Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army											Date: February 2015	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2014**	**FY 2015**	**FY 2016 Base**	**FY 2016 OCO**	**FY 2016 Total**	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**Cost To Complete**	**Total Cost**
Total Program Element	-	69.192	67.302	63.409	-	63.409	67.350	70.520	75.422	76.878	-	-
855: *Topographical, Image Intel & Space*	-	17.530	15.476	16.116	-	16.116	17.555	18.367	18.498	18.859	-	-
H71: *Meteorological Research For Battle Command*	-	6.349	6.459	6.455	-	6.455	6.476	6.590	6.632	6.762	-	-
T40: *Mob/Wpns Eff Tech*	-	30.743	27.102	26.514	-	26.514	28.142	29.830	34.462	35.139	-	-
T41: *Mil Facilities Eng Tec*	-	6.251	5.641	5.845	-	5.845	6.216	6.437	6.477	6.593	-	-
T42: *Terrestrial Science Applied Research*	-	5.106	5.203	5.158	-	5.158	5.152	5.343	5.377	5.482	-	-
T45: *Energy Tec Apl Mil Fac*	-	3.213	3.421	3.321	-	3.321	3.809	3.953	3.976	4.043	-	-
T53: *Military Engineering Applied Research (CA)*	-	-	4.000	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

This program element (PE) investigates, evaluates, and advances technologies, techniques and tools for depiction and representation of the physical and human environment for use in military planning and operations; for characterizing geospatial, atmospheric and weather conditions and impacts on systems and military missions; for conducting mobility, counter-mobility, survivability and force protection; and for enabling secure, sustainable, energy efficient facilities. Research focuses on special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Project 855 conducts geospatial research and development supporting a standard sharable geospatial foundation enabling a common operating environment across mission and command systems. Project H71 supports the materiel development, testing, and operations communities in evaluating the impacts of weather and atmospheric obscurants on military materiel and operations. Project T40 advances technologies for adaptive and expedient force protection across the range of military operations (includes Deployable Force Protection). This project also designs and evaluates software and hardware to identify and mitigate positive and negative ground obstacles; characterizes austere navigation environments and designs/evaluates materiel solutions including rapidly emplacable bridging, ground stabilization and breakwater structures; and builds and uses modeling and simulation tools to advance understanding of the interactions of weapons/munitions and novel defeat methodologies with buildings, shelters, bunkers, berms and bridges. Project T41 investigates and evaluates application of technologies to enable garrison/post commanders to plan, monitor and operate facilities more efficiently, cost-effectively, securely and sustainably; and creates tools (including advanced models and simulation) that provide a framework for making trades and decisions, and also supports research to evaluate non-combat population characteristics and status from social and cultural perspectives to achieve mission objectives. Project T42 develops and validates models and simulations to understand the impacts of the physical environment on the performance of forces, ground and air vehicles, and sensors; as well as the impact of natural and man-made changes in the environment on military operations. Project T45 investigates and evaluates materials, components and systems that have potential to reduce energy losses in buildings and shelters; and potential to detect and mitigate consequences of contaminants such as bacteria and molds in air handling equipment and building materials.

Exhibit R-2, RDT&E Budget Item Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*	

The cited work is consistent with the Assistant Secretary of Defense, Research Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Research is transitioned to PE 0603734A (Military Engineering Advanced Technology) and PE 0603125A (Combating Terrorism, Technology Development).

Work in this PE is led, managed or performed by the U.S. Army Engineer Research and Development Center, Vicksburg, MS, and the Army Research Laboratory, Aberdeen Proving Ground, MD. Deployable force protection activities are coordinated with research, development and engineering centers and laboratories across the US Army, Navy and Air Force.

B. Program Change Summary ($ in Millions)	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total
Previous President's Budget	70.027	63.311	62.757	-	62.757
Current President's Budget	69.192	67.302	63.409	-	63.409
Total Adjustments	-0.835	3.991	0.652	-	0.652
• Congressional General Reductions	-	-0.009			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	4.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-0.835	-	0.652	-	0.652

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2014	FY 2015
Project: T53: *Military Engineering Applied Research (CA)*		
Congressional Add: *Program Increase*	-	4.000
Congressional Add Subtotals for Project: T53	-	4.000
Congressional Add Totals for all Projects	-	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army										Date: February 2015	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*						**Project (Number/Name)** 855 *I Topographical, Image Intel & Space*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
855: *Topographical, Image Intel & Space*	-	17.530	15.476	16.116	-	16.116	17.555	18.367	18.498	18.859	-	-

Note
Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates and advances capabilities for collection, processing, and creation of data and information depicting physical and human terrain, environmental conditions, and relationships in time and space; for digital map creation, transmission, and dissemination; and for map-based analytics for planning, decision making and execution. This project uses non-traditional methods that exploit existing open source text, multi-media and cartographic materials addressing social, cultural and economic geography to advance the capability to produce and transmit high fidelity digital maps depicting the physical terrain, human terrain and environmental conditions. This project also develops software tools and methods for map-based analytics that allow deeper insights into the effects of the physical terrain, human terrain and environmental conditions on military operations, to include tactics and effects upon equipment and Soldier's performance. This project explores and advances components and methods that optimize the utility of the Army Geospatial Enterprise (AGE) to the total Army which provides map and geospatial data, information, and software services to the total force.

Work in this project supports the Army S&T Command, Control, Communications and Intelligence (C3I) Portfolio.

