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

February 2002

BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602784A - MILITARY ENGINEERING TECHNOLOGY

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
	Total Program Element (PE) Cost	54366	59354	51124	53676	56325	57735	59796
855	TOP,IMAGE INTEL&SPACE	9394	9707	10938	11575	12728	13045	13442
EM2	FT GEORGE MEADE FUEL CELL DEMONSTRATION	0	2500	0	0	0	0	0
H71	ATMOSPHERIC INVESTIG	6238	7432	7145	8198	8651	8898	9106
T40	MOB/WPNS EFF TECH	15257	15638	19544	19884	20123	20962	22021
T41	MIL FACILITIES ENG TEC	4131	4458	5303	5544	5870	5580	5751
T42	COLD REGIONS ENGR TECH	5058	4889	4746	4856	5125	5240	5367
T45	ENERGY TEC APL MIL FAC	2752	2821	3448	3619	3828	4010	4109
T49	UNIVERSITY PARTNERING FOR OPERATIONAL SUPPORT	3845	3374	0	0	0	0	0
T52	DOD FUEL CELL TEST AND EVALUATION CENTER	4807	8535	0	0	0	0	0
T53	THERMOELECTRIC POWER GENERATION FOR MILITARY APPS	2884	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. Key operational science and technology is provided to Army units under PE 0603734A (Military Engineering Advanced Technology). Results are tailored to support the materiel development, test, and operations communities 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. 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 (TCP).

B. Program Change Summary	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2002 PB)	55332	42850	45508
Appropriated Value	55844	59850	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-496	0
b. SBIR / STTR	-754	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-210	0	0
e. Rescissions	-514	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	5616
Current Budget Submit (FY 2003 PB)	54366	59354	51124

Change Summary Explanation:

FY02 (+$16504) Project 855 (-$88), Project H71 (-$65), Project T40 (-$143), Project T41 (-$40), Project T42 (-$43), Project T45 (-$26), Project T49 (-$26), and Project T52 (-$65) received general reductions in funding.

Congressional adds were made for Ft. George G. Meade Fuel Cell Demonstration, Project EM2 (+$2500); Center for Geosciences, Project H71 (+$1500); Cold Regions Military Engineering, Project T42 (+$1000); University Partnership for Operational Support, Project T49 (+$3400); Climate Change Fuel Cell Program, Project T52 (+$3500); and DoD Fuel Cell Test and Evaluation Center, Project T52 (+$5100).

FY03 (+$5616) Project 855 (+227), Project H71 (+$526), Project T40 (+$3144), Project T41 (+$621), Project T42 (+$645), and Project T45 (+$453) funding was increased in order to implement legislative change directing each agency to pay the full Government share of the accruing retirement costs of current Civil Service Retirement System (CSRS) employees and the accruing health care costs of all future Federal retirees.

Projects with no R-2As include:
- ($2500) Ft. George G. Meade Fuel Cell Demonstration, Project EM2: The objective of this one year Congressional add is to demonstrate the

commercial use of 1 Megawatt Solid Oxide Fuel Cells for military and civil stationary power applications. No additional funding is required to complete this project.
- ($3400) University Partnership for Operational Support, Project T49: The objective of this one year Congressional add is to continue research that enhance operational, fine-scale forecast models of basic meteorological variables. No additional funding is required to complete this project.
- ($3500) Climate Change Fuel Cell Program, Project T52: The objective of this one year Congressional add is to support the development and commercialization of domestic stationary fuel cell systems. No additional funding is required to complete this project.
- ($5100) DoD Fuel Cell Test and Evaluation Center, Project T52: The objective of this one year Congressional add is to demonstrate and validate fuel cell technology for military and commercial applications. No additional funding is required to complete this project.

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

February 2002

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
855 TOP,IMAGE INTEL&SPACE	9394	9707	10938	11575	12728	13045	13442

A. Mission Description and Budget Item Justification: The objective of this project is to provide warfighters with superior knowledge of the terrain and environment by adapting technologies to enable the Objective Force to move, shoot, and communicate on the battlefield more efficiently. Information dominance is a critical technology enabler for the Objective Force. Continuing evolution of these research efforts is imperative for the commander's ability to locate enemy forces, position troops in day/night all-weather conditions, provide crucial terrain data for command and control systems (C2) as well as effectively utilize modeling and simulation systems. 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 U.S. 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 (TCP).

