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

February 2003

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602784A - MILITARY ENGINEERING TECHNOLOGY

	COST (In Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	56911	55304	45407	46034	48645	50167	50618	51973
855	TOP,IMAGE INTEL&SPACE	9221	9870	10518	10747	11796	12110	12294	12594
EM2	FT GEORGE MEADE FUEL CELL DEMONSTRATION	2397	0	0	0	0	0	0	0
H71	ATMOSPHERIC INVESTIG	7129	6290	6085	6440	6662	6779	6741	6987
T40	MOB/WPNS EFF TECH	14914	16620	16869	16701	17669	18506	18672	19152
T41	MIL FACILITIES ENG TEC	4255	4576	4780	4689	4746	4862	4897	5026
T42	COLD REGIONS ENGR TECH	4733	3993	4083	4249	4382	4457	4510	4625
T45	ENERGY TEC APL MIL FAC	2691	2899	3072	3208	3390	3453	3504	3589
T48	CENTER FOR GEOSCIENCES & ATMOSPHERIC RESEARCH	0	1142	0	0	0	0	0	0
T49	UNIVERSITY PARTNERING FOR OPERATIONAL SUPPORT	3279	3241	0	0	0	0	0	0
T52	DOD FUEL CELL TEST AND EVALUATION CENTER	8292	6673	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: The objective of this program element is to provide technologies in direct support of critical warfighter functions of mobility, countermobility, survivability, sustainment engineering, and topography needed to transform the force. Research is conducted that supports special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Research is transitioned to PE 0603734A (Military Engineering Advanced Technology) and to Project Managers (PM) such as PM Combat Terrain Information Systems, PM Force Projection, and PM Close Combat Systems. Results are tailored to support the materiel development, test, and operations communities in evaluating the impacts of weather, terrain, and atmospheric obscurants on military materiel and operations. Major research efforts support Advanced Distributed Simulation, including networking of models, complex data interchange, and collaborative training; Military Engineering, including improving airfields and pavements, sustainment and cold regions engineering, vehicle mobility modeling, and reduced logistics footprint at base camps; Energy Technologies, including renewable and distributed energy supplies such as stationary fuel cells; Facilities Engineering, including facility acquisition and revitalization, installation operations, and modeling and simulation for installation transformation; C4 technology, including terrain awareness, C2 software, communications software and components; and ISR technology, including signal processing, automatic target recognition, and RF sensors/devices.

This research will 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 cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center and the U.S. Army Research Laboratory. This program supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds have been provided to the program.

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	59354	51124	53676	56325
Current Budget (FY 2004/2005 PB)	56911	55304	45407	46034
Total Adjustments	-2443	4180	-8269	-10291
Congressional program reductions				
Congressional rescissions		-6628		
Congressional increases		11600		
Reprogrammings	-1887	-318		
SBIR/STTR Transfer	-556	-474		
Adjustments to Budget Years			-8269	-10291

Change Summary Explanation: Funding - FY 2004/2005: Funds realigned to higher priority requirements in the areas of space imaging and target exploitation, battle weather intelligence, and design, construction and revitalization of facilities.

FY03 Congressional Adds:
DoD Stationary Fuel Cell Buy Down Program, Project T52 ($7000); Center for Geosciences, Project T48 ($1200); University Partnership for Operational Support, Project T49 ($3400).

Projects with no R-2As:
- ($7000) DoD Stationary Fuel Cell Buy Down Progam, Project T52: The objective of this Congressional Add is to support the development and commercialization of domestic stationary fuel cell systems. No additional funding is required to complete this project.
- ($1200) Center for Geosciences, Project T48: The objective this Congressional Add is develop and transition technologies for enhanced operational effectiveness in Army and Air Force atmospheric science programs. No additional funding is required to complete this project.
- ($3400) University Partnership for Operational Support, Project T49: The objective of this Congressional Add is to continue research in the area of atmospheric sciences for the purpose of providing operational solutions to environmental problems as identified by Army and Air Force users. No additional funding is required to complete this project.

