Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification										DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**Base FY 2011 Estimate**	**OCO FY 2011 Estimate**	**Total FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	58.671	60.779	79.189	0.000	79.189	77.608	75.650	72.876	70.159	0	574.121
855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*	14.952	15.414	17.056	0.000	17.056	18.106	19.086	19.462	19.846	Continuing	Continuing
H71: *Meteorological Research for Battle Command*	6.706	5.627	5.588	0.000	5.588	6.055	6.228	6.385	6.545	Continuing	Continuing
T40: *MOB/WPNS EFF TECH*	17.750	20.339	31.231	0.000	31.231	30.801	25.742	26.180	26.660	Continuing	Continuing
T41: *MIL FACILITIES ENG TEC*	4.417	4.381	16.949	0.000	16.949	14.199	16.040	12.122	8.206	Continuing	Continuing
T42: *Terrestrial Science Applied Research*	4.746	5.526	5.090	0.000	5.090	5.244	5.348	5.457	5.566	Continuing	Continuing
T45: *ENERGY TEC APL MIL FAC*	3.183	3.246	3.275	0.000	3.275	3.203	3.206	3.270	3.336	Continuing	Continuing
T48: *Center for Geosciences & Atmospheric Research*	1.595	2.984	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
T53: *Military Engineering Applied Research (CA)*	5.322	3.262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) provides military engineering technologies. Research is conducted that supports special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. 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 focus on: 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; facilities engineering including simulation of infrastructure capabilities for force projection, protection, and readiness; and geospatial research and engineering including terrain awareness. This research improves the efficiency and cost effectiveness of supporting the training/readiness/force projection missions in garrison and force sustainment missions in theaters of operation. Research is transitioned to PE 0603734A (Military Engineering Advanced Technology), PE 0603125A (Combating Terrorism, Technology Development), and to Project Managers (PM) such as PM Force Projection and Project Director, Combat Terrain Information Systems. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan. The work in this PE is being performed by the US Army Engineer Research and Development Center, Vicksburg, MS, and the Army Research Laboratory, Aberdeen Proving Ground, MD.

Exhibit R-2, PB 2011 Army RDT&E Budget Item Justification	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	58.810	54.818	55.905	0.000	55.905
Current President's Budget	58.671	60.779	79.189	0.000	79.189
Total Adjustments	-0.139	5.961	23.284	0.000	23.284
• Congressional General Reductions		-0.319			
• Congressional Directed Reductions					
• Congressional Rescissions		0.000			
• Congressional Adds		6.280			
• Congressional Directed Transfers					
• Reprogrammings	0.195	0.000			
• SBIR/STTR Transfer	-0.334	0.000			
• Adjustments to Budget Years	0.000	0.000	23.284	0.000	23.284

Change Summary Explanation

FY10 Congressionally directed increases.FY11 funding increase for Deployable Force Protection, Social/Cultural Behavior Research, Joint Integrated Base Defense, NORAD-NORTHCOM Surveillance Research, Materials Modeling

