transfer, turbulence, clouds, aerosols, and smoke for improved simulations, virtual testing and analysis.</li> <li>• 2875 -Conduct verification and validation of neural network method for retrieval of wind profiles from met satellite sounder data and integrate combined temperature retrieval method to prototype MMS-Profiler processors to achieve better temperature sounding capability for improved artillery accuracy.              -Incorporate full complex terrain/turbulent scattering acoustic propagation model into next generation weather decision aid systems.              -Conduct verification and validation of battlescale forecast model (BFM) modules for icing, low level clouds, and precipitation that will be used to improve target area met for more effective use of smart munitions and sub-munitions in target areas.              -Deliver to ARDEC a new method of aiming artillery by applying met corrections along the entire trajectory for better accuracy and enhanced fire support effectiveness.</li> </ul> <p>Total 6362</p>		
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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)							DATE February 2000			
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602784A Military Engineering Technology				PROJECT AT40		
COST (In Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT40 Mobility & Weapons Effects Technology		12532	14870	15535	16276	16418	16760	17643	Continuing	Continuing
<p><b>Mission Description and Justification:</b> This project will provide warfighters the technologies for: rapid establishment and repair of lines of communications by both light and heavy engineers in support of U.S. force deployment; designs, materials, and construction methods for battlefield, fixed, and forward base survivability against advanced conventional weapons and terrorist weapons; methodologies to predict and mitigate coastal effects on logistics –over-the-shore (LOTS) operations; reliable and cost-efficient roadways and airfields for CONUS installations to support force projection; camouflage, concealment, and deception for fixed and semi-fixed facilities to deny accurate acquisition and engagement by threat weapon systems; rapid obstacle and barrier creation; and accurate assessments of battlefield mobility for maneuver commanders (and materiel developers during virtual prototyping). Civil engineering science and technology in this project directly supports the Army's DoD Project Reliance S&amp;T responsibilities in airfields and pavements, survivability and protective structures, and sustainment engineering. The work is managed by the U.S. Army Engineer Research and Development Center (ERDC).</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 12532 - Identified techniques for troop evaluations of the structural integrity of small protective emplacements; evaluated concepts for application of sprayable multispectral camouflage, cover, and deception (CCD) tonedown agents for large area signature reduction; correlated target structural damage with target type, geometry, and materials and demolition method.             <ul style="list-style-type: none"> <li>- Selected analytic methodologies to predict down-axis ground shock from fully coupled detonations in slabs; completed static and dynamic laboratory experiments and associated analyses of square concrete structural components with large span-to-thickness ratios; developed and validated hardening techniques for roofs to resist vehicle bomb threats.</li> <li>- Designed specifications for rapidly installed breakwater; incorporated algorithms into Riverine Analysis Model to calculate probability bands for hydrologic predictions; incorporated real-time nowcast data analyses into logistics-over-the-shore planning model.</li> <li>- Established criteria and procedures for the use of local materials and equipment for construction of expedient airfields; validated analytic models capable of replicating material and pavement system response under vehicle loading.</li> <li>- Developed an analytic capability for automated assessment and load classification of bridges; identified new non-traditional soil stabilization agents; completed initial software for synergistic allocation of engineer assets within resource constraints to transportation infrastructure maintenance, repair, and construction tasks</li> <li>- Derived soil constitutive relationships describing the traction performance of tires operating in coarse-grained soils; developed stress distribution</li> </ul> </li> </ul> <p>Total 12532</p>										
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<b>FY 2000 Planned Program:</b>		
•	13781	- Identify infrared signature manipulation techniques for use in expedient decoy construction; perform survivability analysis of protective concepts for key assets in forward logistic nodes. - Derive methodologies to predict down axis ground shock from detonation partially above and in burster slab; develop and validate methods for hardening walls to resist terrorist mortar threats. - Complete final version of Coastal Integrated Throughput Model; incorporate snow melt capabilities into military hydrologic model. - Analyze methodologies for making short-term forecasts of soil strength based on predicted weather changes. - Integrate Improved Bridge Assessment Rehabilitation and Repair (IBARR) code with road assessment algorithms; establish criteria for off-road/bypass evaluation around damaged road networks. - Incorporate multiple-wheel interaction and rate dependent response analysis into an advanced pavement analysis model.