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**855**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
855	TOP,IMAGE INTEL&SPACE	9221	9870	10518	10747	11796	12110	12294	12594

A. Mission Description and Budget Item Justification: This project provides advanced technologies for storing, transforming, updating, and disseminating extremely large volumes of terrain and weather effects data at, or near, real-time to enable Objective Force Command and Control Systems with superior knowledge of the battlespace terrain and environment. Work in this project significantly enhances the Army's geospatial data management and dissemination capabilities. Weather/atmospheric data is provided for this project by the US Army Research Laboratory project H71 in this program element. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds have been provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Data Generation – In FY02, developed software to rapidly extract and properly characterize geospatial information of importance to Army and DoD customers. Incorporated knowledge-based techniques to automate and improve digital stereo photogrammetric workstation operations for feature extraction and attribution. Developed new terrain and target detection/classification algorithms that reduced terrain misclassification by a factor of 2. In FY03, develop automated data generation algorithms for tactical level features and attributes that are needed in tactical Assured Mobility decision aids. Develop algorithms that combine terrain information and target identification from different sensors. In FY04, integrate algorithms and demonstrate ability to identify targets and classify terrain. Develop automated methods to detect minor geomorphic changes that affect FCS mobility. In FY05, develop and release software for automated methods to assess soil moisture and drainage attributes for Assured Mobility requirements. Transition these developments to PM Combat Terrain Information System to support tactical analysis and decision-making.	3287	3850	3811	3955
Data Management – In FY02, assessed, formulated, and performed research of technologies to support geospatial data integration that would allow the soldier to have a single picture of the battlespace regardless of the number of data sources. In FY03, develop automated cross sensor registration tools to correct for image inaccuracies so that users will be looking at the same object, regardless of sensor type. In FY04, develop automated multi-feature registration to provide warfighters with a single view of data. Provide data management software that will be able to incorporate new data sources to improve analysis of time-sensitive geospatial information. In FY05, formulate geospatial data integration techniques to permit more intuitive presentation and more rapid comprehension of complex terrain data sets to support military planning and battle command and control.	1272	1777	1961	2306

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Data Representation – In FY02, provided an internet based mapping capability and integrated current state of the art technology to provide the ability for rapid, as-needed, in-field, and seamless use of map and geospatial information world-wide. Developed a tactical capability merging weather and terrain data with thermal and signature models to produce a suite of multispectral 3D visualization products supporting intelligence preparation of the battlefield, mission rehearsal, and target area preview. Demonstrated software to help produce the synthetic terrain scenes utilizing high resolution overhead imagery for added scene detail. Created a prototype common environment database repository that can be used to support general planning, course of action analysis, mission rehearsal, and battle simulation. In FY03, develop methodologies to incorporate non-spatial intelligence data (e.g., vertical obstruction filer and descriptive information to provide and enhance feature attribution) into geospatial databases. In FY04, create software to incorporate non-sensor derived data sources into current spectral sensor algorithms for geospatial data generation. In FY05, develop improved geospatial data access and distribution tools for more efficient dissemination of digital data for tactical systems.	2983	1875	2167	1636
Data Analysis – Battlespace Terrain Reasoning and Awareness will develop a comprehensive suite of battlespace environment terrain and weather effects Tactical Decision Aids (TDAs) that generate information and knowledge necessary to enable decision and execution processes across C4ISR systems and robotic platforms of the Objective Force. In FY02, created semi-automated methods to produce terrain modeling data sets for the Digital Topographic Support System (DTSS) and weather data sets for the Integrated Meteorological System for use with both infrared and millimeter wave scene visualization technologies. In FY03, develop geospatial tools and temporal terrain reasoning tools, which provide the capability to extract the fundamental elements of course-of-action analysis (COA). In FY04, integrate the ability to predict the dynamic state of battlespace environments to modulate the static components of COA. In FY05, create terrain-reasoning capability to provide time-sensitive course-of-action information for Objective Force applications.	1679	2368	2579	2850
Totals	9221	9870	10518	10747

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**H71**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
H71	ATMOSPHERIC INVESTIG	7129	6290	6085	6440	6662	6779	6741	6987