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT 855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*	14.952	15.414	17.056	0.000	17.056	18.106	19.086	19.462	19.846	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project provides novel and innovative technologies for managing, transforming, updating, improving, and disseminating extremely large volumes of terrain and weather effects data at, or near, real-time and dynamic analysis and reasoning of this data to enable future force command and control systems with superior knowledge of the battlespace terrain and environment. Work in this project significantly enhances the Army's spatial-temporal data analysis, management and dissemination capabilities. Work in this project includes developing logic and conceptual models to support Civil Military Operations (CMO), and examining unification of Geospatial Intelligence with environmental and emerging cultural geography information requirements associated with CMO extending geospational tools support to military decision making within stability operation environment. Weather and atmospheric data is provided for this project through the Army Research Laboratory efforts funded in PE 0601102A, project 52C and PE 0602784A, project H71. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.The work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.484	2.595	0.000	0.000	0.000
Terrestrial Data Generation: In FY09, modeled nanomaterial efficiency in identifying or illuminating items of interest using the Light Detection and Ranging (LIDAR) equation across various environmental conditions. In FY10, empirically test optical reporting, or signal emission in the presence of certain target molecules, of remote sensors. In FY11, research is conducted in task "Terrain Analysis for Signal and Signature Phenomenology." *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT 855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Data Generation and Management: In FY09, developed tools and techniques to improve the speed and accuracy to create orthophotos, which are aerial photos geometrically corrected for scale, and support change detection. In FY10, develop tools and techniques to exploit Buckeye, airborne and terrestrial Light detection and Ranging (LIDAR), and other sensor data, for bare earth digital elevation derivation, automated feature extraction, forest and tree canopy segmentation, and modeling extracted data into realistic three-dimensional representations. In FY11, research is conducted in task "Imagery and GeoData Sciences" and "Geospatial Infostructure & Framework." *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	5.899	5.786	0.000	0.000	0.000
Program #3	6.569	6.906	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT 855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Data Analysis: In FY09, developed battlefield geospatial reasoning tools for planning and analysis by Brigade Combat Teams that is accessible through Commercial Joint Mapping Toolkit which supports Battle Command systems. In FY10, evolve evidential reasoning model(s) from standalone to reachback services. In FY11 research is conducted in task "Geospatial Reasoning", "Geoenabled Battle Command" and "Geospatial Infostructure & Framework." *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Terrain Analysis for Signal and Signature Phenomenology In FY11, will matrix test Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) reporters, which are engineered materials that emit signals when triggered by a target molecule. Will conduct laboratory and field trials under real environmental conditions to optimizing reportor selection for incorporation into a nano-material tool kit. *FY 2009 Accomplishments:* FY 2009	0.000	0.000	3.517	0.000	3.517

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT 855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5 Imagery and GeoData Sciences: In FY11, will develop urban mapping tools and techniques including modeling complex buildings, roofs, building interiors, and subterranean features. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.000	2.514	0.000	2.514
Program #6	0.000	0.000	1.511	0.000	1.511

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT 855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Geospatial Reasoning: In FY11, will develop geospatially enabled decision support aids to meet uncertain adaptive threats and will develop techniques to increase the rate at which large volumes of geospatial data and products are disseminated. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #7 Geospatial Infostructure & Framework: In FY11 will incorporate weather effects and cultural feature analysis to support unmanned systems command and control. Will develop framework for describing elements of political, military, economic, social, infrastructure, and information domains and linking to temporal and spatial analysis. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.000	5.766	0.000	5.766

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT 855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #8 Geo-Enabled Battle Command: In FY11, will extend common geospatial architecture and services to support geospatial analysis tools and linkages to command and control for U.S. and coalition force applications. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.000	3.748	0.000	3.748
Program #9 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009	0.000	0.127	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT 855: *TOPOGRAPHICAL, IMAGE INTEL & SPACE*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	14.952	15.414	17.056	0.000	17.056

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT H71: *Meteorological Research for Battle Command*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
H71: *Meteorological Research for Battle Command*	6.706	5.627	5.588	0.000	5.588	6.055	6.228	6.385	6.545	Continuing	Continuing