FY 2001 Accomplishments:

- 9394 - Created a capability for automated feature attribution using knowledge-based rules to provide better knowledge of the battlefield for FCS and the Objective Force.
  - Extended advanced geospatial data management technology to support rapid update of terrain information using best available sources.
  - Integrated a model derived from infrared and millimeter wave sensor performance overlays into 3D visualization for enhanced visualization of theater characteristics.
  - Completed implementation of spectral/spatial algorithms for detection and identification of terrain features and conditions.
  - Improved the spatial analysis tool to support course of action analysis for ground order of battle.
  - Provided enhanced analytical terrain-reasoning tools to Army Battle Command System's All-Source Analysis System (ASAS) and Combat Terrain Information System (CTIS).

Total 9394

FY 2002 Planned Program

- 9707 - Create initial terrain reasoning capability to provide time-sensitive course-of-action information for Objective Force applications.
  - Generate improved geospatial data access and distribution tools for more efficient dissemination of digital data.
  - Create semi-automated methods to produce modeling data sets for the Digital Topographic Support System (DTSS) and weather data sets from the Integrated Meteorological System (IMETS) for use with both infrared and millimeter wave scene visualization technologies.
  - Integrate new multi-sensor exploitation software into the digital stereo photogrammetric workstation for quicker and more efficient digital database construction.
  - Create a prototype for common environment database repository resulting in one integrated database for mission planning and rehearsal, modeling and simulation and common operating picture of the battlefield.
  - Complete spatial analysis software to support course of action analysis for ground order of battle.
  - Prototype rapid distributed data insertion software to tactical units for increased situational awareness to improve capability to provide time-sensitive course-of-action information.
  - Provide data exploitation software for new data sources to improve analysis of time-sensitive geospatial information.
  - Explore spatial and spectral information fusion techniques.
  - Establish interoperable web solutions for geospatial information.
  - Develop prototype of a low cost wheeled tactical navigator for improved battlefield vehicle POS/NAV.

Total 9707

FY 2003 Planned Program

- 10938 - Transition Tactical Decision Aid software into the Joint Precision Strike Demonstration program.
  - Provide a Web Mapping capability and integrate current state of the art technology to provide the ability for rapid, as-needed, in-field, and seamless use of map and geospatial information from servers world-wide; combining information from numerous enterprise systems into integrated visual and alphanumeric displays for the warfighter.
  - Generate enhanced data exploitation software sets for improved data analysis for Objective Force tactical decision aids.
  - Establish advanced tactical decision aids based on improved geospatial information.

FY 2003 Planned Program (Continued)

- Formulate geospatial data fusion techniques to permit more intuitive presentation and more rapid comprehension of complex information sets.

- Create and integrate knowledge based editing software into the digital stereo photogrammetric workstation to reduce time required to develop a digital database.

- Integrate, test and evaluate the next generation national systems for developing geospatial information.

- Create software to incorporate secondary input sources (non-sensor sources) into current spectral sensor algorithms.

Total 10938

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
H71	ATMOSPHERIC INVESTIG	6238	7432	7145	8198	8651	8898	9106

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 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. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2001 Accomplishments:

- 6238 - Integrated joint weather impacts into decision aids for the Army's First Digitized Division weather capability.
  - Upgraded the Weather Impact Decision Aid models with the characteristics and the impacts of weather on threat platforms, weapons, sensors and operations to enable the forecast of the deltas between threat and friendly systems.
  - Completed a 3D atmospheric propagation and simulation model that included the effects of absorption, scattering, and radiative transfer, turbulence, clouds, aerosols, and smoke for improved simulations, virtual testing and analysis.
  - Expanded the Electro Optics Systems Atmospheric Effects Library (EOSAEL) model suite with an acoustics model with documentation, for improved military analysis studies and wargames.

