



**US Army Corps  
of Engineers®**  
Engineer Research and  
Development Center

**ERDC**  
INNOVATIVE SOLUTIONS  
for a safer, better world

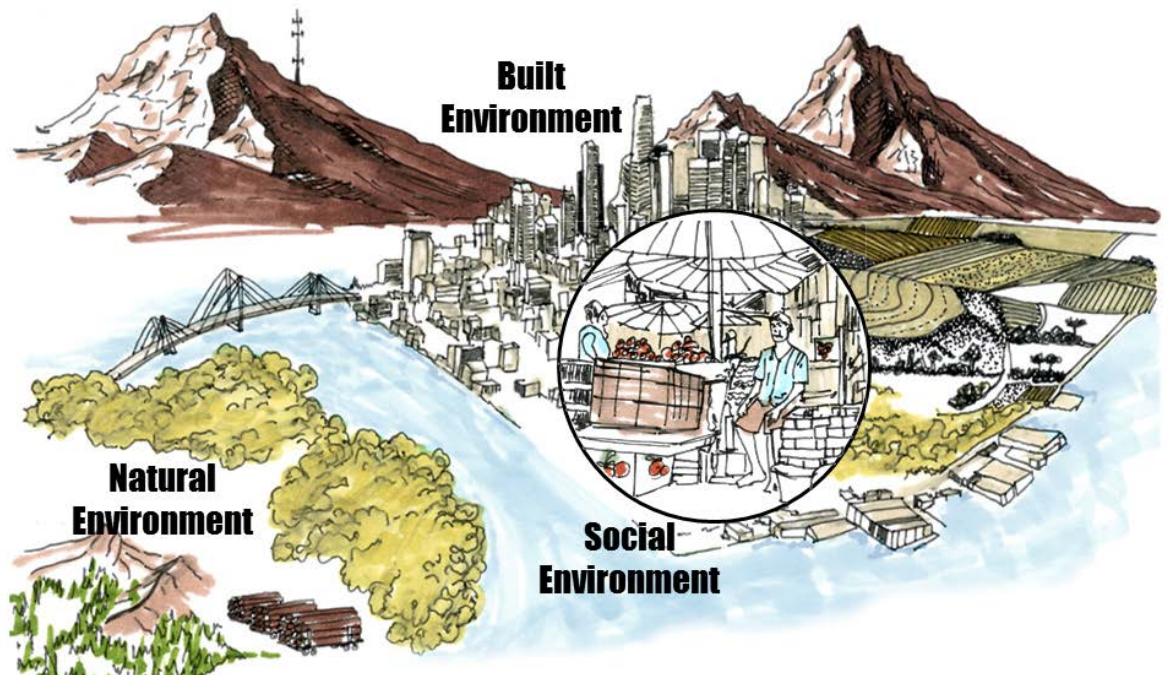
*Engineer Site Identification for the Tactical Environment (ENSITE)*

## **Proposal for Funding the ENSITE Project**

Under ERDC Environmental Quality & Installations and Geospatial Research and Engineering Business Areas

George W. Calfas

December 2017



**The U.S. Army Engineer Research and Development Center (ERDC)** solves the nation's toughest engineering and environmental challenges. ERDC develops innovative solutions in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, the Department of Defense, civilian agencies, and our nation's public good. Find out more at [www.erdcl.usace.army.mil](http://www.erdcl.usace.army.mil).

To search for other technical reports published by ERDC, visit the ERDC online library at <http://acwc.sdp.sirsi.net/client/default>.

## **Proposal for Funding the ENSITE Project**

Under ERDC Environmental Quality & Installations and Geospatial Research and Engineering Business Areas

George W. Calfas

*Construction Engineering Research Laboratory  
U.S. Army Engineer Research and Development Center  
2902 Newmark Drive  
Champaign, IL 61822*

Final report

Approved for public release; distribution is unlimited.

Prepared for Engineer Research and Development Center  
3909 Halls Ferry Rd  
Vicksburg, MS 29180-6199

Under ERDC Environmental Quality & Installations and Geospatial Research and Engineering Business Areas

## Abstract

Although the U.S. Army recognizes the importance of strategically siting its contingency bases (CBs), there remains a gap in capability to acquire, analyze, and understand implications and risks to site location and population response. CBs can be thought of as operating in an ecology that encompasses a local context comprised of physical, built environment, and sociocultural systems. The construction and operation of a CB can have local to global effects on the physical and sociocultural systems within this ecology. Having the capability to anticipate CB impacts during the site planning stage allows the military planners to consider the impacts that siting and operating a CB will have on the local context, and to consider the effects of the site on the operation of a CB. This proposal applies the principles of ecology and social impact assessment to develop a methodology that will be instantiated in a visualization system designed to inform a characterization and prioritization of the potential natural, physical, and sociocultural impacts of a CB's lifecycle upon the operational environment. ERDC capabilities also support integration of the ecological approach into existing tools, algorithm development, the development of software interfaces and toolkits, and the integration of open source data.