Work in this project complements efforts in PE 0602784A, Project H71.

The cited work is consistent with the Assistant Secretary of Defense, Research Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

The work in this project is performed by the U.S. Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Terrain Analysis for Signal and Sensor Phenomenology	3.704	2.608	2.248
Description: This effort develops means to collect, process, and visualize very high-fidelity data and information to capture the dynamic effects of the physical and human terrain impacting military ground operations. The research focuses on tactical, rather than national or commercial, remote sensing of physical terrain to achieve the fidelity required for current and future operations. Research includes methods for radical, effective sensor systems and materials to 'tag' features, items and people of interest;			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		**Date:** February 2015
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*	**Project (Number/Name)** 855 *I Topographical, Image Intel & Space*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
these capabilities are based upon novel and emerging light detection and ranging (LiDAR) sensor systems and an array of other sensor systems for intermittent and persistent optimal data collection, object identification, and classification for ground operations. *FY 2014 Accomplishments:* Investigated LiDAR detectable, engineered optical materials to perform adversary tagging, physical location, disturbance, and tracking for area and point operations; investigated uncertainties associated with bio-affected sensors and sensing modalities (i.e., time-varying, and terrain-varying conditions) to enhance capabilities for target of interest identification in high clutter environments; developed geospatial display layers for digital maps that depict sensor performance and associated sensor uncertainties. Conducted research and experiments to develop standoff detection and early warning capability of threats to critical infrastructure in extreme environments using innovative fiber optic sensing technology. *FY 2015 Plans:* Develop advanced collection and processing strategies for the exploitation and visualization of high-fidelity, persistent remote sensing technologies (e.g., LiDAR, Hyperspectral imaging) for the generation of geospatial foundation data, rapid detection of change, dynamic terrain characterization, object identification and tracking to support ground operations, surveillance, and force protection. *FY 2016 Plans:* Will develop initial algorithms to exploit 3D terrain data using hyper-spectral data sources; Will analyze existing algorithms for tactical terrestrial remote sensing capabilities to enhance geospatial 3D data for expanded awareness in the area of interest (AOI).			
Title: Imagery and GeoData Sciences *Description:* This effort advances map creation and content through both conventional and non-traditional methods. This research exploits existing open source text, leverages multi-media and cartographic materials, and investigates data collection methods to ingest geospatial data directly from soldiers (i.e., crowd sourcing) to characterize parameters of social, cultural and economic geography. Results of this research augment existing conventional geospatial datasets by providing the rich context of the human dimension which offers a holistic view of the operational environment for the Warfighters. *FY 2014 Accomplishments:* Continued development of remote sensing capabilities to support multi-agency efforts in remote illicit crop monitoring; developed and integrated cultural mapping into military geospatial narratives; developed visualization and analysis tools for user generated content and volunteered geographic information to support ongoing collaboration with partners. *FY 2015 Plans:* Develop methods to process and quantify relationships in typically non-exploitable data (i.e., social media and open source data) of a highly qualitative and unstructured nature. Efforts will add novel context to conventional quantitative data sources	3.563	2.438	4.970

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015	
Appropriation/Budget Activity 2040 I 2		R-1 Program Element (Number/Name) PE 0602784A I *Military Engineering Technology*	Project (Number/Name) 855 I *Topographical, Image Intel & Space*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
and information, thereby providing increased awareness and surveillance of both the human and physical dimensions. Develop automated workflows to provision high-resolution imagery and geodata to mobile, dismounted devices for mission command platforms in mounted and mobile computing environments. Develop open geospatial techniques to process and transform massive datasets rapidly and accurately into usable knowledge that will be sharable across the Army Geospatial Enterprise enabling a common situational understanding through a standard, shareable geospatial foundation. *FY 2016 Plans:* Will investigate and develop geospatial analysis tools leveraging authoritative DoD databases to support military planning; Will develop methods to efficiently query databases in multiple Computing Environments to produce geospatial overlays depicting elements of sociocultural behavior; Will research methods allowing Army planners to exploit the Standard, Shareable, Geospatial Foundation (SSGF) data and services to provide a common geospatial framework for commanders and their staff.			
Title: Geospatial Reasoning *Description:* This effort develops and evaluates software analysis tools and methods to provide impact and context of the effects of the physical terrain, human terrain and environmental conditions on military operations. This analysis examines and models these effects upon unit tactics, equipment and Soldiers' performance. *FY 2014 Accomplishments:* Designed and developed the framework for a common scalable architecture to deploy geospatial, geo-environmental, and social-cultural data, in the form of analytics and tools, through the Army Geospatial Enterprise. Developed geospatial operational risk zone analytics based on insurgent activity, terrain attributes, mission, and environmental influences; incorporated real-time feedback on integrated sensor performance and effectiveness for enhanced mission planning. *FY 2015 Plans:* Develop methods for super-resolution data processing (i.e., imagery, Light Detection and Ranging, Hyperspectral, multispectral), and algorithms to exploit this data. This research will be specific to challenges faced by small units in urban environments that can be addressed through high-fidelity geospatial data. Will initiate development for a geo-environmental framework to analyze and predict weather, model and observe terrestrial and environmental data, and geospatial information into a risk-based ensemble system to support predictive battlespace preparation. *FY 2016 Plans:* Will begin development on methods to deliver and integrate novel geospatial products using open standards and formats into the Army Geospatial Enterprise (AGE); Will begin research on information fusion to evaluate accuracy and relevance of dynamic terrain information layers that support the military decision making process; Will initiate methods to leverage and develop open source Light Detection and Ranging (LIDAR) processing capabilities to enhance feature classification and sensor exploitation. Will begin development of stand-off soil moisture assessments and comparisons to further assist real-time mapping of moisture levels,	4.703	5.958	6.082

