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Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Army **Date:** February 2016

Appropriation/Budget Activity 2040: <i>Research, Development, Test & Evaluation, Army / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
Total Program Element	-	66.582	80.909	67.416	-	67.416	70.683	74.519	75.986	77.555	-	-
855: <i>Topographical, Image Intel & Space</i>	-	15.319	16.116	17.621	-	17.621	18.530	18.595	18.967	19.346	-	-
H71: <i>Meteorological Research For Battle Command</i>	-	6.442	6.455	6.476	-	6.476	6.590	5.632	5.762	5.897	-	-
T40: <i>Mob/Wpns Eff Tech</i>	-	26.731	26.514	28.142	-	28.142	29.830	34.462	35.139	35.842	-	-
T41: <i>Mil Facilities Eng Tec</i>	-	5.542	5.845	6.216	-	6.216	6.437	6.477	6.593	6.725	-	-
T42: <i>Terrestrial Science Applied Research</i>	-	5.161	5.158	5.152	-	5.152	5.343	5.377	5.482	5.621	-	-
T45: <i>Energy Tec Apl Mil Fac</i>	-	3.387	3.321	3.809	-	3.809	3.953	3.976	4.043	4.124	-	-
T53: <i>Military Engineering Applied Research (CA)</i>	-	4.000	17.500	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates and advances technologies, techniques, and tools for 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 planning and operations; 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. 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 emplaceable 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 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.

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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 Army Engineer Research and Development Center, Vicksburg, MS, and the Army Research Laboratory, Aberdeen Proving Ground, MD.

B. Program Change Summary (\$ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	67.302	63.409	67.350	-	67.350
Current President's Budget	66.582	80.909	67.416	-	67.416
Total Adjustments	-0.720	17.500	0.066	-	0.066
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	17.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.720	-			
• Adjustments to Budget Years	-	-	0.066	-	0.066

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: T53: *Military Engineering Applied Research (CA)*

Congressional Add: *Program Increase*

	FY 2015	FY 2016
	4.000	17.500
Congressional Add Subtotals for Project: T53	4.000	17.500
Congressional Add Totals for all Projects	4.000	17.500

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army **Date:** February 2016

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>				Project (Number/Name) 855 / <i>Topographical, Image Intel & Space</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
855: <i>Topographical, Image Intel & Space</i>	-	15.319	16.116	17.621	-	17.621	18.530	18.595	18.967	19.346	-	-

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; digital map creation, transmission, and dissemination; and 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 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 Science and Technology Command, Control, Communications and Intelligence (C3I) Portfolio.