**DISCLAIMER:** The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. All product names and trademarks cited are the property of their respective owners. The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

**DESTROY THIS REPORT WHEN NO LONGER NEEDED. DO NOT RETURN IT TO THE ORIGINATOR.**

# Contents

<b>Abstract</b> .....	<b>ii</b>
<b>Preface</b> .....	<b>iv</b>
<b>Foreword</b> .....	<b>v</b>
<b>1 Strategic Siting of U.S. Army Contingency Bases</b> .....	<b>1</b>
1.1 Problem statement.....	1
1.2 Objective.....	2
1.3 Scope - Magnitude of the problem .....	3
1.3.1 Drivers/mission requirements .....	4
1.3.2 Army-unique nature of the problem .....	9
1.4 Advantages of this capability .....	10
1.5 Potential cost/benefit.....	12
1.6 Technology solution .....	13
1.6.1 Innovation level .....	16
1.6.2 Technology approach.....	17
1.7 Technical feasibility .....	20
1.8 Transition plan .....	21
1.9 Potential Army proponents.....	22
1.9.1 Opportunities.....	23
1.9.2 Execution potential .....	24
<b>References</b> .....	<b>26</b>
<b>Appendix A: Drivers/Mission Requirements</b> .....	<b>29</b>
<b>Appendix B: Endorsements</b> .....	<b>35</b>
<b>Report Documentation Page</b>	

## Preface

This work was originally prepared for the Board of Deputy Directors of the Engineer Research and Development Center (ERDC) as a proposal to receive competitive 6.2 funding under the Environmental Quality and Installations (EQI) and Geospatial Research and Engineering (GRE) business areas.

The work was performed by the Environmental Branch (CNE) of the Installation Division (CN), U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL). At the time of publication, Mr. H. Garth Anderson was Chief, CEERD-CNE; Mr. Donald K. Hicks was Acting Chief, CEERD-CN; and Mr. Kurt Kinnevan (CEERD-CZT) was the Technical Director for Adaptive and Resilient Installations. The Interim Deputy Director of ERDC-CERL was Ms. Michelle Hanson, and the Interim Director was Dr. Kirankumar Topudurti.

The Commander of ERDC was COL Bryan S. Green, and the Director was Dr. David W. Pittman.

## Foreword

This work was originally presented as a proposal to the Environmental Quality and Installations (EQI) and Geospatial Research and Engineering (GRE) business areas of the Engineer Research and Development Center (ERDC).

This report captures the original proposal's contents, with small editing and formatting changes made to meet ERDC publication style.

JEAN S. NOELLSCH  
Writer-Editor (CTR)  
Information Science and Knowledge Management (ISKM) Branch  
Information Technology Laboratory (ERDC-ITL)

(Intentionally blank.)



# **1 Strategic Siting of U.S. Army Contingency Bases**

## **1.1 Problem statement**

To sustain itself as the world's premier land power, the Army needs the capability to support expeditionary forces by projecting a minimal basing footprint with reduced logistical burdens. Strategically sited Contingency Bases (CB) allow the Army's expeditionary forces to rapidly respond and attack the enemy throughout the joint area of operations (JOA). "Strategic conditions will be analyzed through the lens of eight operational environment (OE) variables—political, military, economic, social, information, infrastructure, physical environment, and time (PMESII-PT)." [38] The Army has neither a well-grounded methodology nor the tools that enable this strategic decision making capability.

Decision makers require reliable information about the situational dynamics of the OE to anticipate the impacts that siting and operating CBs will have on the local context, and to consider the effects of the site on the operation of CBs. This capability to anticipate CB impacts on a local context becomes particularly important for engagement operations when CBs will have a longer duration of use and interaction with the local populace. Understanding of these potential impacts enables decision makers to evaluate implications of the effects of the CB lifecycle for commander's intent in the pre-operational planning stage.