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 I 2	R-1 Program Element (Number/Name) PE 0602784A I *Military Engineering Technology*	Project (Number/Name) 855 I *Topographical, Image Intel & Space*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
assisting in mobility forecasts. Will begin research on information fusion to evaluate accuracy and relevance of dynamic terrain information layers that support the military decision making process.			
Title: Geospatial and Temporal Information Structure and Framework	5.560	4.472	2.816
Description: This effort designs and evaluates geospatial data and information architecture to ensure content and representation of data and actionable geospatial information for operational decision making. Research advances here allow for the automatic inference and correlation between events and objects (i.e. people, places) through space and time from massive datasets. Success in meeting these objectives advances the Army's ability to network the force to achieve information dominance. *FY 2014 Accomplishments:* Conducted research to integrate geo-environmental and socio-cultural information at the tactical edge; generated geospatial information that defines aggregate constructs of spatial and structural data key to Civil Military Operations (CMO); identified and built relational networks to define the interactive complexity between geospatial structures and actor/event and outcome dynamics. Initiated design for a data and query model, and system architecture capable of ingesting, processing, storing, and searching high volume and velocity multi-modal, multi-scale geospatial data. *FY 2015 Plans:* Develop algorithms and methods to automatically create narratives in a geospatial format by inferring connections, relating events, times, locations, and actors; this effort facilitates the existing laborious and manual process of correlating such objects, and serves to automate the discovery of information in a geospatial context. Investigate the unique capability to characterize sub-national populations, environmental degradation, and risks to security in complex operational environments based on accessible pre-conflict data. *FY 2016 Plans:* Will develop data mining algorithms to support discovery of relevant information and patterns contained within large, multi-modal, and multi-scale spatially and temporally referenced datasets; Will explore new exploitation techniques and algorithms to characterize the urban operational environment and develop geospatial products focused on hazardous terrain identification; Will enhance the capability to capture and visualize dynamic spatio-temporal narratives that describe relationships of people, events, and geographic locations through time; Will develop the capability to characterize the relationship between environment and conflict through systems models that demonstrate the impacts of environmental conditions on stability. Will develop algorithms to incorporate sociocultural factors and data for more effective analysis of violent events.			
Accomplishments/Planned Programs Subtotals	17.530	15.476	16.116

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2016 Army		**Date:** February 2015
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*	**Project (Number/Name)** 855 *I Topographical, Image Intel & Space*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army											Date: February 2015	
Appropriation/Budget Activity 2040 I 2				**R-1 Program Element (Number/Name)** PE 0602784A I Military Engineering Technology						**Project (Number/Name)** H71 I Meteorological Research For Battle Command			

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
H71: *Meteorological Research For Battle Command*	-	6.349	6.459	6.455	-	6.455	6.476	6.590	6.632	6.762	-	-

Note
Not applicable for this item.

A. Mission Description and Budget Item Justification
This project develops tactical weather and atmospheric effects/impacts algorithms for their integration into battlefield information products. Efforts include high-resolution, local assessments and forecasts of meteorological conditions in near real time including effects of urban and mountainous terrain; analytical tools to assess the impact of the atmosphere to optimize system performance and operations planning and advanced atmospheric sensing applications to characterize and mitigate wind and turbulence in complex terrain. 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 decision support systems for assessing the impacts of weather/atmosphere across a spectrum of friendly and threat weapons systems, sensors, platforms, and operations. Information can be applied to mission planning and execution, battlefield visualization, reconnaissance surveillance and target acquisition, route planning to maximize stealth and efficiency, web enabled tactical decision aids, and also modeling of environmental impacts for combat simulations and war games.

This project supports the Army S&T Command, Control, Communications and Intelligence (C3I) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

This work transitions technologies to the Department of Defense weather and operations modeling community, the US Air Force Weather Agency to improve their operational weather support to the Army PM-MaTIC (PM-Meteorological and Target Identification Capabilities) and Marine Corps Systems Command (MCSC) for field artillery systems, the Project Manager, Distributed Common Ground System-Army (DCGS-A), the Joint Improvised Explosive Device (IED) Defeat Organization, the Program Executive Office Aviation, and Tactical Airspace Integration System (TIAS).

Work in this project is performed by the U.S. Army Research Laboratory located at Adelphi, MD and White Sands Missile Range, NM.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Atmospheric Modeling *Description:* This effort develops high resolution, short-range forecasting, and high resolution atmospheric modeling capabilities for mountainous, urban, and forest complex terrain.	2.526	2.579	2.558