Work in this project complements efforts in Program Element (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 Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2015	FY 2016	FY 2017
Title: Terrain Analysis for Signal and Sensor Phenomenology	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; 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. Elements of this effort develop further in Geointelligence - Terrestrial Remote Sensing and Data Visualization in Fiscal Year (FY) 2017.			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) 855 / <i>Topographical, Image Intel & Space</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p><i>FY 2015 Accomplishments:</i> Developed 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.</p> <p><i>FY 2016 Plans:</i> Develop initial algorithms to exploit three-dimensional (3D) terrain data using hyper-spectral data sources; Analyze existing algorithms for tactical terrestrial remote sensing capabilities to enhance geospatial 3D data for expanded awareness in the area of interest (AOI).</p>				
<p><i>Title:</i> Imagery and GeoData Sciences</p> <p><i>Description:</i> 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. Elements of this effort develop further in Map-Based Planning Services (MBPS), and Human Geography - Spatial Reasoning, Analysis, and Visualization in FY17.</p> <p><i>FY 2015 Accomplishments:</i> Developed 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 added novel context to conventional quantitative data sources and information, thereby providing increased awareness and surveillance of both the human and physical dimensions. Developed automated workflows to provision high-resolution imagery and geodata to mobile, dismounted devices for mission command platforms in mounted and mobile computing environments. Developed 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.</p> <p><i>FY 2016 Plans:</i> Investigate and develop geospatial analysis tools leveraging authoritative Department of Defense (DoD) databases to support military planning; Develop methods to efficiently query databases in multiple Computing Environments to produce geospatial overlays depicting elements of sociocultural behavior; conduct research methods allowing Army planners to exploit the Standard,</p>		2.438	4.970	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
Shareable, Geospatial Foundation (SSGF) data and services to provide a common geospatial framework for commanders and their staff.				
<p>Title: Geospatial Reasoning</p> <p>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. Elements of this effort develop further in GeoIntelligence - Terrestrial Remote Sensing and Data Visualization, GeoIntelligence – Geospatial Data Generation and Decision Support, and Army Terrestrial Environmental Modeling & Intelligence System (ARTEMIS) in FY17.</p> <p>FY 2015 Accomplishments: Developed methods for super-resolution data processing (i.e., imagery, Light Detection and Ranging, Hyperspectral, multispectral), and algorithms to exploit this data. This research is specific to challenges faced by small units in urban environments that can be addressed through high-fidelity geospatial data. Initiated 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.</p> <p>FY 2016 Plans: Develop methods to deliver and integrate novel geospatial products using open standards and formats into the AGE. Begin research on information fusion to evaluate accuracy and relevance of dynamic terrain information layers that support the military decision making process; Initiate methods to leverage and develop open source LIDAR processing capabilities to enhance feature classification and sensor exploitation. Develop stand-off soil moisture assessments and comparisons to further assist real-time mapping of moisture levels, assisting in mobility forecasts. Begin research on information fusion to evaluate accuracy and relevance of dynamic terrain information layers that support the military decision making process.</p>		5.958	6.082	-
<p>Title: Geospatial and Temporal Information Structure and Framework</p> <p>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. Elements of this effort develop further as GeoIntelligence - Geospatial Data Generation and Decision Support , and Human Geography - Spatial Reasoning, Analysis, and Visualization in FY17.</p> <p>FY 2015 Accomplishments:</p>		4.315	2.816	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>Developed 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. Investigated the unique capability to characterize sub-national populations, environmental degradation, and risks to security in complex operational environments based on accessible pre-conflict data.</p> <p>FY 2016 Plans: 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; Explore new exploitation techniques and algorithms to characterize the urban operational environment and develop geospatial products focused on hazardous terrain identification; Enhance the capability to capture and visualize dynamic spatiotemporal narratives that describe relationships of people, events, and geographic locations through time; Develop the capability to characterize the relationship between environment and conflict through systems models that demonstrate the impacts of environmental conditions on stability. Develop algorithms to incorporate sociocultural factors and data for more effective analysis of violent events.</p>				
<p>Title: GeoIntelligence - Geospatial Data Generation and Decision Support</p> <p>Description: This effort investigates novel map content generation and geo-temporal analytics for the development of geospatially-based decision support tools. This research focuses on automatic inference and the correlation between events and objects (i.e., people, places) through space and time from massive data sets developed in the Geospatial and Temporal Information Structure and Framework effort. In addition, the effort investigates advanced model forecast effects of the physical terrain, human terrain, and environment for applications to the Military Decision Making Process, an analysis that informs course of action development and evaluation of tactics, equipment, and mission risk. This item continues efforts from Geospatial Reasoning, and Geospatial and Temporal Information Structure and Framework.</p> <p>FY 2017 Plans: Will complete development of a new algorithm suite to enable rapid processing and searching of high volume multi-modal spatiotemporal datasets for revealing and illuminating relevant embedded relationships, spatiotemporal threads, and discoverable meaningful patterns associated with human geography (e.g., actors, places, events, and time); research new terrain analytics and tactical decision aids supporting Warfighter tactical operations in 3D dense urban terrain environments by providing hazard identification and mitigation, remote feature classification, and 3D terrain analysis techniques; and develop rapid tools for characterization of hazardous urban terrain effects, the detection and identification of urban and peri-urban feature classes using remotely sensed data, and input layers for geospatial analytics enabling multi-source, urban-relevant data enterprise integration.</p>		-	-	4.940
<p>Title: GeoIntelligence - Terrestrial Remote Sensing and Data Visualization</p>		-	-	4.462