A. Mission Description and Budget Item Justification: The objective of this project is to perform the applied research for tactical weather and atmospheric effects algorithms, and for the integration of battlefield atmospheric environments simulations. The Army's transformation plan to the Objective Force will require capabilities for battlefield commanders to make decisions based on tactical weather technology and impacts. This weather intelligence data will have to be not only accurate and timely, but distributed down to the lowest levels of command, which may include the individual soldier. This project 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 Department of Defense (DoD) modeling community. It provides the weather data from forecast/nowcast models, the distributed four dimensional (4D) weather database, and the weather decision aids that use this data 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 the Army's transformation to the Objective Force through future applications and platforms that support echelons at Brigade and below, down to the individual soldier, and Defense Technology Objectives, Weather/Atmospheric Impacts on Sensor Systems, and On-Scene Weather Sensing and Prediction Capability. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Research Laboratory (ARL). This program supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds have been provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Mature a new high resolution, short-range forecasting capability based on integrating new battlefield meteorological data sources (non-conventional meteorological sensors such as Unmanned Aerial Vehicles, Unattended Ground Sensors, and robotic sensors) into model initialization which will directly impact nowcast/very short-range forecast accuracy especially over the target area, and provide much higher resolutions over the theater of operations. In FY02, verified the new Cumulus Parameterization Scheme for estimating convective precipitation to transition into the Integrated Meteorological System and field artillery meteorological models. In FY03, apply a test set of methods for integration of non-traditional meteorological data sources to Army meteorological forecast models. Begin evaluation of the modified models with emphasis on target areas and short-term forecasts. In FY04, evaluate and modify as needed model packages that include a microscale diagnostic model for very fine resolutions nested in a mesoscale predictive model. In FY05, evaluate models with a complete set of modifications for insertion of likely sources of meteorological data from the battlefield. Evaluate model package for very fine scale analysis that uses data from non-traditional sources likely to exist on the net-centric battlefield.	956	2076	1950	2072
Implement a research version of the Battlescale Forecast Model (BFM) that has software for ingesting data from meteorological satellites, Unmanned Aerial Vehicles, and distributed ground-based sensors. Research and test the capability to host the BFM on battlefield gun platforms to allow for fully autonomous artillery meteorological message generation during battle. In FY02, investigated weather effects software that provides accurate artillery-tailored weather effects decision aids for trajectory analysis, targeting, and go/no-go forecasts to the fire control databases. Modified the BFM to accept weather data from local and RSTA sensors for improved meteorological data collection and utilization. In FY03, evaluate artillery improvement algorithms using the research model. Complete a set of artillery-tailored decision aids for evaluation using model output and real data. In FY04, evaluate the set of artillery-tailored decision aids. Modify the research model as needed for operation on the processors expected to be available on gun platforms of the Future Combat Systems and in use as part of the NetFires concept. In FY05, evaluate the modified research model for operation on gun platform processors. Modify and evaluate the research model for its ability to accept and process data from local and RSTA sensors. Evaluate the gain in accuracy of the modified model.	1355	1195	1181	1261

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Integrate distributed weather client applications and database connectivity with the Army Battle Command System or other Command, Control, Communications, Computing and Intelligence (C4I) systems identified for Future Combat Systems Command and Control "on the move" in order to utilize new weather effects decision aid technology at lower echelons through hand-held visualization devices such as Personal Digital Assistants (PDA's). Incorporate sets of weather algorithms that can be integrated into existing soldier and system embedded processors describing basic information for the individual soldier on current terrain and weather conditions, weather forecasts, weather warnings, heat stress, canteen use, and meteorological satellite imagery. In FY02, matured distributed weather client applications for push/pull of forecasts and weather impact decision aids to soldier-level interactive displays. Proved out the wireless capability to display limited forecast data and decision aids on PDA hand-held devices. In FY03, augment the capability of the PDA to accept and process data from "reachback" databases to increase capability and timeliness. Upgrade the number and application of the PDA software for weather effects decision aids. In FY04, mature an upgraded capability to access and process data from other battlefield processors that will have applicability to the Objective Force. Evaluate the PDA software in exercises that evaluate its effectiveness. In FY05, implement software on the PDA that can be used as part of a package of software for the wearable computer for the Future Warrior.	876	629	674	787