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015	
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602784A I *Military Engineering Technology*		**Project (Number/Name)** H71 I *Meteorological Research For Battle Command*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016**
FY 2014 Accomplishments: Investigated and verified the Atmospheric Boundary Layer Environment (ABLE) model that incorporates microscale wind, temperature, and moisture dynamics for more realistic and accurate prediction of turbulence, jets, convective eddies and gusts; investigate and verify the sub-kilometer Weather Running Estimate-Nowcast (WRE-N) (with tailored four-dimensional data assimilation) for complex terrain and implemented version to supply data for actionable weather impact decision aids; and evaluated modeling post-processing methods for enhancement of meteorological accuracy for artillery applications. *FY 2015 Plans:* Develop microscale (local) weather prediction model (ABLE) and mature the capability to implement this model in the mesoscale WRE-N model to provide and increase the reliability of microscale (local) weather forecasts; develop new techniques for using data from traditional and non-traditional weather sources (i.e., surface observations, radar, light detection and ranging (LIDAR)) to produce more accurate forecast model grids of Soldier-focused parameters (e.g., wind direction for improved plume dispersion in urban domains); and implement ABLE model capability for artillery target area domains. *FY 2016 Plans:* Will complete WRE-N accuracy assessments with applications to Army aviation, artillery, and dismounted operations; evaluate potential improvements to artillery firings by implementing three-dimensional forecast datasets into targeting solutions; develop a method in WRE-N that combines four-dimensional data assimilation (FDDA) and variational data assimilation methods to ingest remotely sensed indirect weather observations such as radar/LIDAR, global positional system (GPS) techniques, and satellite imagery or radiances; extend WRE-N's grid spacing resolution to hundreds of meters; and develop a method to assimilate doppler wind LIDAR data into the microscale model for more accurate predictions of wind fields in the atmospheric boundary layer over complex terrain.			
Title: Atmospheric Diagnostics *Description:* This effort develops diagnostic technologies and methods to improve the acquisition of environmental data such as temperature, humidity, wind speed and direction for use in decision aids that enhance and protect autonomous and semi-autonomous systems. *FY 2014 Accomplishments:* Investigated and evaluated electromagnetic, intelligent optical and acoustic remote sensing techniques and sensor performance models for the detection of adverse environmental conditions, individual targets and local and regional events to support Army Operations and Military Intelligence; developed anomaly image quality metrics for detecting areas of interest within optical images; investigated and evaluated a prototype dynamic passive optics aperture system for its ability to reduce short exposure turbulence	1.935	1.964	1.972

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015	
Appropriation/Budget Activity 2040 I 2		**R-1 Program Element (Number/Name)** PE 0602784A I *Military Engineering Technology*	**Project (Number/Name)** H71 I *Meteorological Research For Battle Command*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
blur as it captures images; and investigated mobile handheld technology applications that determine atmospheric impacts on Soldiers and autonomous systems to enhance mission effectiveness at the lowest echelons. *FY 2015 Plans:* Develop the Meteorological Sensor Array (MSA) at White Sands Missile Range, NM to collect highly-detailed meteorological field measurements for precise atmospheric characterization and weather forecast model verification; determine the performance effectiveness of dual-band (midwave infrared (MWIR) and long wavelength IR (LWIR)) thermal polarimetric imagers to discriminate camouflage under varying environmental conditions; conduct experiments to determine vulnerabilities of various camouflage materials when simultaneously exposed to dual-band thermal polarimetry; develop elevation and location correction algorithms to more accurately detect and track Unmanned Aircraft Systems (UASs) by acoustic arrays; and develop elevation correction due to atmospheric propagation for UAS tracking by acoustic arrays. *FY 2016 Plans:* Will design and develop MSA components that provide, non-standard sensing capabilities for the atmospheric boundary layer; and investigate developing an array at an alternate site in order to study atmospheric characteristics in different climatic/terrain regimes; and develop automated approaches to quality control, archiving, and ingest to microscale meteorological and turbulence models of MSA array data.			
Title: Atmospheric Prediction for Local Areas *Description:* This effort designs and evaluates software models and sensors to improve local characterization and prediction of atmospheric conditions in urban and complex terrain by directly integrating boundary layer meteorological (MET) measurements into high resolution models and decision aids and verifies these improvements with field measurements. *FY 2014 Accomplishments:* Investigated techniques for integrating forecast grids into weather impacts decision support tools (DSTs); and researched, developed, and verified impact enhancements to DSTs to improve the characterization of local atmospheric impacts and support source identification of aerosol particles. *FY 2015 Plans:* Research tactical network capabilities to identify the most efficient methods to transmit/receive weather data for mobile weather decision aid applications; mature techniques and algorithms for integrating forecast grids into weather DSTs and implement initial capabilities in those systems; continue research of underlying methodologies to develop and transition a DST that quantifies and displays friendly versus enemy system/operations performance due to weather-related impacts; develop a DST to exploit anomaly image quality metrics for detecting areas of interest within optical images; and research how weather affects human behavior and begin development of a threat personnel	1.888	1.916	1.925

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 I 2	R-1 Program Element (Number/Name) PE 0602784A I *Military Engineering Technology*	Project (Number/Name) H71 I *Meteorological Research For Battle Command*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
biometeorological impacts and insurgent/terrorist activities prediction system. This system will correlate existing or predicted weather conditions with possible insurgent/terrorist activities, such as improvised explosive device (IED) emplacement. *FY 2016 Plans:* Will prepare the ABLE microscale model for transition into the Distributed Common Ground Station-Army (DCGS-A) architecture; research and develop an initial capability to ingest and depict probabilistic forecast data into DCGS-A weather impacts DSTs; and mature automated algorithms and methods for the microscale model initial and boundary conditions using data from WRE-N mesoscale model results. The microscale and WRE-N now-casting model results (rapidly updated local short-term predictions) will be integrated with weather decision support tools for mission planning and execution.			
Accomplishments/Planned Programs Subtotals	6.349	6.459	6.455