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016
<p>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 investigating new methods for effective sensor systems and materials to 'tag' features, items, and people of interest based upon novel and emerging LiDAR sensor systems, innovative LiDAR collection and analysis techniques, and an array of other sensor systems for intermittent and persistent optimal data collection, object identification, and classification for ground operations. This item continues efforts from Terrain Analysis for Signal and Sensor Phenomenology, and Geospatial Reasoning.</p> <p>FY 2017 Plans: Will conduct research on terrain feature extraction important to mission planning to provide the terrain and image analyst access to surface roughness, vegetation density, characterization of built-up areas, and near ground obstacles; investigate laser detection and ranging (LADAR) sensors for base force protection through physical mounting integration, mast stabilization optimization, and software techniques enabling anomaly detection, change assessment, and sensor cueing capabilities.</p>			
<p>Title: Human Geography - Spatial Reasoning, Analysis, and Visualization</p> <p>Description: This effort integrates behavior and population dynamics research and analysis to depict the operational environment including culture, demographics, terrain, climate, and infrastructure, into geospatial frameworks. Research exploits existing open source text, leverages multi-media and cartographic materials, and investigates data collection methods to ingest geospatial data directly from the tactical edge 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 aspects of the operational environment, which offers a holistic understanding of the operational environment for the Warfighter. This item continues efforts from Imagery and GeoData Sciences, and Geospatial and Temporal Information Structure and Framework and complements the work in PE 0602784A/Project T41.</p> <p>FY 2017 Plans: Will research and design a framework to investigate the impacts of environmental stressors (e.g. water security) on populations and military operations.</p>		-	-
<p>Title: Weather and Terrain Integration</p> <p>Description: This effort investigates innovative methods for integrating weather and physical terrain applications with geospatial systems compliant with the Army's Common Operating Environment approach to the Army Geospatial Enterprise thereby providing significant advancement to fused all-weather and all-season tactical decision aids supporting risk-based assessments. This item continues efforts from Geospatial Reasoning.</p>		-	-
		2.007	2.455

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
FY 2017 Plans: Will complete uncertainty and sensitivity analysis of stand-off soil moisture assessments and comparisons to further mature real-time mapping of moisture levels and develop improved tactical mobility forecasts; and investigate new visibility algorithms based on dust, aerosol, and humidity fields for line of sight representation in a Situationally Aware Geospatially Enabled (SAGE) terrain analysis decision aid.				
Title: Map-Based Planning Services (MBPS) Description: This effort develops geospatially-enabled, collaborative mission planning capabilities providing services, data, and information to Army planners, staffs, and leaders. These mission planning capabilities will allow collecting, processing, storing, displaying, and sharing of authoritative data and information in a geo-temporal context. Work will leverage AGE standard data sets and incorporate Geo-Enabled Mission Command tools and analytical capabilities. This item continues efforts from Imagery and GeoData Sciences. Resultant work products proceed into 0603734A/T08.		-	-	3.757
FY 2017 Plans: Will develop approaches to enable Army planners at multiple echelons and at distributed locations to exploit a common geospatial framework within the planner enclave for concurrent planning; and investigate migration of planners' tools and services to a web-based capability				
Accomplishments/Planned Programs Subtotals		15.319	16.116	17.621
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>				Project (Number/Name) H71 / <i>Meteorological Research For Battle Command</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
H71: <i>Meteorological Research For Battle Command</i>	-	6.442	6.455	6.476	-	6.476	6.590	5.632	5.762	5.897	-	-

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 Science and Technology 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 557th Weather Wing to improve their operational weather support to the Army PM-Meteorological and Target Identification Capabilities (PM-MaTIC) 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/Tactical Airspace Integration System (TAIS).