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Increase effectiveness of target acquisition in urban and other domains by applying advances in optical turbulence research for atmospheric effects on modern small aperture sensors and lasers, and new models for the effects of nighttime light scattering due to urban light pollution on night sensors into advanced tactical decision aids for use in RSTA planning, special operations, and Objective Force Warrior. Integrate hyperspectral and polarimetric imagery to extend target signature analysis, improve target acquisition capabilities and evaluate polarimetric imaging techniques, including improved imager performance against camouflage and decoys. Incorporate these polarimetric imaging techniques into sensor platforms being developed for the Future Combat Systems. In FY02, evaluated polarimetric imaging techniques for support of Army missile systems. Completed approximately 3,000 new rule thresholds for various weapons systems, both friendly and threat, that will be used in developing new generation of physics-based tactical decision aids. In FY03, mature weather effects for interface into Army Warfare System/Joint Warfare System (AWARS/JWARS) war games. In FY04, create a model for determining environmental effects for urban target acquisition and urban inherent signatures. In FY05, mature capability to use remote sensing imagery to identify urban signatures operationally and urban combat simulations used in mission planning.	935	1069	1036	1089
Measure single particle fluorescence spectra and scattering signatures of biological and natural aerosols in the atmospheric boundary layer. In FY02, assessed a prototype fluorescent particle sensor for bio-hazard detection and identification. Researched and created new data retrieval methods that can be used in conjunction with a broadband Light Detection and Ranging (LIDAR). In FY03, create algorithms to use these measurements to improve chemical/biological aerosol detection capability. In FY04, research laser based techniques for aerosol detection/classification using polarization scattering for aggregate particles. In FY05, improve other laser-based techniques for aerosols detection/classification including plasma emission for elemental composition, and broadband LIDAR for size distribution and concentrations.	1062	944	922	898
Integrate the effects of vegetation and terrain on acoustic propagation into a battlefield decision aid and extend the acoustic decision aids to infrasonic frequencies for intelligence operations. In FY02, the Acoustic Battlefield Aid (ABFA) decision aid was implemented in the Integrated Weather Effects Decision Aid (IWEDA) suite. In FY03, establish an infrasound test site, develop infrasonic signature database. In FY04, implement high compression techniques for acoustic and infrasonic data retrieval. In FY05, create a first principles, three dimensional (3D) propagation model capable of handling dynamic atmospheric inputs and complex ground surfaces to produce high-fidelity simulated signals and realistic environmental impact for acoustic sensors.	443	377	322	333

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Supported collaborative research in various aspects of environmental sciences to include data assimilation, chemical and biological aerosols, and numerical weather prediction capabilities. In FY02, the external partner, Colorado State University, Center for Geosciences/Atmospheric Research delivered to Army elements, a hydrological model that improved rainfall prediction, a cloud drift wind algorithm for development of an automated cloud feature system, a prototype numerical weather prediction model that initializes using data from non-conventional sources, and a water vapor retrieval algorithm based on using the Beysian Method.	1502	0	0	0
Totals	7129	6290	6085	6440

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T40**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T40	MOB/WPNS EFF TECH	14914	16620	16869	16701	17669	18506	18672	19152

A. Mission Description and Budget Item Justification: The objective of this project is to mature technology for rapid upgrading, construction, and repair of in-theater airfields; rapid establishment and repair of lines of communications (roads and bridges); expedient protection for the warfighter during contingency operations; and rapid port enhancement. This research supports development of the Future Combat Systems (FCS) and Objective Force by providing physics-based representation of mobility, obstacle and barrier creation, survivability, and weapons effects in urban terrain in modeling and simulation. Additionally, the project will mature technologies that will increase the survivability of critical assets from conventional and terrorist weapons, and sustainability of deployed forces, while reducing their logistical footprint. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. This work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds have been provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Force Protection - In FY02, produced guidance for designing survivability measures to protect base camps from small arms, rockets, and fragmentation threats. Integrated survivability designs and measures into Anti-Terrorist Planner software. In FY03, will develop systematic procedures to identify construction methods and characterize their material properties. This development will characterize buildings world-wide based on 20 structural types. In FY04, develop guidance for rapid construction of survivability and fighting positions tailored to urban environments. This effort will increase probability of survival of personnel and critical assets in urban structures by a minimum of 30% from enhanced blast and fragmentation weapons. In FY05, will increase number of structural types that can be rapidly assessed from 13 to 20 structural types.	4188	1995	1968	1917
Weapons Effects and Structural Response – In FY02, incorporated damage prediction algorithms for remaining infrastructure components in vulnerability assessment software for protection of the selected critical infrastructure from asymmetric terrorist attacks. Provided validated techniques for lighter, more survivable protection by predicting ground shock and structure-media interaction. In FY03, produce methods for predicting blast effects on protected and unprotected structures and ground shock effects in different rock types, and improve techniques for predicting high velocity penetration into structural materials, such as concrete. In FY04, complete methodology to predict airblast coming from adjacent buildings. In FY05, complete methodology to predict very high velocity projectile penetration in soil, and quantify the effects of explosive types on structures and soil.	2474	2659	2776	2965
Materials and Criteria for Protective Construction – Provides material solutions, implementation guidance, and structural modeling capabilities for increased survivability against current and future weapon and sensor threats. In FY02, matured analytical design/analysis methodologies for forced entry threat mitigation and produced Simplified Survivability Assessment (SSA) software for troop use. In FY03, mature elastomeric polymer structural retrofit capabilities for protection of conventional construction. In FY04, evaluate protective concepts for theater missile defense systems used in transforming the force. In FY05, produce enhanced SSA including analysis of emerging threat weapon systems.	1439	1995	2351	2360