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army										Date: February 2015	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*						**Project (Number/Name)** T40 *I Mob/Wpns Eff Tech*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
T40: *Mob/Wpns Eff Tech*	-	30.743	27.102	26.514	-	26.514	28.142	29.830	34.462	35.139	-	-

Note
Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates, evaluates, and creates technologies for adaptive and expedient force protection across the range of military operations; for force projection and maneuver, including austere port entry and overcoming battlespace gaps (such as cliffs, ravines, mudflats, shallow rivers, and other natural obstacles) through prediction, definition, avoidance, or defeat of the gaps; for scalable weapons effects; and for high-resolution representation of near-surface terrain and environment for use with sensor models for things such as target detection and unmanned ground systems (UGS) navigation. This research further provides physics-based representations of ground vehicle mobility, obstacle and barrier placement, survivability, and weapons effects in complex and urban terrain modeling and simulation. Work in this project increases the survivability of critical assets from conventional, unconventional, and emerging weapons attacks and enables maneuver support of deployed forces, while reducing their logistical footprint. This project supports Deployable force protection (DFP) efforts for overcoming critical capability gaps for protecting troops operating at smaller bases that are remote or integrated in with local communities.

Work in this project supports the Army S&T Ground Maneuver, and Command, Control, Communications and Intelligence (C3I), and Soldier Portfolios.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Engineer Research and Development Center, Vicksburg, MS. Deployable force protection activities are coordinated with research, development and engineering centers and laboratories across the US Army, Navy and Air Force.

B. Accomplishments/Planned Programs ($ in Millions)

	FY 2014	FY 2015	FY 2016
Title: Adaptive Protection	7.546	10.559	10.521

Description: This effort develops new analytical techniques, advanced materials, and integrated protection systems to support the protection of critical assets on the battlefield.

FY 2014 Accomplishments:
Developed capability to plan and construct a protected Combat Outpost (COP) or Patrol Base (PB) in 30 days with integrated protective construction, sensing and active defense capabilities; developed a baseline COP construction handbook and decision support tools for planning of overall basing architecture that integrates force protection and basing functions; developed planning

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / *Military Engineering Technology*		Project (Number/Name) T40 / *Mob/Wpns Eff Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
tools for the complete lifecycle of the COP; completed development of modeling and simulation capabilities for comprehensive mine and improvised explosive device (IED) blast loads for vehicle occupant threats. *FY 2015 Plans:* Develop technologies to determine vulnerability of critical facilities and assess degradation to operational capability; develop protective measures that use indigenous materials and on-site production capability; provide integrated protection planning tools that include pre-deployment, construction, operations, and relocation. *FY 2016 Plans:* Will develop rapidly emplaced force protection technologies and survivability and planning tools that will lead to decreased required Soldiers needed for construction of COP/PB. Will develop force protection technologies to mitigate lethality of advanced threats in order to increase survivability of personnel, critical assets, and fixed facilities. Will develop/improve Modeling and Simulation (M&S) capabilities to rapidly and comprehensively model the blast from a wide range of recent and emerging non-ideal homemade explosives (HME) in a variety of soil types and conditions.			
Title: Austere Entry and Maneuver *Description:* This effort investigates, designs, and creates tools and technologies that address theater access, tactical logistics resupply, and tactical maneuver of small units. *FY 2014 Accomplishments:* Developed the capability to numerically simulate complex, impulsive, fixed and moving infrasound, which are very low frequency sound waves, sources for regional assessment of strategic infrastructure and assets; created a high-performance computational testbed (CTB) for dismounted operations including simulations of potential offloading platforms as well as soldiers in the 9-man squad; provided a rapid remote port assessment capability for improving Force Projection in expeditionary environments; provided improved bridging materiel solutions for spanning gaps (wet or dry) that can impede critical operations; developed advanced force projection technologies for landing zones and port construction in areas of Anti-Access/Area Denied. *FY 2015 Plans:* Develop technologies to rapidly and remotely assess the conditions of potential airfields and ports to support operational movement and maneuver in austere/denied locations using space-based/underwater operational remote sensors. Develop simulation capability to enable rapid remote assessment of real-time structural capacity of infrastructure (airfields, ports, roads), river, estuary, and near shore. *FY 2016 Plans:* Will develop computational testbed applications to simulate the influence of dynamic environmental effects created by vehicles and humans on sensor-based perception. Will complete modeling of dismounted operations and continue to develop the	11.269	13.900	12.760