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

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2015	FY 2016	FY 2017
Title: Atmospheric Characterization, Modeling, and Impacts (formerly Atmospheric Modeling)	2.562	2.558	5.126
Description: This effort develops high resolution, short-range forecasting, and high resolution atmospheric modeling capabilities for mountainous, urban, and forest complex terrain.			
FY 2015 Accomplishments: Developed the Atmospheric Boundary Layer Environment (ABLE) microscale (local) weather prediction model and matured the capability to implement this model in the mesoscale Weather Running Estimate-Nowcast (WRE-N) model to provide and increase			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>the reliability of local weather forecasts; developed 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 implemented the ABLE model capability for artillery target area domains.</p> <p>FY 2016 Plans: 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 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.</p> <p>FY 2017 Plans: Will refine and mature Meteorological Sensor Array (MSA) computer applications that provide non-standard sensing capabilities for the atmospheric boundary layer, including novel employment of weather sensing small unmanned aircraft systems (UAS) vehicles; develop MSA systems at multiple sites to study atmospheric characteristics in different microclimate/terrain regimes; conduct research to quantify climate and weather impacts on the design and deployment of renewable energy systems that are operationally relevant to the Army; conduct research, analysis, and software development to quantify the effects of weather on systems and operations; complete initial studies addressing integration of probabilistic and uncertainty forecasts into decision support tools (DSTs); fully-integrate various sources of observational data into the forecast model assessment processes, utilizing Geographic Information System-based and other advanced assessment techniques; fully evaluate the benefits of assimilated Doppler wind LIDAR data into microscale models to improve predictions of winds in the atmospheric boundary layer over complex terrain; conduct initial capability studies addressing high-resolution atmospheric model performance as related to sensor performance; conduct applied research to better characterize the impact of airborne aerosols on electro-optical propagation; apply appropriate techniques to the mitigation of atmospheric turbulence on the propagation of electro-optical signals; and improve the performance of DSTs for acoustics propagation and characterizing the state of the atmosphere.</p>				
<p>Title: Atmospheric Diagnostics</p> <p>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.</p> <p>FY 2015 Accomplishments:</p>		1.964	1.972	-

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>Developed 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; determined the performance effectiveness of dual-band (midwave infrared (MWIR) and long wavelength IR (LWIR)) thermal polarimetric imagers to discriminate camouflage under varying environmental conditions; conducted experiments to determine vulnerabilities of various camouflage materials when simultaneously exposed to dual-band thermal polarimetry; developed elevation and location correction algorithms to more accurately detect and track UASs by acoustic arrays; and developed elevation correction due to atmospheric propagation for UAS tracking by acoustic arrays.</p> <p>FY 2016 Plans: Design and develop MSA components that provide, non-standard sensing capabilities for the atmospheric boundary layer; 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.</p>				
<p>Title: Local Area Atmospheric Prediction for Geospatial Applications (formerly Atmospheric Prediction for Local Areas)</p> <p>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.</p> <p>FY 2015 Accomplishments: Researched tactical network capabilities to identify the most efficient methods to transmit/receive weather data for mobile weather decision aid applications; matured techniques and algorithms for integrating forecast grids into weather DSTs and implement initial capabilities in those systems; continued 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; developed a DST to exploit anomaly image quality metrics for detecting areas of interest within optical images; and researched how weather affects human behavior and began development of a prediction system for threat personnel biometeorological impacts and insurgent/terrorist activities. This system will correlate existing or predicted weather conditions with possible insurgent/terrorist activities, such as IED emplacement.</p> <p>FY 2016 Plans: Prepare the ABLE microscale model for transition into the 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</p>		1.916	1.925	1.350