FY 2001 Accomplishments: (Continued)

- Incorporated turbulent scattering into scanning acoustic wave propagation models for enhanced acoustic target acquisition.
- Coupled Acoustic Battlefield Aid (ABFA) with an Acoustic Target Recognition database and quantified the impacts on prediction of sensor performance.
- Conducted evaluation of neural network methods for retrieval of wind profiles from met satellite sounder data and integrated combined temperature retrieval methods to proof-of-concept Mobile Meteorological System Profiler (MMS-Profiler) processors to achieve better temperature sounding capability for improved artillery accuracy.
- Conducted verification and validation of Battlescale Forecast Model (BFM) modules for critical target area forecast parameters such as temperature, wind speed and wind direction, that will lead to more effective use of smart munitions and sub-munitions in the target areas.

Total 6238

FY 2002 Planned Program

• 5932

- Incorporate full complex terrain/turbulent scattering acoustic propagation model into next generation weather decision aid systems.
- Evaluate polarimetric imaging techniques for incorporation into sensor platforms for the Future Combat Systems (FCS).
- Modify the BFM to accept weather data from local and RSTA sensors for improved meteorological information collection and utilization.
- Evaluate techniques for effectively compressing meteorological data for distribution over low bandwidth networks.
- Investigate methods for delivering meteorological information to FCS in compressed form to conserve limited bandwidth.
- Investigate weather effects software to provide accurate artillery-tailored weather effects decision aids for trajectory analysis, targeting, and go/no-go forecasts to the fire control databases.
- Evaluate non-hydrostatic mesoscale forecast model for mo re accurate battlefield moisture forecasts.
- Verify the new Cumulus Parameterization Scheme for estimating convective precipitation for transition into IMETS and field artillery meteorological models.
- Assess utility of prototype fluorescent particle sensor as part of a sensor suite for hazard detection and identification.

FY 2002 Planned Program (Continued)

- Research and test interim weather nowcast capability that can integrate ground-truth weather observations from non-conventional meteorological sensors such as Unmanned Aerial Vehicles (UAV), surface observations, and robotic sensors, with the current long-term forecasts generated at higher echelons to provide full spectrum weather support to the Army's Objective Force.

- Prepare distributed weather client applications for push/pull of forecasts and weather impact decision aids to lower echelons of the Objective Force, including Brigade Combat Weather Teams and soldier level interactive displays.

• 1500 - This one year Congressional add (Project H71) supports collaborative chemical and biological defense research. No additional funding is required to complete this project.

Total 7432

FY 2003 Planned Program

• 7145 - Integrate hyperspectral imaging with polarimetric imaging to aid in target signature analysis and target acquisition.

- Integrate the effects of a forested canopy on acoustic propagation into a battlefield decision aid.

- Implement advanced forecasting techniques for predicting critical target area meteorological (TAM) messages for test and evaluation.

- Implement a research version of the BFM that has software for ingesting data from meteorological satellites, UAV, and distributed ground based sensors.

- Research and test the capability to host the BFM on battlefield gun platforms, initialized with data from the non-hydrostatic model hosted on the MMS-Profiler to allow for fully autonomous artillery meteorological message generation during battle.

- Verify a new high resolution, short-range forecasting capability based on integrating new battlefield meteorological data sources into model initialization. Improved data initialization will directly impact nowcast accuracy's, especially over the target area, and provide much higher resolutions over the theater of operations.

- Integrate distributed weather client applications and database connectivity with the ABCS or other joint C4I systems identified for Future Combat Systems Command and Control "on the move".

- Incorporate a new generation of physics-based weather impact decision aids into Army tactical weather workstations, to include a forecast of optical turbulence effects on RSTA, signature management and improved forecasts of nighttime light pollution on detection using low light level devices.

FY 2003 Planned Program (Continued)

- Incorporate sets of weather algorithms that can be integrated into existing soldier and system embedded processors and that can use distributed processing to compute and replicate basic information for the individual soldier on current terrain and weather conditions, weather forecasts, weather warnings, heat stress, canteen use, and meteorological satellite imagery.

- Implement data assimilation techniques for incorporating data from chemical and biological sensors into nowcasting and hazard prediction models.