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*	**Project (Number/Name)** T40 *I Mob/Wpns Eff Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
distribution management tool and provide systems integration to simulate the entire logistics distribution network. Will complete development of the capability to numerically simulate infrasonic sources for regional assessment of infrastructures. Will refine radar evaluation of airports/seaports of debarkation and reduced order modeling for austere entry assessment.			
Title: Environmental Impacts on Sensor Performance	1.923	1.479	2.000
Description: This effort investigates, designs, and creates physics-based, multiscale numerical models of the geo-environment and synthetic environments representing geo-environment impacts on various sensor modalities and systems. These enable such things as development of sensors and sensor algorithms for object or target detection, for sensor-target pairing, and for intelligent autonomous navigation and tactical behaviors in unmanned ground systems. This effort further investigates, designs, and fabricates non-line-of-sight and beyond- line-of-sight sensing in remote areas, including optimizing coupling of sensors to soil for understanding surface and subsurface activities. This effort supports persistent surveillance and detection capabilities. **FY 2014 Accomplishments:** Provided system performance optimization of linear sensors for austere deployment environments; developed a sensor model response for tracking of human and vehicular stimuli with 3-dimensional seismic source models; developed high fidelity excitation models of these linear sensors; quantified coupling scenarios for unique geo-environments. **FY 2015 Plans:** Validate three-dimensional source models of human and vehicular traffic in complex environments to determine transduction mechanisms of linear sensors; and develop physics-based model of linear sensor excitation by high-fidelity viscoelastic and discrete element methods. **FY 2016 Plans:** Will develop high performance computing (HPC)-enabled models that simulate the geo-environmental impact on performance of multi-modal imaging sensor combinations for threat scenarios. Develop three-dimensional, integrated surface evaporation/condensation algorithms for ground and vegetated surfaces and validate with ground truth characterization of the hydrodynamic and thermal processes in dense rainforest environments.			
Title: Deployable Force Protection	8.900	-	-
Description: This effort researches, designs, and creates rapidly deployable detection, assessment, passive protection and active defensive technology-enabled capabilities to meet critical capability gaps for troops operating remotely at smaller bases or integrated with local communities. The needs at these smaller bases (less than 300 persons, not all U.S. troops) are unique based on constraints in transportability, manpower, organic resources, lack of hardening of structures, resupply, and training for example. Moreover, lack of interoperability and scalability consume manpower and take away from time needed to perform missions. Threats include bases being overrun by hostiles; direct fire; rockets, artillery and mortars; and improvised explosive			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 I 2	R-1 Program Element (Number/Name) PE 0602784A I *Military Engineering Technology*	Project (Number/Name) T40 I *Mob/Wpns Eff Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
devices. Force protection challenges at these remote, smaller bases include providing increased standoff detection, blast and ballistic protection, and kinetic technologies subject to the constraints mentioned above. This work is coordinated with PE 0603784A/T08, PE 0603125A/DF5, PE 0603313A/G03 and PE 0602786A. Work is performed by Army, Navy and Air Force labs and centers. ***FY 2014 Accomplishments:*** Completed research and development on selected materials and system designs for rapidly erectable or constructed personnel protective systems to decrease logistics (e.g., weight, set up time), increase transportability, and increase protection levels for the next-generation systems; developed non-lethal stand-off enforcement technologies and conducted analysis to assess suitability for employment at small base entry control points; developed second-generation, low-logistics structural components for exterior and interior protection of indigenous structures; research and development on promising technologies and systems approaches that detect, assess, and accurately locate threats in non-line-of sight and complex environments and will decrease size, weight, and power requirements. User assessment and feedback gathered from deployable force protection experiments were used to improve technical performance, logistics, and user factors associated with deployable force protection for the activities described above.			
Title: Materials Modeling ***Description:*** This effort investigates and leverages physics-based computational models and laboratory experiments to understand the relationships between the chemical and micro-structural composition of material and performance characteristics when used in protecting facilities. ***FY 2014 Accomplishments:*** Created a first version of a computational testbed to simulate materials at the nanometer scale using a combination of the Discrete Element Method coupled with continuum analyses. ***FY 2015 Plans:*** Develop and enhance the fidelity and efficiency of multi-scale predictive design tools to incorporate materials by design principles for development of enhanced protective structures; develop and integrate novel multiscale reinforced cementitious materials and components of protective structures; develop additive manufacturing methodologies to facilitate and optimize multi-scale reinforcement augmentation to tailor performance, facilitate manufacture and construction and accelerate transition of this technology to the warfighter. ***FY 2016 Plans:*** Will enhance materials by design of cementitious and polymer composite protective materials through the continued development and validation of multi-scale predictive design tools; will develop methods to control bonds between reinforcement and	1.105	1.164	1.233

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / Military Engineering Technology	Project (Number/Name) T40 / Mob/Wpns Eff Tech

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
cementitious matrices at multiple scales to optimize composite performance; will integrate novel processing and additive manufacturing methodologies into material system design and fabrication methods to support the maturation of advanced protective solutions.			
Accomplishments/Planned Programs Subtotals	30.743	27.102	26.514

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

E. Performance Metrics

 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army										Date: February 2015	

Appropriation/Budget Activity 2040 / 2				R-1 Program Element (Number/Name) PE 0602784A / Military Engineering Technology						Project (Number/Name) T41 / Mil Facilities Eng Tec	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
T41: Mil Facilities Eng Tec	-	6.251	5.641	5.845	-	5.845	6.216	6.437	6.477	6.593	-	-

Note

Not applicable for this item

A. Mission Description and Budget Item Justification

This project investigates and evaluates technologies and techniques to ensure sustainable, cost efficient and effective facilities and to achieve 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.