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
WRE-N nowcasting model results (rapidly updated local short-term predictions) will be integrated with weather decision support tools for mission planning and execution. FY 2017 Plans: Will conduct very fine-scale nowcast modeling research using the Weather Research and Forecasting (WRF) model, the WRF coupled with atmospheric chemistry (WRF-Chem) model, and other appropriate models to address dust lofting and model coupling to terrain/trafficability models; complete model resolution tests of acoustic sensor performance to determine optimized model configurations and resolutions for operational use; configure and complete acoustic sensor/atmospheric modeling field experiments to validate the model resolution conclusions; and design and complete sub-kilometer atmospheric modeling studies linking land surface models with WRF to improve soil strength and terrain trafficability models.				
Accomplishments/Planned Programs Subtotals		6.442	6.455	6.476
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army **Date:** February 2016

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T40 / <i>Mob/Wpns Eff Tech</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
T40: <i>Mob/Wpns Eff Tech</i>	-	26.731	26.514	28.142	-	28.142	29.830	34.462	35.139	35.842	-	-

A. Mission Description and Budget Item Justification

This project investigates, evaluates, and develops technologies for adaptive and expedient force protection across the range of military operations. Focus areas include: force projection and maneuver, including austere port and airfield entry and overcoming battlespace gaps (such as cliffs, ravines, mudflats, shallow rivers, and other natural obstacles); prediction, definition, avoidance, or defeat of the gaps; scalable weapons effects; and high-resolution representation of near-surface terrain and environment for use with sensor models for 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 threats and enables maneuver support of deployed forces, while reducing their logistical footprint. This project supports efforts for overcoming critical capability gaps for protecting troops operating at smaller bases that are remote or integrated with local communities.

Work in this project supports the Army Science and Technology 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 Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2015	FY 2016	FY 2017
<p>Title: Adaptive Protection</p> <p>Description: This effort develops new analytical techniques, advanced materials, and integrated protection systems to support the protection of critical assets on the battlefield. Technology development efforts include techniques and materials to protect small bases, techniques to protect, conceal, or deter against advanced threats including missiles, and techniques to identify tunnels and subterranean activities.</p> <p>FY 2015 Accomplishments: Developed technologies to determine vulnerability of critical facilities and to assess degradation to operational capability; developed protective measures that use indigenous materials and on-site production capability; provided integrated protection planning tools that include pre-deployment, construction, operations, and relocation.</p> <p>FY 2016 Plans:</p>	10.459	10.521	11.173

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T40 / <i>Mob/Wpns Eff Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>Develop rapidly emplaced force protection technologies and survivability and planning tools to decrease required Soldiers needed for construction of Combat Outpost or Patrol Base (COP/PB). Develop force protection technologies to mitigate lethality of advanced threats in order to increase survivability of personnel, critical assets, and fixed facilities. Develop and 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.</p> <p>FY 2017 Plans: Will conduct experiments to determine the blast and penetration performance of cast-in-place protective structural components made with indigenous materials. Will develop geophysical linear sensor systems in support of tactical security systems. Will increase and refine blast prediction M&S capabilities of HMEs and expand soil and condition databases. Will develop technologies to detect tunnels and subterranean activities for protection of forces and critical assets.</p>				
<p>Title: Austere Entry and Maneuver</p> <p>Description: This effort investigates, designs, and creates tools and technologies that identify, assess, and monitor structural and functional suitability of theater access points and infrastructure, allow planning of tactical logistics resupply networks that enable planners to develop and compare courses of action, and simulate manned/unmanned tactical maneuver and mobility of small units in complex and urban terrains. This effort is coordinated with Program Element 0603005A.</p> <p>FY 2015 Accomplishments: Developed 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. Developed a simulation capability to enable rapid remote assessment of real-time structural capacity of infrastructure (airfields, ports, and roads), river, estuary, and near shore.</p> <p>FY 2016 Plans: Develop computational test bed applications to simulate the influence of dynamic environmental effects created by vehicles and humans on sensor-based perception. Develop computational test bed applications to simulate the influence of dynamic environmental effects created by vehicles and humans on sensor-based perception. Complete modeling of dismounted operations and continue to develop the distribution management tool and provide systems integration to simulate the entire logistics distribution network. Complete development of the capability to numerically simulate infrasonic sources for regional assessment of infrastructures. Refine sensor evaluation of airports and seaports of debarkation and reduced order modeling for austere entry assessment.</p> <p>FY 2017 Plans: Will continue development of dynamic environmental vehicle simulation tools to support autonomous ground resupply operations. Will complete development of a planning tool for comparing early entry alternative courses of action for a logistics distribution</p>		13.629	12.760	12.766