A. Mission Description and Budget Item Justification

The objective of this project is to perform applied research for tactical weather and atmospheric effects algorithms, and for the integration into battlefield atmospheric environment information products. The Army's transformation plan to the future force requires capabilities for battlefield commanders to make decisions based on tactical weather technology and impacts. This weather intelligence data must not only be 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 Program Manager, Distributed Common Ground System-Army (DCGS-A), through support to the Project Manager for Target Identification and Meteorological Systems (PM-TIMS) for field artillery systems, and to the Department of Defense (DoD) weather and operations modeling community. It provides detailed model applications for various effects of the atmosphere on electro-optical and acoustic target detection, location, and identification. This project develops both physics-based decision aids and rule-based expert systems for assessing the impacts of weather on a very broad spectrum of friendly and threat weapons systems, sensors, platforms, and operations. The technology can be applied to mission planning, battlefield visualization, reconnaissance surveillance and target acquisition (RSTA); route planning to maximize stealth and efficiency; web enabled tactical decision aids, and modeling of environmental impacts for combat simulations and war games. This project supports the future Army through research and development of novel environmental methods and applications that support echelons at Brigade and below (down to the individual Soldier). Products include weather/ atmospheric impacts on Army systems and personnel, and an on-scene weather sensing and prediction capability. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.Work in this project is performed by the Army Research Laboratory (ARL) located at Adelphi, MD.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.544	2.259	2.188	0.000	2.188
Weather Modeling: Develop new high resolution, short-range forecasting capability and high resolution urban diagnostic modeling capability. In FY09, formulated new methods to use microscale model output for critical micro-unmanned aircraft system (UAS) flight parameters that can improve launch, operation, and recovery of UAS assets. Designed, and applied high resolution meteorological model improvements that account for fine scale structure in the urban boundary layer for an improved capability for predicting atmospheric effects. In FY10,					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT H71: *Meteorological Research for Battle Command*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
complete a dynamic weather data assimilation package for weather running estimate nowcast (WRE-N) and couple a diagnostic Microscale model such as 3D wind field (3DWF) to provide high resolution meteorological sources for weather products and applications. Improve the physics and computational accuracy of the 3DWF model by applying an immersed boundary approach and parameterization of unresolved turbulence to better model the effects of complex steep topography such as mountains and high-rise buildings in urban terrain. In FY11, will complete a full physics version of the WRE-N for Distributed Common Ground System-Army (DCGS-A) Nowcasting and verify the accuracy improvements in the 3DWF model achieved by applying an immersed boundary method for 3DWF with additional parameterizations of unresolved turbulence to improve the accuracy and increase the resolution of local flow modeling and weather parameter predictions in high resolution urban and complex terrain. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Weather Diagnostics: Measure critical value thresholds for weather impacts on systems for tactical decision aids. Devise technologies to improve environmental awareness and to enhance and protect autonomous and semi-autonomous systems.In FY09, collected urban acoustic signature data to support the development of an acoustic model predicting effects of urban structures on detection and avoidance. Explored machine-to-machine options for	2.100	1.697	1.721	0.000	1.721