Total 7145

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T40	MOB/WPNS EFF TECH	15257	15638	19544	19884	20123	20962	22021

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 (TCP).

FY 2001 Accomplishments:

- 14257 - Matured analytical prediction methodology for forced-entry design criteria; evaluated protective concepts for base clusters and forward logistic nodes.

  - Selected analytic methodologies to provide lighter, more survivable protection by predicting down-axis ground shock from detonation partially in and below burster slab; completed dynamic experiments and analyses for enhanced survivability using square concrete structural components with intermediate span to thickness ratios; provided methods for retrofitting walls to resist terrorist mortars from asymmetric threats.

  - Completed Coastal Integrated Throughput Model Version II to include effects of nearshore bars, sea state, tidal changes, and validated improved, robust basin delineation computer sub-routines in a tactical planning exercise. Supported military exercise and real world evaluations of potential Joint Logistics Over The Shore (JLOTS) throughput and JLOTS sites.

  - Derived operational unit level movement algorithms for rapid, accurate and reliable representation of future force maneuver in Army models and simulations.

  - Advanced rapid construction, maintenance, and repair techniques and materials for roads and bridges to enable rapid force projection.

FY 2001 Accomplishments: (Continued)

- Incorporated realistic performance/damage concepts into the advanced pavement analysis model to ensure accurate and reliable damage assessments on airfields during rapid force projection.
- Tested and evaluated Computer Aided Earthmoving System for initial assessment of rapid airfield construction capability.
- Implemented military bridging (ribbon bridge) representation, smart munitions (Hornet) with basic acoustic signals and weather effects, basic object models for rapid building generation, and physics-based airblast damage algorithms for modeling and simulation (OneSAF Testbed Baseline).

• 1000 - Added capability to the vulnerability assessment software to predict damage from an asymmetric terrorist attack against earth and rockfill dams.

Total 15257

FY 2002 Planned Program

• 14647
- Provide ballistic and low-signature protection for base camps, increasing their survivability from weapons threats; provide software structure and building wizard for regional-specific material properties and construction practices suitable for vulnerability assessments.
- Provide validated techniques for lighter, more survivable protection by predicting ground shock and structure-media interaction; derive analytic methodology to predict ground shock range to effect from detonation in limestone; provide experimentally validated techniques to predict effectiveness of barrier walls in reducing airblast loads on structures from terrorist weapons; evaluate effectiveness of high-strength/high-density overlays in defeating attack by high-velocity kinetic energy rods; create procedures to assess the vulnerability of structures used by deployed forces and methods to reduce blast stand-off distances from terrorist weapons.
- Determine mobility performance requirements for advanced vehicle platforms such as FCS.
- Evaluate hydrology model for effect/assessment on maneuver/counter maneuver during rapid force projection in worldwide scenarios.
- Complete coastal throughput assessment for rapid force projection and sustainment operations for a particular theater of operations to include assessment of capabilities to meet force projection demands associated with the Army Transformation.
- Provide methods for evaluating the effects of weather on engineer effort in rapid repair/construction of roadways during future force projection and sustainment operation scenarios.
- Expand pavement design and analysis model for rapid, accurate and reliable prediction of airfield performance using current and future aircraft.

FY 2002 Planned Program (Continued)

- Assess materials and methods for rapid airfield construction that emphasize speed of construction and reliability of performance with a reduction in logistical tail during construction and maintenance of airfields.

- Create rapid airfield assessment technologies for determination of airfield capacity and performance predictions.

- Incorporate cross-beach Coastal Integrated Throughput Model into improved mobility models for accurate assessment of maneuver and throughput during rapid force projection and sustainment operations.

-Provide algorithms for rapid building generation, advanced vehicle platforms performance, and improve the representation of smart munitions effects in modeling and simulation.

• 991 - Incorporate damage prediction algorithms for remaining infrastructure components in vulnerability assessment software for protection of the selected critical infrastructure from asymmetric terrorist attacks.

Total 15638

FY 2003 Planned Program

• 19544 - Mature protective concepts for future theater missile defense systems used in transforming the force. Initiate evaluations of conceptual designs for survivability positions for dismounted forces in contingency environments.