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
network. Will continue refinement of remote and standoff assessment techniques for airports and seaports of debarkation for austere entry assessment. Will begin an effort to predict vehicle movement in complex and urban environments.				
<p>Title: Environmental Impacts on Sensor Performance</p> <p>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 the 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 the design of non-line-of-sight and beyond line-of-sight sensors for remote areas, including the investigation of coupling between sensors and their environment for understanding surface and subsurface activities. This effort supports persistent surveillance and detection capabilities.</p> <p>FY 2015 Accomplishments: Validated three-dimensional source models of human and vehicular traffic in complex environments to determine transduction mechanisms of linear sensors; and developed physics-based model of linear sensor excitation by high-fidelity viscoelastic and discrete element methods.</p> <p>FY 2016 Plans: 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.</p> <p>FY 2017 Plans: Will integrate HPC-enabled models with Night Vision and Electronic Sensors Directorate's hyperspectral sensors to simulate the geo-environmental impact on performance of multi-modal imaging sensor combinations for threat scenarios. Will continue development of advanced analytic tools to determine detection performance of multi-modal and spectral sensor combinations.</p>		1.479	2.000	2.965
<p>Title: Materials Modeling</p> <p>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.</p> <p>FY 2015 Accomplishments: Developed and enhanced the fidelity and efficiency of multi-scale predictive design tools to incorporate materials by design principles for development of enhanced protective structures; developed and integrated novel multi-scale reinforced cementitious</p>		1.164	1.233	1.238

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>materials and components of protective structures; developed 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.</p> <p>FY 2016 Plans: Enhance materials by design of cementitious and polymer composite protective materials through the continued development and validation of multi-scale predictive design tools; develop methods to control bonds between reinforcement and cementitious matrices at multiple scales to optimize composite performance; integrate novel processing and additive manufacturing methodologies into material system design and fabrication methods to support the maturation of advanced protective solutions.</p> <p>FY 2017 Plans: Will continue to develop and validate multi-scale high performance protective materials, predictive design tools, and material models; will continue to develop methods to predict constituent material properties of cementitious and polymeric materials at multiple scales to optimize performance; will continue to integrate novel processing and additive manufacturing methodologies into material system design and fabrication methods to support the maturation of advanced protective solutions; these efforts support the development of the next generation of high performance materials for force and critical asset protection against advanced threats.</p>				
Accomplishments/Planned Programs Subtotals		26.731	26.514	28.142
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				
E. Performance Metrics				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army **Date:** February 2016

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T41 / <i>Mil Facilities Eng Tec</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
T41: <i>Mil Facilities Eng Tec</i>	-	5.542	5.845	6.216	-	6.216	6.437	6.477	6.593	6.725	-	-