•	1000	- Evaluate techniques to predict the effects of asymmetric terrorist threats against dams and dam support structures.
	89	- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)
Total	14870	
<b>FY 2001 Planned Program:</b>		
•	14535	- Upgrade survivability analysis algorithms for blast and fragmentation effects to include CCD measures; troop evaluation of protective concepts for base clusters and forward logistic nodes. - Select analytic methodologies to predict down-axis ground shock from detonation partially in and below burster slab; complete dynamic experiments and analyses of square concrete structural components with intermediate span to thickness ratios; develop methods for hardening roofs to resist terrorist mortar threats. - Incorporate Coastal Integrated Throughput Model into military hydrologic models and a tactical logistics planning exercise to validate improved, robust basin delineation computer sub-routines. - Derive operational unit level movement algorithms for representation of maneuver in Army models and simulations. - Determine techniques for use of indigenous materials in maintenance, repair, and construction of roadways; develop procedures/guidance for engineer resourcing in repair/maintenance of roadways; develop bridge repair/retrofit materials and components; develop methodologies for assessment of impact on roadway components of vehicle speeds, tire pressures, loadings, etc. - Incorporate fracture concepts into the pavement performance model, incorporate long-term behavior analysis into the advanced pavement analysis model.
•	1000	- Analyze prediction techniques for effects of asymmetric terrorists' threats against locks, levees, and flood control structures.
Total	15535	
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COST (In Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT41 Military Facilities Engineering Technology		3966	4154	4204	4493	4683	4959	5245	Continuing	Continuing
<p><b>Mission Description and Justification:</b> This project exploits innovative developments in a wide range of technologies to achieve critically needed cost reductions in Army facility life cycle processes (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal). Current Army infrastructure operations, maintenance, and repair cost alone is about \$8.5 billion per year. The goal for the DoD Technology Area Plan is to reduce facility acquisition and maintenance and repair costs 15% by FY 2001 from a 1985 baseline. Meeting this critical goal is not possible without application of significant technology innovation. Products already developed and projected for the future have high civilian sector dual use potential. These include innovations in composite materials, concurrent engineering, collaborative decision support, corrosion resistant coatings, seismic vulnerability evaluations, and knowledge processing. Additionally, significant soldier retention benefits also accrue from providing professional work environments and high quality communities for military families. Under the DoD Project Reliance initiative, the Army is responsible for managing the conventional facilities research and development needs of all the military services through the US Army Engineer Research and Development Center (ERDC).</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 3966 - Enhanced the Modular Design for Systems to accommodate 80% of Army facility types.</li> <li>- Initiated development of self-repairing facings, coatings, and membranes for military buildings containing distributed reactive materials in inert casings which when released enable self-repair.</li> <li>- Generated criteria for upgrading seismically vulnerable, concrete frame, barracks structures.</li> </ul> <p>Total 3966</p> <p><b>FY 2000 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4117 - Advance structural integrity monitoring systems to provide information for assessing structural health, safety and remaining service life.</li> <li>- Generate design criteria for non-specific Electro-osmotic Pulse (EOP) system to prevent structural damage from chronic water seepage through floors, walls, and roofs.</li> <li>- Model corrosion degradation mechanism for coated steel and steel reinforced concrete in water and soil.</li> <li>- Characterize diaphragm design deficiencies in existing Army buildings under earthquake loadings.</li> <li>- Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)</li> </ul> <p>Total 37 4154</p>										