- Draft input to the Tri-Service hardened design manual for increasing structure survivability by improved procedures for predicting ground shock due to detonations in or below burster slabs; gather experimental data defining ground shock, structure-media interaction, and structural damage for non ideal explosive detonations adjacent to reinforced-concrete walls.

- Create a basic 3D-modeling/viewing module for rapid bridge modeling system for improved situational awareness.

- Provide mobility risk analysis decision aids for FCS.

- Create hydrologic decision analysis capability for rapid in-theater maneuver assessment for the warfighter.

- Determine rapid force projection and sustainment requirements for future cross-beach operational scenarios.

- Provide digital reconnaissance applications to allow rapid remote main supply route assessments via TeleEngineering.

- Quantify maneuverability within urban environments on the future battlefield.

- Incorporate final Coastal Integrated Throughput Model into existing Military Hydrologic Models.

- Provide rapid in-theater performance model prediction capability for accurate and reliable assessment of airfields to enable rapid force projection.

FY 2003 Planned Program (Continued)

- Create rapid stabilization and surfacing techniques to enable rapid airfield construction and rapid force projection operations in all weather conditions.

- Provide a capability for rapid building generation with correlation of structural properties and a baseline representation of vehicle maneuverability within urban environments for modeling and simulation.

Total 19544

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T41	MIL FACILITIES ENG TEC	4131	4458	5303	5544	5870	5580	5751

A. Mission Description and Budget Item Justification: The objective of his project is to perform applied research necessary to delivery sustainable, cost efficient and effective facilities; and installation operations required to support the Objective Force. The project focuses on advanced technologies for the spectrum of facilities and operations directly supporting training, readiness, power projection, and forward basing. In addition, planned facility enhancements will achieve critically needed cost reduction in the Army facility life cycle process (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal), and the supporting installation operations. The improved facility quality resulting from this work will improve soldier quality of life and thereby enhance soldier retention. Technologies evolving from this work include composite rehabilitation materials, multi-hazard mitigation, electromagnetic shielding, concurrent engineering processes, 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 (TCP).

FY 2001 Accomplishments:

- 4131 - Completed development of an integrated corrosion control selection engineering process for determining use of corrosion control materials and technologies, and to minimize corrosion related Operations and Maintenance costs.
  - Formulated predictive service life tests and criteria for roofing membrane materials to minimize roofing maintenance and reroofing.
  - Created computable building model framework to support collaborative engineering planning and design to ensure integration of multiple and conflicting building requirement.

Total 4131

FY 2002 Planned Program

- 4458 - Complete seismic vulnerability evaluation guidance for building floor and roof elements in Army facilities for assessing compliance with current seismic criteria.

  - Formulate a prototype model for reliability based maintenance of Army infrastructure for maintenance planning and cost reduction.

  - Generate requirements driven military construction (MCA) facility models to ensure facilities meet Army Installation Transformation cost effectiveness goals.

  - Formulate mission/site specific algorithm for rapidly generating base camp facilities requirements and plans.

Total 4458

FY 2003 Planned Program

- 5303 - Generate analytical models and design guidance for seismic rehabilitation of reinforced concrete frames with masonry infill to comply with current seismic criteria.

  - Develop performance envelope for composite structural repair and upgrade materials for predicting long-term usage in maintaining and improving infrastructure.

  - Complete a unified data integration process that supports design and construction analyses to ensure mission responsive facilities.

  - Analyze lightweight, alternative construction materials for base camp logistics reduction.

  - Improve analysis of installation force projection performance for compliance with transformation criteria.

  - Provide improved guidance and procedures to increase the reliability of shielded construction designed to protect critical command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR) facilities against disruption or damage by electromagnetic (EM) threats.