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 Science and Technology 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 Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2015	FY 2016	FY 2017
Title: Adaptive and Resilient Installations	3.040	3.122	3.620
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 2015 Accomplishments: Completed 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; Completed integrated modeling capability building on the Net Zero Energy Framework to support Installation planning for energy, water, and waste resource optimization.			
FY 2016 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T41 / <i>Mil Facilities Eng Tec</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>Research the necessary mixture design and admixtures requisite to allow additive construction using cementitious materials across the broadest possible locations and operating environments. Determine the correct formulations to adapt locally available cementitious materials to required rheology, curing time, and strength for automated additive construction of expeditionary structures. Determine the serviceability of other native materials (such as soils, clay, and sand mixtures like adobe) for use as extrudable building materials.</p> <p>FY 2017 Plans: Will develop a suite of physics-based models and simulations to perform structural, energy, and protection analysis of digital designs used for automated construction of expeditionary structures. Will conduct simulations to generate tradespace analyses for prototype model development. Will develop a prototype tool to assess the impact of physical, ecological, and sociocultural environments relative to contingency base site selection, design, operations, and maintenance to support operational planning.</p>				
<p>Title: Human Geography – Fundamentals of Behavior and Population Dynamics (Previously titled Social/Cultural Behavior)</p> <p>Description: This effort researches population dynamics including physical, cultural, psychological, and behavioral attributes critical to U.S. Army engagement activities in an area of operations, including urban environments. Technology development efforts include means to identify dynamic indicators in the socio-cultural realm to assist in estimating or predicting behavioral response to operations and to display indicators in spatial-temporal views for the Warfighter. This effort complements the work in Program Element 0602784A/Project 855.</p> <p>FY 2015 Accomplishments: Investigated the unique capability to characterize sub-national populations, environmental degradation, and risks to security in complex operational environments based on accessible pre-conflict data; investigated monitoring tools and decision models reflecting effects of changing conditions on the operating environment for Brigade-level operators and mission planners; identified levers of change impacting urban security operating environments to provide timely answers to Commanders on whether the effects of actions support the desired strategy.</p> <p>FY 2016 Plans: Investigate capability to integrate existing information about population and knowledge of the theater environment into urban condition monitoring capabilities and drive assessment of strengths and deficiencies of host-nation areas; develop methods to produce composite geospatial products from multiple human and environmental data inputs and semi-automated analytic tools; investigate approaches to display socio-cultural data markers in spatial-temporal views for the Warfighter to incorporate into Military Decision Making Process (MDMP) and Troop Leading Procedures (TLP) products.</p> <p>FY 2017 Plans:</p>		2.502	2.723	2.596

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T41 / <i>Mil Facilities Eng Tec</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
Will investigate and design a framework for integrating social-cultural dynamics (human aspects of the operational environment) encountered in dense urban environments into mission planning and execution..				
Accomplishments/Planned Programs Subtotals		5.542	5.845	6.216
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army										Date: February 2016		
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>				Project (Number/Name) T42 / <i>Terrestrial Science Applied Research</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
T42: <i>Terrestrial Science Applied Research</i>	-	5.161	5.158	5.152	-	5.152	5.343	5.377	5.482	5.621	-	-

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 Science and Technology 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 Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2015	FY 2016	FY 2017
Title: Analysis for Signal & Signature Phenomenology	1.651	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. This work continues as GeoIntelligence - Terrestrial Phenomenology Characterization for Geospatial Applications.			
FY 2015 Accomplishments: Researched and developed 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 (soils, vegetation, landscape, structures), weather influences (rapid dynamic changes), and information collection modalities (seismic, acoustic, radio frequency, electro-optical propagation); investigated 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: 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; develop techniques for fusing disparate data			