Work in this project supports the Army S&T Innovation Enablers (formerly Enduring Technologies) and Command, Control, Communications and Intelligence (C3I) Portfolios.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Adaptive and Resilient Installations	3.357	3.094	3.122
Description: This effort develops sustainable, cost efficient and effective facilities; and provides technologies and techniques for achieving resilient and sustainable installation and base operations. **FY 2014 Accomplishments:**			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / *Military Engineering Technology*	Project (Number/Name) T41 / *Mil Facilities Eng Tec*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Developed and integrated sustainment, restoration and modernization decision models to support planning and analysis of high performance buildings; developed and validated adaptive system algorithms and relationships, and models for power, water, waste and protection to reflect the dynamics at forward operating bases. *FY 2015 Plans:* Complete sustainment, restoration and modernization decision models that provide installation managers with information necessary to identify actionable operations and investment opportunities to lower energy usage while maintaining mission functionality, thereby reducing facility lifecycle costs; Complete integrated modeling capability building on the Net Zero Energy Framework to support Installation planning for energy, water, and waste resource optimization. *FY 2016 Plans:* Will research the necessary mixture design and admixtures requisite to allow additive construction using cementitious materials across the broadest possible locations and operating environments. Will include determining the correct formulations to adapt locally available cementitious materials to required rheology, curing time, and strength for automated additive construction of expeditionary structures. Will also determine the serviceability of other native material (such as soils, clay sand mixtures like adobe) for use as extrudable building materials.			
Title: Social/Cultural Behavior *Description:* This effort provides technologies which support analysis of socio-cultural and facility issues in forward base operations, including urban environments. Technology development efforts will include means to identify dynamic signatures, or indicators, in the socio-cultural realm to assist in estimating or predicting behavioral response to operations. *FY 2014 Accomplishments:* Developed analytical models that advise the commander on likely socio-cultural consequences of planned military courses of action impacting indigenous population; provided the commander a computer aided methodology to identify insights into socio-cultural issues, needs, and likely perceptions to planned unit actions and tasks in the commander's area of responsibility. *FY 2015 Plans:* Investigate the unique capability to characterize sub-national populations, environmental degradation, and risks to security in complex operational environments based on accessible pre-conflict data; Investigate monitoring tools and decision models reflecting effects of changing conditions on the operating environment for Brigade-level operators and mission planners; identify levers of change impacting urban security operating environments to provide timely answers to Commanders on whether the effects of actions support the desired strategy. *FY 2016 Plans:*	2.894	2.547	2.723

Exhibit R-2A, **RDT&E Project Justification:** PB 2016 Army		**Date:** February 2015
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602784A / *Military Engineering Technology*	**Project (Number/Name)** T41 / *Mil Facilities Eng Tec*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016**
Will investigate capability to integrate existing information about population and knowledge of the theater environment to monitor urban conditions and drive assessment of strengths and deficiencies of host-nation areas; will develop methods to produce composite geospatial products from multiple human and environmental data inputs and semi-automated analytic tools; will investigate approaches to represent indictors in spatial-temporal views for the Warfighter to incorporate into Military Decision Making Process (MDMP) and Troop Leading Procedures (TLP) products.			
Accomplishments/Planned Programs Subtotals	6.251	5.641	5.845

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army										Date: February 2015	

Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602784A I *Military Engineering Technology*					Project (Number/Name) T42 I *Terrestrial Science Applied Research*		

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
T42: *Terrestrial Science Applied Research*	-	5.106	5.203	5.158	-	5.158	5.152	5.343	5.377	5.482	-	-

Note
 Not applicable for this item

A. Mission Description and Budget Item Justification
 This effort provides technologies which support analysis of socio-cultural and facility issues in forward base operations, including urban environments. Technology development efforts will include means to identify dynamic signatures, or indicators, in the socio-cultural realm to assist in estimating or predicting behavioral response to operations.
 Work in this project supports the Army S&T Command, Control, Communications and Intelligence (C3I) Portfolio.

 The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

 Work in this project is performed by the US Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Analysis for Signal & Signature Phenomenology	2.397	2.755	2.722

Description: This effort investigates the dynamics of electromagnetic, acoustic, and seismic signatures in response to changing terrain state and complex terrain features and geometry. Research results improve sensor employment tactics, techniques, and procedures and numerical modeling of terrain properties for tactical advantage and geospatial tactical decision aids.

FY 2014 Accomplishments:
Developed and integrated into the sensor mission planning tool Environmental Awareness for Sensor and Emitter Employment (EASEE) terrain and weather influences and model predictions for radar and radio frequency modalities; developed and integrated functionality for providing multi-modal propagation predictions for multiple moving platforms; developed an automated remote sensing capability to provide tactical commanders a repeatable assessment of mountainous snowpack extent and snowpack total water storage to inform mission planning decision making social-cultural mission impacts.

FY 2015 Plans:
Research and develop a framework to significantly improve geospatial tools that inform mission command systems and the common operational picture by quantifying and displaying risk and uncertainties inherent in data quality of terrestrial properties