Army doctrine published in 2013 (ATP 3-37.10, Base Camps) and the Initial Capabilities Document for Contingency Basing (CB ICD; Joint Capabilities Board [JCB] 2012) recognizes the importance of local population implications on CB site planning, design, construction, operation, and transfer or closure. The CB ICD identifies materiel capability gaps for planning, design, construction, and management of contingency locations, and the requirement to understand and avoid adverse impacts on local populations and cultural resources. ATP 3-37.10 establishes a doctrinal approach for base camp planning through the Military Decision Making Process (MDMP) and identifies the need for information on the local population effects on possible base camp locations, including laws, customs, practices, response, threats, infrastructure, potential work force, and

construction materials. As the CB ICD states, there remains a gap in capability to acquire, analyze, and understand implications and risks to site location and population response.

In the urban environment, local inhabitants will likely congregate on foot, in any manner of vehicles, and by means of the built infrastructure. For ease of movement and maneuver, CBs should be located at an opportune site where possible impediment from the population is lessened. ERDC-CERL has produced a variety of capabilities to inform route planning as well as understanding a location's infrastructure topology. However, how to obtain a clear understanding of when, where, why, and how people congregate, and how traffic flows manifest from stimuli and cultural events is less clear. Projects such as Violent Events Sociocultural Analysis (VESCA) and Phase Zero Assessment of Urban Security Threats utilize open-source data for geo-simulation of population characteristics at the sub-national level. However, this data is not being exploited to understand the dynamic situations that exist within urban morphologies. Understanding the dynamic nature of population as an obstacle to movement and maneuver is vital to the Army's ability to operate in dense urban environments.

CBs can be thought of as operating in an ecology that encompasses a local context comprised of physical, built environment,<sup>1</sup> and sociocultural systems. The construction and operation of a CB can have local to global effects on the physical and sociocultural systems within this ecology. Identifying the effects of a CB on a context and considering how these effects may play out in possible courses of action is analogous to the process of conducting an environmental or social impact assessment, and to the Army's Intelligence Preparation of the Battlespace (IPB) or the Joint Intelligence Preparation of the Operational Environment (JIPOE).

## 1.2 Objective

We propose to apply the principles of ecology and social impact assessment to develop a methodology that will be instantiated in a visualization

---

<sup>1</sup> The built environment refers to the buildings, infrastructure, and landscapes designed and constructed by humans.

system designed to inform a characterization and prioritization of the potential natural, physical, and sociocultural<sup>2</sup> impacts of the CB lifecycle on the operational environment.

### 1.3 Scope - Magnitude of the problem

Since 1991, the United States (U.S.) has engaged in numerous military operations in the Middle East, Central Asia, Africa, Europe, the Pacific Basin, and the Caribbean.

Most recently, the wars in Iraq and Afghanistan were protracted, and U.S. forces were deployed in these areas far longer than initially anticipated. U.S. ground forces will remain capable of full-spectrum operations, with continued focus on capabilities to conduct effective and sustained counter-insurgency, stability, and counterterrorist operations alone and in concert with unified action partners (DoD 2014). Army CBs support full-spectrum operations (FM 3.0 Operations),<sup>3</sup> within the Joint Operating Environment (JOE; JFCOM 2010)<sup>4</sup>. They also support other U.S. military (and multinational) forces that operate anywhere along the spectrum of conflict, from major combat operations, to stability operations, to military civil support/humanitarian operations in areas of stable peace.

A holistic and thorough understanding of the ecological system in the operational environment becomes more critical to military success as kinetic Army missions transition from Phase 0—Shape the Environment to Phase V—Enable Civil Authority (ECA), or as humanitarian assistance/disaster relief missions attempt to establish ECA. Army forces engage regionally to ensure interoperability, build relationships based on common interests,

---

<sup>2</sup> For the purposes of this proposed project, the term sociocultural is defined from an anthropological perspective as the social, cultural, economic, and political aspects of human society.

<sup>3</sup> The Army's operational concept is full-spectrum operations: Army forces combine offensive, defensive, and stability or civil support operations simultaneously as part of an interdependent joint force to seize, retain, and exploit the initiative, accepting prudent risk to create opportunities to achieve decisive results. They employ synchronized action—lethal and nonlethal—proportional to the mission and informed by a thorough understanding of all variables of the operational environment. Mission command that conveys intent and an appreciation of all aspects of the situation guides the adaptive use of Army forces. (FM 3-0 Operations).