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Airfields, Pavements & Sustainment Engineering/Joint Rapid Airfield Construction - In FY02, assessed materials and methods for rapid airfield construction. In FY03, integrate advanced construction technologies to enhance airfield construction productivity. In FY04, demonstrate improved construction techniques and C-130 capable technology. In FY05, develop advanced stabilization techniques to reduce cure time from 30 days to 1-2 days while reducing logistical footprint. Rapid Port Enhancement - In FY03, modify the Coastal Integrated Throughput Model to include attributes and capabilities of the Theater Support Vessel and rapid port enhancement products. Determine rapid force projection and sustainment Sea Port of Debarkation enhancement requirements for future sealift operational scenarios; produce initial suite of overall port enhancement design concepts including application of “hydro-beam” technologies and integration of coastal climatological database system; produce Coastal Integrated Throughput Model Version III, including stochastic modeling capability. In FY04, perform coastal throughput assessment for rapid force projection and sustainment operations for a particular theater of operation to include assessment of capabilities to meet force projection demands associated with the Army Transformation; test database methodology for final Theater Support Vessel design capabilities and provide parameter affecting throughput to the Coastal Integrated Throughput Model. In FY05, integrate Coastal Integrated Throughput Model into larger-scaled modeling systems and applications; conduct intermediate-scale experiments for "hydro-beam" causeway and near-shore breakwater.	1439	3656	3574	3337

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Mobility Modeling – Provides procedures to accurately quantify maneuver and select best network routes over and around obstacles, in urban and non-urban areas, during all weather conditions, to synchronize speed, agility, and flexibility of disbursed tactical units. In FY02, evaluated hydrology model for effect/assessment on maneuver/counter maneuver during rapid force projection in worldwide scenarios. Developed improved pavement materials and expanded pavement design and analysis model for rapid, accurate and reliable prediction and enhancement of airfield performance using current and future aircraft criteria. In FY03, mature solutions for rapidly assessing condition and predicting future performance of roads and bridges in theater of operations to expedite route planning. In FY04, mature solutions for predicting future performance of roads and bridges to expedite throughput assessment. In FY05, provide materials and methods for rapidly upgrading or expanding existing lines of communication for increased throughput capacity with a reduced logistics footprint. Mature advanced throughput models for intelligent maneuver decisions including bypass options, route planning, resourcing, and management tools. Determine mobility performance requirements for advanced vehicle platforms such as FCS. Quantify maneuverability within urban environments on the future battlefield. Create hydrologic decision analysis capability for rapid in-theater maneuver assessment for the warfighter.	3328	4155	4806	4769
Decision Support – In FY02, integrated spatial, predictive and weather software into Digital Topographic Support System architecture for verification and validation. Provided a capability to analyze the obstacle effects of craters on ground vehicles in the One Semi-Automated Force (OneSAF) simulation and a capability for dam breach analysis in TeleEngineering Toolkit. In FY03, develop realistic mobility portrayals as a function of short-term changes in the ground-state to support unit movement evaluation. Provide digital reconnaissance applications to allow rapid remote main supply route assessments via TeleEngineering. In FY04, develop improved NoGo/obstacle analysis. Incorporate the Watershed Modeling System into the OneSAF simulation to provide watershed and riverine analysis. In FY05, develop additional improvements to NOGO/obstacle analysis. Provide algorithms for rapid building generation, advanced vehicle platforms performance, a baseline representation of vehicle maneuverability and improve the representation of smart munitions effects in modeling and simulation.	2046	2160	1394	1353
Totals	14914	16620	16869	16701