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT H71: *Meteorological Research for Battle Command*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
autonomous flight control to eliminate need for the man-in-the-loop. Devised web-enabled decision aid capability for hosting on battlefield systems to enhance data availability in a net-centric environment. Integrated night-time illumination model improvements into Tri-Service Target Acquisition Weapons Software (TAWS) to improve prediction of target acquisition. Investigated bio-inspired technologies to protect small sensor platforms from environmental hazards, to aid in the location and navigation around hazards, and to locate sources based on environmental cues. Investigated use of ultrasonic detection and ranging technology to measure wind profiles to enhance sniper accuracy and to locate objects in low visibility. In FY10, integrate acoustic detection algorithms into the Aviation Weather Routing Tool (AWRT) and verify the light urban model effects (LUME) integrated into TAWS to extend the capability to environmental effects in applications. In FY11, will implement methods for optimizing aircraft routing in adverse weather conditions and integrate AWRT 4-D visualization, situational awareness tools, and weather decision support systems to improve the safety and efficiency of unmanned and manned aviation. Experimentally validate applications of wide band acoustic information processing to improve the characterization of local atmospheric parameters and to detect, locate and identify sources of emitted and reflected acoustic sources. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3	2.062	1.671	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT H71: *Meteorological Research for Battle Command*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Weather Prediction: Devise models to improve prediction of atmospheric conditions in urban and complex terrain that integrate high resolution boundary layer meteorological (MET) measurements. Verify high resolution boundary layer models with field measurements. In FY09, applied stable boundary layer research to improve existing high resolution boundary layer MET models. Delivered a database of detailed high resolution MET measurements including wind flow around a small set of buildings for verification and improvement of urban MET models. Devised an improved urban dust and smoke obscuration model (UDSOM) for electro-optical transmission effects of urban dust and smoke for use in infantry combat simulations. Simulated and evaluated use of a microscale wind model as an integrated part of the DCGS-A weather system. Devised and integrated a Doppler Light Detection and Ranging (LIDAR) analysis toolkit (DLAT) for semi-autonomous data assimilation/ processing. In FY10, complete/evaluate the DLAT for improving the effectiveness of real-time LIDAR data. Investigate receiver arrays for remote sensing LIDAR. Investigate two-wavelength laser induced fluorescence spectra of aerosols; analyze chem biol assays of aerosols to improve environmental monitoring. Perform sampling with novel aerosol sampling equipment and analyze coupled meteorological-sampler data in support of Warfighter health. Develop and evaluate a Local-Rapid Evaluation of Atmospheric Conditions (L-REAC) system to provide automated 24/7 detailed wind flow maps over installation and down to individual building scales by integrating local met and terrain data, forecasts and urban wind models to support installation and forward operating base force protection. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT H71: *Meteorological Research for Battle Command*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #4 Weather Prediction (continued):In FY11, will complete testing of coupled 3DWF and WRE-N for transition to DCGS-A Weather Services. Will employ active LIDAR with passive spectral sensing systems for environmental characterization; Will extend the L-REAC system to integrate airborne CBRN hazard models for rapid decision making for emergency execution of evacuation vs shelter in place and safe routing of emergency responders. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.000	1.679	0.000	1.679
Accomplishments/Planned Programs Subtotals	6.706	5.627	5.588	0.000	5.588

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT H71: *Meteorological Research for Battle Command*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T40: *MOB/WPNS EFF TECH*	17.750	20.339	31.231	0.000	31.231	30.801	25.742	26.180	26.660	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technologies for adaptive and expedient force protection across the range of military operations; overcoming battlespace gaps (such as cliffs, ravines and other natural obstacles) through prediction, definition, avoidance, or defeat of the gaps; for rapid port enhancement; scalable weapons effects; high-resolution representation of near-surface terrain and environment for use with sensor models for things such as target recognition and unmanned systems (UMS). This research supports development of the future force by providing physics-based representations of mobility, obstacle and barrier placement, survivability, and weapons effects in urban terrain modeling and simulation. Additionally, the project develops and assesses technologies that increase the survivability of critical assets from conventional and terrorist weapons, and maneuver support of deployed forces, while reducing their logistical footprint. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	6.979	8.298	10.645	0.000	10.645
Adaptive Protection: In FY09, designed and assessed protective systems and retrofits to defeat large caliber rockets, light artillery, and 50-caliber arms. Developed sensor/geophysical algorithms for disturbed material signatures to be utilized by sensors that detect buried objects. Commenced development of tunnel sensor fusion algorithms and real time analysis techniques for tunnel sensor performance assessment. Using the computational protection testbed, assessed expedient protection against artillery and missiles. In FY10, develop interim lightweight rapidly erected protective systems for use inside and outside base perimeters to defeat emerging weapons effects. Develop the capability to accurately predict vehicle loadings due to subsurface explosive detonations to increase the survivability of the current and future tactical wheeled vehicle fleet by providing protection with significant weight savings. In FY11, will produce a computational protection testbed for validated high-performance modeling to predict and evaluate protective material and system response to blast and ballistic loads. Will develop force protection technologies for use in remote outposts or in other expeditionary					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
modes, where there is little access to engineering equipment and explore options for use of organic materials in conjunction with light-weight, blast and penetration resistant composite materials and detection capabilities. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Austere Entry and Maneuver: In FY09, provided technical expertise to support Joint Capability Technology Demonstrations (JCTD) user evaluations and provide guidance and training to military units selected to test and evaluate the LMCS residuals. The residuals included an emplacement and recovery system, two sections of LMCS (approximately 100 feet), and the associated mooring system. In FY11, will initiate effort to provide material and modeling solutions that provide a logistics capability for austere entry and maneuver. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	7.854	0.000	1.036	0.000	1.036