<sup>4</sup> Joint Operating Environment examines three questions. What future trends and disruptions are likely to affect the Joint Force over the next quarter century? How are these trends and disruptions likely to define the future contexts for joint operations? What are the implications of these trends and contexts for the Joint Force? By exploring these trends, contexts, and implications, the Joint Operating Environment provides a basis for thinking about the world over the next quarter century. Its purpose is not to predict, but to suggest ways leaders might think about the future. (JFCOM 2010).

enhance situational awareness, assure partners, and deter adversaries. Because threats starting at low levels often gain strength and become more dangerous over time, Army forces engaged regionally are essential to the defense policy goals of shaping security environments and preventing conflict (Training and Doctrine Command [TRADOC] Pamphlet 525-3-1). If CB locations are selected, designed, constructed, operated, and closed or transferred with an awareness of their potential effects on sociocultural systems in the OE, CBs can become strategic tools for full-spectrum operations.

Inadequate tactical knowledge about the effects of CBs on the sociocultural conditions in the OE can lead to unintended consequences. These consequences may have impacts that extend to the global arena with the proliferation of social media and media attention. Several examples follow to illustrate the magnitude of unintended consequences that may occur from the effects of a CB on the OE throughout its lifecycle:

- **Site Selection** – CB located on top of a major, world-class cultural site such as Babylon.
- **Design** – CBs designed for transition to host nation being built to U.S. specifications and then later retrofitted to serve local practices.
- **Construction** – International companies are favored over local construction companies in building CB facilities because the internationals companies are familiar with the contracting process and have ready access to a labor pool and thus, Department of State (DoS) goals for building partner capacity are undermined.
- **Closure/transfer** – Multitude of CBs dismantled rather than reused by the local population.

For strategic planning, one needs to anticipate the impacts of CB at the tactical scale.

### **1.3.1 Drivers/mission requirements**

Future operations will require strategic and tactical maneuver capabilities of a predominately Continental U.S. (CONUS)-based military. The Army, as an agile military force, must be capable of reacting to global need in an expeditionary. In order to do so, the force must be able to establish intermediate support bases to project combat power across all domains. This project supports the growing need to project an expeditionary force and

meets the requirements of the national military strategies to support a deployed force for the next 20+ years (JFCOM 2010; DoD 2012, 2014; Joint Chiefs 2015; DoD 2014; JCB 2012; TRADOC Pam 525-3-1 2010; ATP 3-37.10 2016; TRADOC G-2 2012; TRADOC Pam 525-3-0 2012). Furthermore, this capability will allow for the optimal use of resources associated with CB operations.

The key concept is to develop the capability to provide the U.S. Army and Joint, Interagency, Intergovernmental, and Multinational (JIIM) organizations at all levels with the tools and processes that enable decision makers to assess the impacts of CBs proactively and to plan and design, construct or deconstruct, and operate and maintain CBs in ways that enhance mission accomplishment. This capability supports the operational mission by improving effectiveness, efficiencies, and sustainability. The current national strategies and JOE predict long-term military commitments abroad in order to achieve national goals. Specifically, this project directly supports Army DOTmLPP<sup>5</sup> Integrated Capabilities Recommendation for Base Camp Strategic Integration (JCB 2012), TRADOC Pam 525-8-5 (2014; U. S. Army Functional Concept for Engagement and Joint Concept for Entry Operations, Executive Summary), TRADOC Pam 525-3-0 (2012; Army Capstone Concept), and Army Intelligence: Focus Areas for Science and Technology (AUSA 2017).

Appendix A highlights some of these drivers and mission requirements by extracting pertinent sections of current doctrine.

As a result of the shift in enemy size and tactics, U.S. forces have become more agile and capable of deploying to any location to establish the means to conduct joint military operations successfully and then, retrograding to home station without the support of fixed installations. With the armed forces becoming more expeditionary in nature, a new dynamic force projection model is evolving to contend with uncertainty and to meet the many security challenges we face. As a result, the U.S. will require bases and stations within and beyond Western Europe and Northeast Asia, as well as temporary access arrangements for the long-distance deployment of U.S. forces (Obama 2015). The changes from how Cold War operations were carried out to how future missions are to be conducted are significant. However, there is one common thread between them—namely the

---

<sup>5</sup> Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, Facilities.

need to be able to position a military unit at any location with requisite operational support capabilities (U.S. Army 2008)

As the Army transforms, the power projection platforms from which the Army operates will also need to transform. Deployed forces will need to evolve into more self-sufficient organizations, and associated footprints will need to shrink accordingly (DoD January 2012). Based upon the Army Capstone Concept, strategic forces will be projected worldwide into any operational setting and will conduct operations immediately upon arrival (TRADOC Pam 525-3-0, Appendix B).