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T42 / <i>Terrestrial Science Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
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.				
<p>Title: Army Terrestrial Environmental Modeling & Intelligence System (ARTEMIS)</p> <p>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.</p> <p>FY 2015 Accomplishments: Researched and established 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).</p> <p>FY 2016 Plans: 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. Initiate evaluation of acoustic, seismic, and radiofrequency (RF) modeling complexities in complex urban and terrain environments where signals are impacted by scattering objects. Conduct research of time-sensitive activity within the soil as shaped by dynamic soil descriptors to support enhanced predictive analysis of soil-weather-terrain governed maneuver and sensor constraints. Investigate remote and automated analysis methods for identifying and locating areas suitable for aircraft landing or drop zones.</p> <p>FY 2017 Plans: Will complete development of remote assessment of landing zones and drop zones capability for Intelligence Preparation of the Battlefield products; integrate and validate the utility of high resolution weather data in signal propagation prediction software; complete initial development of a fused and synchronized dynamic geospatial framework for understanding, through risk-based applications, the effect of weather-impacted terrestrial processes on military operations at all echelons.</p>		3.510	2.436	3.500
<p>Title: GeoIntelligence - Terrestrial Phenomenology Characterization for Geospatial Applications (Formerly Analysis for Signal & Signature Phenomenology)</p> <p>Description: This effort investigates the dynamics of electromagnetic, acoustic, and seismic signatures in response to changing terrain state and complex terrain geometry. Research results improve sensor employment tactics, techniques and procedures, and numerical modeling of terrain properties for tactical advantage and geospatial tactical decision aids.</p>		-	-	1.652

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T42 / <i>Terrestrial Science Applied Research</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2015	FY 2016	FY 2017
<i>FY 2017 Plans:</i> Will research web-based three-dimensional (3D) visualization of tactical decision aids to enhance point cloud analytics in bandwidth limited environments and mobile applications; investigate utility of LiDAR and terrain based 3D products through new algorithms and processes to access and reuse level zero (raw) data collections preserving sensor calibration and error meta-data.			
Accomplishments/Planned Programs Subtotals	5.161	5.158	5.152

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T45 / <i>Energy Tec Apl Mil Fac</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
T45: <i>Energy Tec Apl Mil Fac</i>	-	3.387	3.321	3.809	-	3.809	3.953	3.976	4.043	4.124	-	-

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 and training, and in the theater of operations to reduce logistical footprint. This effort investigates 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 matures 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 Science and Technology 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 Army Engineer Research and Development Center, Vicksburg, MS.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2015	FY 2016	FY 2017
Title: Adaptive and Resilient Installations	3.387	3.321	3.809
Description: This effort investigates and develops technologies necessary for energy efficient and sustainable military installations, emphasizing energy and utility systems.			
FY 2015 Accomplishments: Developed 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. Investigated use of indigenous materials for forward operating bases and contingency bases; investigated smart and multifunctional materials and systems that increase strength, durability, resilience, and electromagnetic shielding for buildings and hard shelter envelopes.			
FY 2016 Plans: Investigate the impacts on energy efficiency and lifecycle sustainability of contingency basing structures constructed with cementitious materials assembled via an additive process for construction. Investigate the impacts on construction geometries of the structures along with the physical attributes of the supporting pad, walls, and ceiling. Evaluate material mixtures and			

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army		Date: February 2016		
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T45 / <i>Energy Tec Apl Mil Fac</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
additives, as well as nozzle shapes and combinations, to allow complex wall configurations to improve thermal characteristics while maintaining structural integrity. FY 2017 Plans: Will validate simulations for a prototype automated construction capability for expeditionary structures and assess modified designs to allow for improved thermal characteristics and structural integrity. Will investigate methods for rapid and automated acquisition of existing facility information in remote environments.				
Accomplishments/Planned Programs Subtotals		3.387	3.321	3.809
C. Other Program Funding Summary (\$ in Millions) N/A				
Remarks				
D. Acquisition Strategy N/A				
E. Performance Metrics N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Army **Date:** February 2016

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602784A / <i>Military Engineering Technology</i>	Project (Number/Name) T53 / <i>Military Engineering Applied Research (CA)</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
<i>T53: Military Engineering Applied Research (CA)</i>	-	4.000	17.500	0.000	-	0.000	0.000	0.000	0.000	0.000	-	-

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 2015	FY 2016
Congressional Add: Program Increase	4.000	17.500
FY 2015 Accomplishments: Program increase for military engineering applied research		
FY 2016 Plans: Program increase for military engineering applied research		
Congressional Adds Subtotals	4.000	17.500

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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