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T41**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T41	MIL FACILITIES ENG TEC	4255	4576	4780	4689	4746	4862	4897	5026

A. Mission Description and Budget Item Justification: The objective of this project is to perform applied research necessary to delivery sustainable, cost efficient and effective facilities; and provide installation operations required to support the Objective Force. The project focuses on facilities and operations advanced technologies directly supporting training, readiness, force projection, force protection, homeland security and forward basing. In addition, planned facility enhancements will achieve cost reduction in the Army facility life cycle process (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal), and the supporting installation operations. This work will improve quality of facilities and enhance soldier quality of life, thereby enhancing soldier retention. Technologies evolving from this work include composite rehabilitation materials, multi-hazard mitigation, electromagnetic shielding, concurrent engineering processes, sustainable facility management, collaborative decision support, and knowledge processing. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds have been provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Facility Modeling and Simulation – The Fort Future program will develop the capability to model, simulate, assess, and optimize installation capability to support the Objective Force (OF). The technology will enable a more holistic approach to facility design, including incorporation of anti-terrorism and sustainability (e.g., energy, water, environmental) considerations that currently threaten long-term viability of installations. In FY02, developed capability to deliver facilities that better match OF requirements in a shorter time by automating requirements generation, speeding up generation of designs, and increasing reuse of designs that have already been generated. Completed beta version of the GeoBest sustainment model that predicts facility requirements for initial/bare base construction standards. In FY03, simulate force projection flow through the installation in order to provide a local optimization tool and to enable a risk-based approach to investing in mission-critical infrastructure. In FY04, develop integrated tools for judging suitability of infrastructure to support power projection, readiness, threat vulnerability, and sustainability requirements. In FY05, validate prediction and optimization algorithms for installation capability to support Army Installation Transformation.	1943	2562	2178	1949

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Facility Engineering – In FY02, completed seismic vulnerability evaluation guidance for building floor and roof elements in Army facilities for assessing compliance with current seismic criteria. Developed and tested "self-healing" coatings which exhibited a 30% reduction in undercutting (improved corrosion protection) compared to conventional coatings. Completed a prototype model for reliability-based maintenance of Army infrastructure for maintenance planning and cost reduction. In FY03, generate analytical models and design guidance for seismic rehabilitation of reinforced concrete frames with masonry infill to comply with current seismic criteria. Develop an Installation Mission Essential Task List requirements process to directly tie resource decisions to unit mission. In FY04, develop performance envelope for composite structural repair and upgrade materials for predicting long-term usage in maintaining and improving infrastructure. Develop innovative strategies and business practices for Army roofing asset management to reduce cost of roof replacement. Develop prototype sector analysis and modeling for strategic sourcing. In FY05, complete fiber reinforced polymer rehabilitation concepts and methodologies for seismic strengthening. Develop short-term impedance testing parameters as indicators to predict performance for corrosion resistant coating systems. Develop a holistic integrated tool, system and service to optimize regional and local installation management across power projection, training, and industrial tenant units in support of Army Installation Transformation.	2312	2014	2602	2740
Totals	4255	4576	4780	4689

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T42**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T42	COLD REGIONS ENGR TECH	4733	3993	4083	4249	4382	4457	4510	4625