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Scalable Weapons Effects: Future Force Breaching in MOUT: In FY09, determined blast effects from multi-output explosive and coupled reactive materials, penetration performance of novel weapons geometries, and numerical simulations of blast, fragmentation and structural target debris. In cooperation with Armament Research, Development and Engineering Center (ARDEC), developed and transitioned a lightweight, single-stage explosive wall breaching system to Project Manager Close Combat Systems (PM-CCS) for system development and demonstration. In FY10, demonstrate warhead technologies for rapid wall breaching (RWB) that can create a man-sized hole in a double-reinforced concrete wall in a single step, reducing time on target and enhancing Soldier survivability. Quantify damage to concrete, brick, and adobe walls due to prototype shoulder launched munitions impact. Complete evaluations of multi-phase low-to-high order detonation-blast effects against urban walls, conduct perforation tests against ultra-high strength concrete panels with current and advanced weapon designs, and characterize advanced materials. In FY11, will participate in the demonstrations of small, medium and large caliber scalable weapons against urban structure and bunker targets. Will utilize data to finalize prediction capabilities for the use of scalable weapons. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	1.707	5.107	4.203	0.000	4.203

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #4 Geospatial Research and Engineering Support: In FY09, developed bridging analysis tactical decision aid (TDA) for determining necessary bridging assets to conduct gap crossing and eliminate solutions, and will support geospatial battle management language (GEOBML) syntax in support of the Battlespace Terrain Reasoning and Awareness Battle Command (BTRA-BC) efforts. In FY10, complete development of a bridging analysis TDA for determining necessary bridging assets to conduct gap crossing and defeat solutions. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.210	0.461	0.000	0.000	0.000
Program #5 Near Surface Effects: This effort develops a physics-based, multiscale numerical testbed for virtual testing of unmanned systems (UMS) for intelligent autonomous navigation and tactical behaviors for sensors. In FY10,	0.000	6.444	7.683	0.000	7.683

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
provide sophisticated innovative physics models for disturbed soil phenomenology. Develop Joint Architecture for Unmanned Systems (JAUS) compliant components for performance evaluations during mission simulations in complex environmentally enriched models. In FY11, will provide novel automated target recognition algorithms for electro-optical (EO), infrared (IR), radar and multi-modal sensors. Will provide parameter estimation models to approximate terrain surface properties for false alarm reduction. Will integrate sensor perception of unmanned systems (UMS) interactions for intelligent navigation. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 NORAD-NORTHCOM Surveillance Research: In FY11 will demonstrate capability to image subsurface voids, or tunnels, up to thirty feet below surface, and work toward demonstration of integrated technologies and sensor fusion capabilities to characterize tunnel features, such as axes of approach and cross sections, and movement of contraband. *FY 2009 Accomplishments:* FY 2009	0.000	0.000	3.659	0.000	3.659

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #7 Joint Integrated Base Defense: This funding is intended to support the stand-up of a Joint Program Office with the purpose of achieving integration and interoperability among different sensor systems and suites used in bases and base camps, to include expeditionary and smaller base camps. This will improve situational awareness and effectiveness in base protection and will potentially reduce manpower requirements by fusing data and information on common displays. These sensor systems include systems such as the Base Expeditionary Targetting Surveillance System - Combined (BETSS-C), Counter Rockets, Artillery, and Mortars (CRAM), Entry Control Point (ECP), and others. These systems detect threat activity (e.g., persons, vehicles, incoming fires) out to several kilometers. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	0.000	0.000	4.005	0.000	4.005