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<p><b>FY 2001 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4204 -Create testbed infrastructure to support collaborative facility design and installation management processes in a distributed, heterogeneous environment.</li> <li>- Evaluate infrastructure to support collaborative processes (e.g., engineering activities in the facility design and installation management processes) with the Modular Design System (MDS) version 3.0.</li> <li>- Generate design guidance for cost effective seismic rehabilitation of unreinforced masonry walls typically found at DoD installations.</li> <li>- Evaluate a corrosion control selection system that will assist in the proper selection and use of corrosion control materials and technologies based on site conditions and design.</li> <li>- Test earthquake hazard mitigation techniques for diaphragms in existing Army buildings.</li> <li>-Complete optimization model using probabilistic condition prediction tools for the maintenance and repair of facilities.</li> </ul> <p>Total            4204</p>		
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COST ( <i>In Thousands</i> )				FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT42 Cold Regions Engineering Technology				4618	4935	3747	3930	4106	4248	4480	Continuing	Continuing
<p><b>Mission Description and Justification:</b> This project is the only DoD applied research program focused on the knowledge base and engineering principles needed to efficiently sustain an effective force in winter and the cold regions of the world. This research supports DoD forces conducting combat support, combat engineering and base/facility construction, operation and maintenance missions across the spectrum of operations. This program provides the basis for extending the operability of forces and materiel in cold weather and increasing their deployability while directly lowering high life-cycle costs and extending the service life of DoD facilities. Research supports readiness and effectiveness of DoD conventional, light and special operations forces in the Arctic, Alaska, Scandinavia, Korea, Japan, Europe, the U.S. northern tier and remote/high altitude environments. This program is a source of special technologies for civilian engineering and environmental applications not obtainable through the private sector and is essential to improving projection of power and operational capabilities in cold weather areas of the world. The U.S. Army Engineer Research and Development Center (ERDC) manages the work.</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 3418 Prepared guidance for soil modifiers and geosynthetics for expedient, low-volume roads in thawing soils.</li> <li>• Identified engineering activities most sensitive to the winter environment in future combat simulations.</li> <li>• Completed finite element models of tires operating in wet, trafficked snow.</li> <li>• Provided map-based products for millimeter wave and infrared sensor performance for battlespace planning and operations.</li> <li>• Formulated asphalt pavement temperature model.</li> <li>• 1200 Evolved technology for detection of in-flight, aircraft icing conditions.</li> <li>• Advanced technology to improve mobility and mine detection along lines of communication in cold regions.</li> </ul> <p>Total 4618</p> <p><b>FY 2000 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3541 Formulate an integrated seismic/acoustic signature simulation model that will generate acoustic and seismic signatures for heavy tracked and wheeled vehicles in a variety of terrains.</li> <li>• Confirm application of physics-based models and visualization to support weapons selection and mission rehearsal for weapon systems equipped with infrared targeting sensors.</li> <li>• Provide winter climate index characterization manual for snow and soil freezing effects.</li> <li>• Originate model for predicting the effect of moisture and temperature gradients on pavement strength and roughness during freezing and thawing for airfields and pavements in cold regions.</li> <li>• 1300 Grow technologies for forecasting winter/seasonal impacts on Objective Force logistics and mobility.</li> <li>• 94 Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)</li> </ul> <p>Total 4935</p> <p><b>FY 2001 Planned Program:</b></p> <p>Project AT42</p>												

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**2 - Applied Research**

PE NUMBER AND TITLE  
**0602784A Military Engineering Technology**

- 3747 Confirm modeling and target location and tracking capabilities against non-real time data to improve operational effectiveness.
  - Integrate multispectral (infrared and millimeter wave) sensor performance products into 3-dimensional terrain visualization.
  - Advance innovative thawed soil stabilization techniques for base camps and expedient roadways in austere/remote theaters.
  - Incorporate the freeze-thaw model into the 3-D finite element pavement model in order to predict pavement performance during freeze-thaw periods.