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 I 2	R-1 Program Element (Number/Name) PE 0602784A I *Military Engineering Technology*	Project (Number/Name) T42 I *Terrestrial Science Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
(soils, vegetation, landscape, structures), weather influences (rapid dynamic changes), and information collection modalities (seismic, acoustic, radio frequency, electro-optical propagation); investigate potential uses of full waveform Light Detection and Ranging (LiDAR) backscatter remote sensing of terrestrial surfaces for remote classification of terrestrial material properties and characterization for geospatial applications. *FY 2016 Plans:* Will investigate methods and advanced tools for storing, indexing and managing raw LiDAR sensor data in a geospatial database enabling immediate remote processing and exploitation for tactical terrain analysis; will develop techniques for fusing disparate data sources and types (e.g. point clouds and imagery) by retaining all critical collection attributes, thus providing significant military utility of terrain information and features for high fidelity mission planning and execution.			
Title: Geospatial Reasoning *Description:* This effort integrates terrain knowledge and the dynamic effects of weather and mission to provide geospatial reasoning solutions to the Soldier. The understanding gained and products developed improve the ability to predict signature (emitter) behavior and sensor performance in complex operational environments, and support materiel development, sensor performance products for tactical decision-making, and visualization for mission command. *FY 2014 Accomplishments:* Developed decision support tool for combat outpost applications optimizing human and physical terrain surveillance by matching sensor modalities to mission, terrain complexity, and predicted weather effects; investigated and developed components of a sensor coverage and management framework for integrating ground and air surveillance assets based upon site specific terrain and weather conditions; investigated sensor modalities and developed software to perform rapid, stand-off assessments of austere entry locations by remotely assessing terrain condition (soil physical properties) and integrating weather effects. *FY 2015 Plans:* Research and establish an Environmental Intelligence modeling framework supporting broad Army mission utility including trainers, Soldiers, planners and materiel developers, with real world operational environment terrestrial and climate modeling integral to training scenarios, mission planning, and materiel performance, through geospatial tools depicting terrain and climate influences in a unit's operational environment, landscape and climate impacts to stability operations (land use, water resources), courses of action (COA) development, and capability development analysis of alternatives (AoA). *FY 2016 Plans:* Will initiate development of digital product layers that reflect land-atmosphere impacts on mobility, austere entry, and sensor performance and research risk-based analysis of terrestrial processes on military operations. Will initiate evaluation of acoustic, seismic and radiofrequency (RF) modeling complexities in complex urban and terrain environments where signals are impacted by scattering objects. Will conduct research of time-sensitive activity within the soil as shaped by dynamic soil descriptors to support	2.709	2.448	2.436

Exhibit R-2A, **RDT&E Project Justification:** PB 2016 Army		**Date:** February 2015
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*	**Project (Number/Name)** T42 *I Terrestrial Science Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2014**	**FY 2015**	**FY 2016**
enhanced predictive analysis of soil-weather-terrain governed maneuver and sensor constraints. Will investigate remote and automated analysis methods for identifying and locating areas suitable for aircraft landing or drop zones.			
Accomplishments/Planned Programs Subtotals	5.106	5.203	5.158

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army										Date: February 2015	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*						**Project (Number/Name)** T45 *I Energy Tec Apl Mil Fac*	

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
T45: *Energy Tec Apl Mil Fac*	-	3.213	3.421	3.321	-	3.321	3.809	3.953	3.976	4.043	-	-

Note
Not applicable for this item

A. Mission Description and Budget Item Justification
This project investigates and evaluates technologies necessary for secure, efficient, sustainable military installations, and contingency bases, emphasizing facility systems protection in response to evolving needs. 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. This effort provides technologies to protect facility indoor air quality from contaminants such as mold, bacteria and viruses in work and living spaces as well as develops methods to optimize sustainable operations and maintenance to minimize lifecycle costs. In addition, technologies from this work provide a better understanding of critical infrastructure interdependencies to support sustainable and flexible facility operations and evolving mission requirements.

Work in this project supports the Army S&T Innovation Enablers (formerly Enduring Technologies) Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

Work in this project is performed by the US Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Title: Adaptive and Resilient Installations	3.213	3.421	3.321
Description: This effort investigates and develops technologies necessary for energy efficiency and sustainable military installations, emphasizing energy and utility systems. *FY 2014 Accomplishments:* Developed and began the integration of sustainment, restoration and modernization decision models that maximize effectiveness of facility retrofits, specifically for energy performance; validated multi-dimensional models and algorithms using emerging building envelope materials to reduce energy losses and transition innovative concepts for application of advanced technology to meet mandated energy reduction goals. *FY 2015 Plans:*			

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army		Date: February 2015
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602784A *I Military Engineering Technology*	**Project (Number/Name)** T45 *I Energy Tec Apl Mil Fac*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015	FY 2016
Develop sustainment, restoration and modernization decision models that provide installation managers with information necessary to identify actionable operations and investment opportunities to lower energy usage while maintaining mission functionality, thereby reducing facility lifecycle costs. Investigate use of indigenous materials for forward operating bases and contingency bases; investigate smart and multifunctional materials and systems that increase strength, durability, resilience and electromagnetic shielding for buildings and hard shelter envelopes. *FY 2016 Plans:* Will investigate the impacts on energy efficiency and lifecycle sustainability of contingency based structures constructed with cementitious materials assembled via an additive process for construction. Will investigate the impacts on construction geometries of the structures along with the physical attributes of the supporting pad and walls as well as the ceiling. Will evaluate material mixtures and additivies, as well as nozzle shapes and combinations, to allow complex wall configurations to improve thermal characteristics while maintaining structural integrity.			
Accomplishments/Planned Programs Subtotals	3.213	3.421	3.321

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2016 Army			Date: February 2015	

Appropriation/Budget Activity 2040 *I* 2	R-1 Program Element (Number/Name) PE 0602784A *I Military Engineering Technology*	Project (Number/Name) T53 *I Military Engineering Applied Research (CA)*

COST ($ in Millions)	Prior Years	FY 2014	FY 2015	FY 2016 Base	FY 2016 OCO	FY 2016 Total	FY 2017	FY 2018	FY 2019	FY 2020	Cost To Complete	Total Cost
T53: *Military Engineering Applied Research (CA)*	-	-	4.000	-	-	-	-	-	-	-	-	-

Note
 Not applicable for this item

A. Mission Description and Budget Item Justification
 Congressional Interest Item funding for Military Engineering applied research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2014	FY 2015
Congressional Add: Program Increase	-	4.000
FY 2015 Plans: Program increase for military engineering applied research		
Congressional Adds Subtotals	-	4.000

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
 N/A