A. Mission Description and Budget Item Justification: This project provides advanced technologies for developing planning and assessment tools, innovative construction materials for extreme climatic conditions and techniques, and procedures to improve Objective Force capabilities throughout cold regions of the world. Further, this project focuses on minimizing or eliminating the dramatic effects of dynamically changing terrain states on sensing and maneuver operations conducted by the Army. To achieve this, effective decision making tools such as models, simulations, and mission planning and rehearsal factors are required that accurately predict the state of the ground, near-surface atmospheric conditions, and system performance in complex environments. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. The work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds have been provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Terrain State – In FY02, proved feasibility of using dynamic terrain state models in a tactical setting, with tactical computing assets to support sensor performance and mobility predictions in support of Battlespace Terrain Reasoning and Awareness. Completed mechanistic model for pavement design and evaluation to prevent and alleviate frost heave and thaw weakening, thermal cracking, cracking induced by structural loading during thaw periods. In FY03, develop realistic winter mobility portrayal as a function of short-term changes in the ground state to support unit movement evaluation. Complete site assessment methodology and establish criteria for remedy of high moisture content soils. Will develop all-season material models that will simulate the mechanical behavior of different terrain materials (freezing/thawing soil), ice, and snow to improve simulation of vehicle-terrain interaction in support of TARDEC led High Fidelity Ground Platform and Terrain Mechanics Modeling program. In FY04, develop terrain state modeling and sensor performance tactical decision aids (TDAs). Complete ground and support assessments for strengthening indigenous soils during thaw periods for rapid all-season construction of forward theater airfields. Extend finite element modeling of tire-terrain interactions to these materials. In FY05, develop models and tactical decision aids for commander's mobility analysis and course-of-action decisions. Establish remote site assessment, evaluation and selection techniques for Joint Rapid Airfield Construction. Develop high fidelity real-time motion environment to study moving vehicle operations and mitigating factors.	2957	3155	3207	3387
Signature Physics – In FY02, developed a geophysical model of Yuma Proving Grounds Smart Weapons Test Range for use in simulation-based system prototype development and advanced target location and tracking capabilities for unattended ground sensor seismic sensing arrays. Performed seismic simulation sensitivity study of ground vibrations coming from armored vehicles moving over varied terrain, to verify accuracy of seismic simulations in comparison to field test results of moving tracked vehicles in support of ARDEC led Advanced Acoustic Seismic Systems program. In FY03, finalize high fidelity seismic propagation modeling. Modify thermal models to include a wider range of manmade materials in support of ARL's Command and Control (C2) in Complex and Urban Terrain program. In FY04, develop tactical terrain thermal modeling tools for urban and complex features. Establish basis for developing generic performance criteria for sensor TDAs. In FY05, adapt for local geology, algorithms for unattended ground sensors in seismic sensor networks. Develop query and subscription based incorporation of signature physics tool set with C2 collaboration tools.	784	838	876	862
Winter Base Camp Construction - This one year Congressional Add demonstrated improved base camp winter construction techniques and procedures. No additional funding is required to complete this project.	992	0	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Totals	4733	3993	4083	4249

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

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research	**0602784A - MILITARY ENGINEERING TECHNOLOGY**	**T45**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
T45	ENERGY TEC APL MIL FAC	2691	2899	3072	3208	3390	3453	3504	3589

A. Mission Description and Budget Item Justification: The objective of this project is to provide technology necessary to provide cost effective, energy efficient, sustainable military installations, emphasizing a secure and reliable energy supply for Army Installations supporting transformation. Advanced energy technologies and processes are also applied to the Army's industrial base to maintain its cost-effective readiness for munitions production. Advanced technologies include integrated, distributed and renewable energy supply, hybrid cooling, and microturbines for Army application at all installations, to include theater of operations. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. The program element contains no duplication with any effort within the Military Departments. Work is performed by the U.S. Army Engineer Research and Development Center. This project supports the Objective Force transition path of the Transformation Campaign Plan.

No Defense Emergency Response Funds were provided to the project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
Installation Modeling and Simulation – The Fort Future program will develop the capability to model, simulate, assess, and optimize installation capability to support the Objective Force. In FY02, identified threats and options for chem/bio mitigation in water systems. Studied threats and options for chem/bio hardening of facility air handling systems for incorporation into the Fort Future modeling and simulation system. In FY03, adapt utility distribution system software models to military scenarios including mobilization (Force Projection) and response to terrorist threats such as chem/bio contamination (Force Protection). In FY04, develop dynamic risk models to analyze supply and demand energy/environment distribution systems to include chem/bio terrorist threat scenarios for critical military facilities. In FY05, develop integrated tools for judging suitability of energy infrastructure to support power projection, readiness, threat assessment, and sustainability requirements.	1293	1884	2012	2097
Secure/Reliable Utility Systems – In FY02, updated Army energy strategy to reflect the latest supply and demand energy technologies and terrorism threats. Conceptualized standard control system protocol for Army facilities to ensure common operating maintenance practices on all Army installations. In FY03, craft energy control system architecture and protocol compatible with facility technologies to optimize building energy performance and worker comfort and productivity. In FY04, adapt supply and demand technologies to communicate through control network allowing for multiple building control networks that are highly reliable. In FY05, adapt emerging supply and demand equipment (i.e. next generation fuel cells, air-conditioning) to communicate through control systems for critical military facilities.	1398	1015	1060	1111
Totals	2691	2899	3072	3208