- Total 3747

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)							DATE February 2000			
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602784A Military Engineering Technology				PROJECT AT45		
COST (In Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
AT45 Energy Technology Applied to Military Facilities	2276	2578	2797	2845	2996	3194	3372	Continuing	Continuing	
<p><b>Mission Description Justification:</b> The research conducted in this project provides the technology for providing energy efficient facilities, adapting new energy source technologies to military facilities, applying cost effective renewable energy technologies for Army uses, and improving the efficiency of Army central energy plants. Research focuses on leveraging industry technology investments and integrating a broad range of advanced technologies into a comprehensive system to meet the specialized needs of the Army utilities systems. The new Executive Order 13123 (signed 6/4/99). Greening the Government Through Efficient Energy Management” requires a 35% energy reduction by 2010, a 30% carbon reduction by 2010, greater use of renewables and sustainable building design and development. New technologies and procedures also support Army goals for improved air quality, sustainable design, and expanding the use of energy savings performance contracts. This project is managed by the U.S. Army Engineer Research and Development Center (ERDC).</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2276 - Completed self-tuning adaptive control algorithms for utility plant automation.</li> <li>- Completed condition assessment methodology for HVAC systems.</li> <li>- Validated concurrent engineering principles for community design concepts between electrical and mechanical building systems.</li> </ul> <p>Total 2276</p> <p><b>FY 2000 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2560 - Investigate screening, design and application tools for hybrid cooling systems.</li> <li>- Confirm methodology for integrated strategic planning for Army Installations.</li> <li>- Confirm automated procedures for heat system inventory, inspection, condition assessment, and condition prediction for systematic maintenance and repair of heat distribution systems.</li> <li>18 -Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)</li> </ul> <p>Total 2578</p> <p><b>FY 2001 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2797 - Complete process for maintaining technology for improving energy system performance for building energy systems.</li> <li>- Automate selection/design practice for hybrid cooling systems.</li> <li>- Complete process energy and pollution reduction (PEPR) program with expert system capability.</li> </ul> <p>Total 2797</p>										
Project AT45			Page 14 of 17 Pages				Exhibit R-2A (PE 0602784A)			

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<b>ARMY RDT&amp;E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)</b>							DATE <b>February 2000</b>			
<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>				<b>PE NUMBER AND TITLE</b> <b>0602784A Military Engineering Technology</b>				<b>PROJECT</b> <b>AT46</b>		
<i>COST (In Thousands)</i>	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
AT46 Climate Change Fuel Cell Technology	2877	2452	0	0	0	0	0	0	5329	
<p><b>Mission Description and Justification:</b> Funds for this project were provided by Congress in FY98 and FY99. Recent DoD demonstrations of stationary phosphoric acid fuel cells (PAFC) have shown them to be clean, reliable, efficient and high quality sources of energy. The purpose of this project is to provide additional research to reduce system capital cost, expand applications to megawatt size systems, and to develop a capability to use available fuels. This funding will increase DOD's ability to more effectively use clean and efficient combined heat and power technology and accelerate the use of fuel cell technology for military deployment and in-theater operations. The research will be jointly executed by the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Armament Research Development Center, U.S. Air Force Research Laboratory, and the National Defense Center for Environmental Excellence (NDCEE).</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2877 - Implemented component testing at NDCEE             <ul style="list-style-type: none"> <li>-Validated methods of reforming available fuels (no non-DoD fuels)</li> <li>- Analyzed power plant deficiencies and identified research area for improved performance of fuel cell technology.</li> </ul> </li> </ul> <p>Total 2877</p> <p><b>FY 2000 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2386 - Completion of reforming available fuels (no non-DoD fuels).             <ul style="list-style-type: none"> <li>- Complete investigation and recommend technology for on-site stack refurbishment which will prolong stack life, reducing costs.</li> </ul> </li> <li>66 - Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)</li> </ul> <p>Total 2452</p> <p><b>FY 2001 Planned Program:</b> Program not funded in FY 2001.</p>										