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T40: *MOB/WPNS EFF TECH*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #8 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.029	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	17.750	20.339	31.231	0.000	31.231

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T41: *MIL FACILITIES ENG TEC*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T41: *MIL FACILITIES ENG TEC*	4.417	4.381	16.949	0.000	16.949	14.199	16.040	12.122	8.206	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project delivers sustainable, cost efficient and effective facilities and provides technologies and techniques for achieving resilient and sustainable installation and base operations. The project focuses on facilities and operations technologies directly supporting training, readiness, force projection, force protection, homeland security, and forward base operations. Facility enhancement technologies contribute to cost reductions in the Army facility life cycle process (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal), and the supporting installation operations. This work improves the ability of installations to support forces to meet transformation goals, improves designs for close battle training facilities, and enhances security of Soldiers, families, and civilians. Technologies evolving from this work include integrated planning and design tools for US facilities and forward bases, models predicting water dispersed contaminant effects on facilities and occupants; sustainable facility and base management; collaborative decision support tools; and advanced materials. In addition, technologies from this work will support analysis of socio-cultural and facility issues in forward base operations, including urban environments. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS. The work in deployable force protection is coordinated with the US Army Research Development and Engineering Command, the Defense Advanced Research Projects Agency (DARPA) and the Services.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.050	2.798	2.860	0.000	2.860
Facility Engineering: In FY09, developed and validated predictive models and algorithms for durability of fiber reinforced polymer (FRP) composites for facilities and equipment, based on mechanisms of deformation and degradation. Also, developed molecular polarity maps for contaminant compounds using computational chemistry models. Synthesized a 1-million psi carbon-nanotube (CNT)-based filament at the macro-scale. In FY10, conduct assessment of material enhancement using self healing technologies. Initiate micro-scale design of high-performance CNT-composite materials. In FY11, will conduct evaluations of multi-layered protective systems and protection decision/assessment tools.					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T41: *MIL FACILITIES ENG TEC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Facility Modeling and Simulation: In FY09, developed analysis and predictive capabilities to enable units to gain cultural competence relevant to their mission. Developed rate constants for uptake of contaminates on pipe wall\ based on results of the dynamic models using static representation of the contaminant alone. In FY10, develop a framework for integrated ontology for facility life-cycle model. Incorporate near real-time assessment of facility sustainment metrics for energy and water and expand model framework for net-centric regional management with emerging resiliency concepts. In FY11, will develop sensor fusion algorithms for facility life-cycle model. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base	2.367	1.574	1.333	0.000	1.333

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T41: *MIL FACILITIES ENG TEC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
OCO FY 2011 Plans: FY 2011 OCO					
Program #3 Socio-Cultural Modeling: In FY11, will develop models relating socio-cultural and cultural geographic factors to human, or population response or behaviors to inform decision making in Counter-Insurgency Operations, Stability and Support Operations, and nation building, Will develop means to identify dynamic signatures, or indicators, in the socio-cultural realm to assist in estimating or predicting behavioral response to operations. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.000	2.750	0.000	2.750
Program #4 Materials Modeling: In FY11 will build on foundational knowledge of nano- and macro-scale physical, chemical, and mechanical properties of materials as well as understanding of the fate of the materials once in the environment to research and develop designs that will scale well for production and manufacturing. The focus will be on composite materials with exceptional properties such as tensile strength and resistance to cracking and penetration. The goal is to increase performance and decrease volume and weight while keeping the environment safe. Work is coordinated with Nanotechnology/Fate and Effects effort in PE0602720A/Project 835.	0.000	0.000	1.006	0.000	1.006