Total 5303

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T42	COLD REGIONS ENGR TECH	5058	4889	4746	4856	5125	5240	5367

A. Mission Description and Budget Item Justification: This project is the only Department of Defense (DoD) applied research effort focused on the knowledge base and engineering principles for achieving Objective Force capabilities across seasonal conditions and in cold regions of the world. The Objective Force and Future Combat Systems (FCS) must have expert knowledge of the battlespace environment to obtain desired lethality, survivability and mobility. Advances in sensing and target acquisition capabilities critical to FCS require greater fidelity and more accurate forecasts of state of the terrain. Research provides the basis for extending the operability of the Objective Force in all seasons through application of physics-based models for predicting state of the terrain, and the effects of the environment on target and target background signatures. To achieve superior mobility and enable required strategic, operational, and tactical maneuver in all seasons, the Objective Force requires non-materiel advances in military engineering capabilities. Research provides for advances in planning and assessment tools, innovative construction materials, and techniques and procedures to reduce dependence on ports and airfields. 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 (TCP).

FY 2001 Accomplishments:

- 5058 - Characterized the geophysical properties at Yuma Proving Grounds Smart Weapons Test Range with geophysical testing techniques and ran corresponding computer simulations to verify accuracy of simulated seismic signal levels for non-moving impulsive loads.

  - Measured significant improvements to target detection and battle position selection by providing synthetic infrared scenes for warfighter preview.

  - Advanced thawed soil stabilization and winter concrete construction techniques for base camps and expedient roadways in austere/remote theaters.

  - Incorporated freeze-thaw theory into the 3D finite element pavement model in order to predict pavement performance during freeze-thaw periods.

  - Applied high fidelity vehicle dynamics modeling capability for development of seismic source signatures.

Total 5058

FY 2002 Planned Program

•	3889	- Use DoD high performance computing resources to perform a seismic simulation sensitivity study of ground vibrations propagating from armored vehicles moving over a variety of terrains and geologic settings. Use results of the study to verify accuracy of seismic simulations in comparison to field test results of moving tracked vehicles. - Establish feasibility of generating 3D dynamic multi-spectral synthetic scenes for mission planning, training, and weapon selection through the Digital Topographic Support System. - Establish feasibility of using Dynamic Terrain State models in a tactical setting, with tactical computing assets to support sensor performance and mobility predictions. This forms one set of tools for combat decision support using terrain reasoning. - Complete mechanistic model for pavement design and evaluation to prevent/alleviate frost heave and thaw weakening, thermal cracking, and cracking induced by structural loading during thaw periods. - Develop high fidelity model for prototype wheeled vehicle performance evaluation on a dynamic surface (alterable friction coefficients representing snow and ice conditions).
•	1000	- This one year Congressional add (Project T42) demonstrates and completes effort to improve base camp winter construction techniques and procedures. No additional funding is required to complete this project.
Total	4889	

FY 2003 Planned Program

•	4746	- Develop 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 Raptor-like seismic sensing arrays. - Formulate preliminary model that includes parameters of seasonal high amplitude background noise in a range of urban conditions as a baseline for acoustic detection algorithm development applicable to Objective Force unattended ground sensor requirements. - Fuse weather forecast and terrain reasoning products with thermal sensor performance modeling capability for enhanced battlefield terrain reasoning and awareness. - Complete ground and support assessments for strengthening indigenous soils during thaw periods for rapid all-season construction of theater airfields. - Develop high fidelity, high resolution, deformable all-season terrain database for input to concept vehicle dynamics simulations.
Total	4746	

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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
T45	ENERGY TEC APL MIL FAC	2752	2821	3448	3619	3828	4010	4109

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 proces ses 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 (TCP).

FY 2001 Accomplishments:

- 2752 - Completed technology maintenance process for improving energy system performance and efficiency.
  - Created a template and design practice for optimizing the selection of hybrid cooling systems.
  - Provided process energy and pollution reduction (PEPR) program with expert system capability to ensure enhanced life-cycle performance.

Total 2752

FY 2002 Planned Program

- 2821 - Determine the number and types of verification processes necessary to validate the full range of Army energy projects.
  - Generate prototype 'open system' direct digital control implementation concept for Heating Ventilation and Air Conditioning (HVAC) control systems to ensure common operating maintenance practices on all Army installations.

Total 2821

FY 2003 Planned Program

•	3448	- Establish air pressure leak management techniques for modernizing Army compressed air systems. - Investigate effective renewable and distributed energy technologies and compile recommendations for integration into a strategic energy plan that provides for a more diverse portfolio of energy supply options at Army installations.
Total	3448	