Project AT46			<i>Page 15 of 17 Pages</i>				Exhibit R-2A (PE 0602784A)			

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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)							DATE February 2000			
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602784A Military Engineering Technology				PROJECT AT49		
COST (In Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
AT49 University Partnering for Operational Support		2890	2943	0	0	0	0	0	0	5833
<p><b>Mission Description and Justification:</b> This program provides applied research for operational, fine-scale forecast models of basic meteorological variables for inclusion in Air Force Weather Agency (AFWA) modeling capabilities supporting Army tactical requirements. These efforts include enhancements to operational mesoscale prediction models that predict and forecast icing, turbulence, soil moisture, surface fluxes as well as chemical/biological and smoke plume dispersion.</p> <p><b>FY 1999 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2890 - Completed enhanced fine scale arctic weather prediction using current models upgraded for use at higher resolutions for Army applications.               <ul style="list-style-type: none"> <li>- Completed improved methods of forecasting icing and turbulence for Army air operations.</li> <li>- Completed improved modeling of surface fluxes and soil moisture that affect army logistics operations.</li> <li>- Completed improved high latitude bio/chem plume dispersion techniques that will enhance the capability to identify and predict chemical/biological agents atmospheric flow patterns.</li> <li>- Completed improvements in the atmospheric path characterization capabilities that will enhance target detection and tracking.</li> </ul> </li> </ul> <p>Total 2890</p> <p><b>FY 2000 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2864 - Complete research and evaluation of the effectiveness of the Mesoscale Model 5<sup>th</sup> Generation (MM5) numerical forecast model in arctic environments.               <ul style="list-style-type: none"> <li>- Research improved methods for forecasting icing conditions in an arctic environment</li> <li>- Perform analysis of volcanic eruption data to parameterize and extend the existing ash cloud models.</li> <li>- Complete investigation using the upgraded agriculture meteorology (AGRMET) model for use in improving surface flux and soil moisture modeling to improve trafficability forecasts.</li> <li>- Complete investigation of cloud microphysics to improve the forecasting of cloud evolution and contrails.</li> </ul> </li> <li>79 Small Business Innovative Research/Small Business Technology Transfer Programs (SBIR/STTR)</li> </ul> <p>Total 2943</p> <p><b>FY 2001 Planned Program:</b> Program not funded in FY 2001.</p>										

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BUDGET ACTIVITY <b>2 - Applied Research</b>				PE NUMBER AND TITLE <b>0602784A Military Engineering Technology</b>				PROJECT <b>AT50</b>		
<i>COST (In Thousands)</i>	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
AT50 Enhanced Geographic Synthetic Aperture	7704	0	0	0	0	0	0	0	7704	
<p><b>A. <u>Mission Description and Justification:</u></b> At congressional direction, this project was transferred to the National Imagery and Mapping Agency (NIMA) in October 1999 for execution. This project was to develop and build a unique, dual frequency (X-band and P-band) airborne interferometric Synthetic Aperture Radar (SAR) and associated processing system for terrain mapping. The project was to provide all-weather mapping under foliage and/or bare earth. Resulting products were to enhance military operations dependent on timely, accurate, true ground surface elevation data. The effect of terrain on mobility could have been evaluated more precisely with this capability. The project may have yielded a civil capability in land use, flood prediction, and environmental impact analyses.</p> <p><b>FY 1999 Accomplishments:</b> FY99 Congressional add of \$7704 was moved from PE 0602784, through Congressional direction, to NIMA.</p> <p><b>FY 2000 Planned Program:</b> Project not funded in FY 2000.</p> <p><b>FY 2001 Planned Program:</b> Project not funded in FY 2000.</p> <p align="center" style="font-size: 24pt; font-weight: bold; margin-top: 20px;">THIS PAGE INTENTIONALLY LEFT BLANK</p>										
Project AT50			Page 17 of 17 Pages				Exhibit R-2A (PE 0602784A)			