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T41: *MIL FACILITIES ENG TEC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #5 Deployable Force Protection: In FY11 will develop integrated system constructs for base protection technologies in smaller bases that often operate in remote locations or are near/with local populations and have a less overt security posture. The integrated designs will include interoperable systems that are reliable, transportable by smaller vehicles or sling-load, use minimal power and energy, and have low manpower requirements for set-up and operation. Technologies pursued will address detection of threats, assessment of activities and signals, and passive and active defense capabilities. Will investigate means to increase sensor detection capabilities for layered defense of the operational environment, including electro-optical, infared, seismic and acoustic. Will develop designs for sustainable power and energy. Efforts support deployable force protection activities in PE 0603734A and 0603313A *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	0.000	0.000	9.000	0.000	9.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T41: *MIL FACILITIES ENG TEC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #6 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.009	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	4.417	4.381	16.949	0.000	16.949

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T41: *MIL FACILITIES ENG TEC*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T42: *Terrestrial Science Applied Research*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T42: *Terrestrial Science Applied Research*	4.746	5.526	5.090	0.000	5.090	5.244	5.348	5.457	5.566	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project will provide Warfighters with timely understanding of the physical environment's effect on personnel, platforms, sensors, and systems in order to develop improved tactics, techniques, procedures, and plans that ensure information superiority, situational awareness, and force projection. Specifically, this project seeks solutions for minimizing or eliminating the adverse effects of dynamically changing terrain states on sensing capabilities, engineer construction, and tactical maneuver 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 Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	2.744	1.773	1.426	0.000	1.426
Terrain State: In FY09, assessed the use of risk-based analyses in employing terrain-sensitive platforms and sensor mixes operating in harsh, complex environments with accompanying uncertainty about the physical environment. In FY10, develop algorithms to interpret local terrain characteristics from on-board vehicle sensors (tactile and stand-off) through real-time terrain characterization for on-board mission decision logic to assure the tactical mobility of manned and unmanned ground vehicles on complex terrain. In FY11, will design weather effects physical security sensor planning tool integrated with passive protection systems.					
FY 2009 Accomplishments: FY 2009					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T42: *Terrestrial Science Applied Research*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Signature Physics: In FY09, designed and evaluated sensor data fusion aids based on predicted environmental effects for incorporation into geo-precise software tools; and implement infrared and acoustic sensor performance algorithms. In FY10, build geo-precise software tools incorporating awareness about the physical environment (known and unknown) to optimize sensor emplacement and selection of sensor asset mixes. In FY11, will define normal and anomalous sensor data features (statistical properties) as a function of the geospatial and socio-cultural context; will leverage the Warfighter's understanding of important features and contextual cues; and will develop street-level simulation of sensor data across a wide range of modalities and urban terrain contexts to develop signal propagation rules for fusion and anomaly recognition. Will develop re-usable, object-oriented, software tools for cross-modality sensor performance modeling, high-level fusion including operational environment context, and emplacement recommendations that can be readily incorporated into Army command and control and terrain analysis systems. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010	2.002	3.724	3.664	0.000	3.664

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T42: *Terrestrial Science Applied Research*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Base FY 2011 Plans: FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.029	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	4.746	5.526	5.090	0.000	5.090

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T42: *Terrestrial Science Applied Research*

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T45: *ENERGY TEC APL MIL FAC*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T45: *ENERGY TEC APL MIL FAC*	3.183	3.246	3.275	0.000	3.275	3.203	3.206	3.270	3.336	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project will provide technologies necessary for secure, energy efficient, sustainable military installations, emphasizing energy and utility systems protection in response to evolving needs. Energy technologies and processes are also applied to the Army's industrial base to maintain its cost-effective readiness for munitions production, training, and in the theater of operations to reduce logistical footprint. Provide technologies to protect facility indoor air quality from contaminants such as mold, bacteria and viruses in work and living spaces. Develop methods to optimize sustainable energy generation and use including integration of renewable energy resources and approaches for the reduction of carbon footprint. In addition, technologies from this work provide a better understanding of critical infrastructure interdependicies. The cited work is consistent with the Director, Defense Research and Engineering Strategic Plan, the Army Modernization Strategy, and the Army Science and Technology Master Plan.Work in this project is performed by the US Army Engineer Research and Development Center (ERDC), Vicksburg, MS.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	3.183	2.440	1.701	0.000	1.701
Systems Response to Threats: In FY09, evaluated and tested simulation algorithms based on failure modes and mechanistic models under interactive conditions. Developed nanotechnology based detection and identification of targeted multiple contaminants in near-real-time for detect-to-warn sensing in mission critical facilities. In FY10, predict nanosensing complex stability under long term storage conditions that involve evaluating the stability of fluorescent nanoparticles, conjugated with antibodies, at various temperatures and in different environments. In FY11, will evaluate sensing ability with encapsulation and re-suspension after freeze drying to assess improving the stability of the complex using chemical preservatives and encapsulation with silica.					
FY 2009 Accomplishments: FY 2009					

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T45: *ENERGY TEC APL MIL FAC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2010 Plans: FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #2 Installation Modeling and Simulation: In FY10, initiate development of parametric models of most effective energy measures for high demand Army facilities and initiate algorithms to identify high value clusters of facilities with complementary spatial, thermal, hydraulic, and electric power characteristics to provide enterprise solutions for Army Installations future energy efficiency requirements.In FY11 will develop a computational framework for non-linear network simulation to predict performance and optimize integration of installation energy systems. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	0.000	0.800	1.574	0.000	1.574

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T45: *ENERGY TEC APL MIL FAC*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #3	0.000	0.006	0.000	0.000	0.000
Small Business Innovative Research/Small Business Technology Transfer Programs *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	3.183	3.246	3.275	0.000	3.275

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T48: *Center for Geosciences & Atmospheric Research*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T48: *Center for Geosciences & Atmospheric Research*	1.595	2.984	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Geosciences/Atmospheric Research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1	1.595	2.984	0.000	0.000	0.000
Geosciences/Atmospheric Research. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	1.595	2.984	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T48: *Center for Geosciences & Atmospheric Research*

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.

Exhibit R-2A, PB 2011 Army RDT&E Project Justification			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T53: *Military Engineering Applied Research (CA)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	Base FY 2011 Estimate	OCO FY 2011 Estimate	Total FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
T53: *Military Engineering Applied Research (CA)*	5.322	3.262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Military Engineering applied research.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #1 Airborne Threats. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	1.495	0.000	0.000	0.000	0.000
Program #2 Nano-Crystalline Cement for High Strength, Rapid Curing Concrete with Improved Blast Resistance. This is a Congressional Interest Item.	1.435	0.000	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T53: *Military Engineering Applied Research (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
FY 2009 Accomplishments: FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Program #3 Cellulose Nanocomposite Panels for Blast and Ballistic Protection. In FY09, this Congressional Interest Item investigated the feasibility of using bio-based nanocomposite materials to develop advanced structures for defense and infrastructure applications. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO	2.392	1.591	0.000	0.000	0.000

Exhibit R-2A, PB 2011 Army RDT&E Project Justification		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 2040: *Research, Development, Test & Evaluation, Army* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602784A: *MILITARY ENGINEERING TECHNOLOGY*	PROJECT T53: *Military Engineering Applied Research (CA)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	Base FY 2011	OCO FY 2011	Total FY 2011
Program #4	0.000	1.671	0.000	0.000	0.000
Environmentally Intelligent Moisture and Corrosion Control for Concrete. This is a Congressional Interest Item. *FY 2009 Accomplishments:* FY 2009 *FY 2010 Plans:* FY 2010 *Base FY 2011 Plans:* FY 2011 Base *OCO FY 2011 Plans:* FY 2011 OCO					
Accomplishments/Planned Programs Subtotals	5.322	3.262	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Performance metrics used in the preparation of this justification material may be found in the FY 2010 Army Performance Budget Justification Book, dated May 2010.