Expeditionary operations require the ability to deploy quickly to austere areas and shape conditions to seize and maintain the initiative. These capabilities will be resident in readily available and trained regionally and globally aligned Army forces. Properly sited CBs “will better enable an expeditionary Army to respond rapidly and attack simultaneously throughout the depth and breadth of a joint operations area (JOA) while diminishing enemy anti-access and area denial capabilities” (TRADOC Pam 525-3-0, Appendix B). Across the full spectrum of Army operations from Phase I--Deter to Phase V--Enable Civil Authority, the establishment of a military presence to support the mission will likely be a requisite to the capability to ensure the success of the overall mission. The capability to establish and provide base operations capabilities to support the operational army in a contingency environment has been identified by Army leadership as a crucial capability (Thurman 2008).

Stability operations are a core U.S. mission that the Department of Defense (DoD) must remain prepared to conduct and support. Stability operations are given priority comparable to combat operations and are to be explicitly addressed and integrated across all DoD activities including doctrine, organizations, training, education, exercises, materiel, leadership, personnel, facilities, and planning; most will require the siting of CBs (DoDI 3000.05).

The concept of sustainable lifecycles must be integrated into programs for planning, design, construction, operations and management of CBs. A multidisciplinary approach is necessary to conduct capability-based planning of future-force CBs and to “transition toward sustainability, improving society’s capacity to use the earth in ways that simultaneously meet the needs of a much larger but stabilizing human population, ... to sustain the

life support systems of the planet” (NRC 1999, 4) To meet the needs of the current and future force, contingency/expeditionary CBs and their systems are required to have all of these features (U.S. Army 2008; GAO 2009; Hager 2009; Dallal-Shwartz et al. 2009; ATP 3-37.10):

- modular,
- scalable,
- portable,
- versatile,
- cost effective,
- interoperable and interdependent with other U.S. Services (as well as other governmental agencies, allies or coalition partners), and
- employ sustainable processes and systems to the greatest extent practical.

The following areas were identified by the Army as part of their capabilities-based assessment for CBs (JCB ):

#### *1.3.1.1 Planning and design*

- Commanders at all levels require the capability for rapid, adaptive, and continuous planning of the life cycle of CB operations in a JIIM environment throughout full spectrum operations.
- Those planning CBs need to be linked with CB operations and management leadership to ensure operational needs are being met by the CBs that are being planned, designed, and constructed.
- Mission planning should incorporate CB operations planning at the earliest possible opportunity, to include war gaming and operational training. This step will allow and encourage the development of the capabilities to analyze 2nd and 3rd order effects to the three focus areas of planning/design, construction/deconstruction, and operations/management of CBs on the operational mission, which in turn, increases overall mission planning effectiveness.
- Planners (as well as operators and managers) of CBs should analyze, assess, and evaluate operational conditions in both real and virtual environments.

### *1.3.1.2 Construction and/or deconstruction*

- Construction/deconstruction needs to reflect mission requirements, the operational environment, the human domain, and availability of local materials and infrastructure related to plans, designs and standard operating procedures.
- Equipment capabilities necessary for CB construction and operations need to reflect the modular component requirements as well as have the ability to adapt to alternative construction capabilities to reflect the operational situation.
- Construction equipment requirements and capabilities practical for urban CBs will vary significantly with those associated with rural CBs. Construction equipment requirements for urban or rural CBs will also vary depending on the geographic location, terrain, climate, and weather.
- The ability to simulate the impact of the operational environment is critical to understanding the limiting factors that CB construction or deconstruction and facility maintenance have on mission dynamics.

### *1.3.1.3 Operations and management*

- Base camp commanders in a JIIM environment that is supporting full spectrum operations require the capability and authority to command and control CB operations, enabling the operational commander(s) and staff to focus on the operational mission with increased flexibility and less distractions.
- Trained personnel will be required to manage and operate CBs in a JIIM environment. The capability to provide both institutional and mobile on-site operating and management training will be essential to support the mission. Onsite training may be necessary should institutionally trained personnel be unavailable or if augmentation to CB operations is required.

### *1.3.1.4 Timeliness considerations*

The risk in not developing a geospatially referenced decision support tool to address the complex ecological system within the operational environment as it relates to the CB lifecycle is that the Army will continue to develop CBs without a holistic perspective on the area of operations. Use of local and U.S.-provided resources will not be optimized and thus, significant amounts of limited resources will be wasted. Current designs do not



emphasize self-sufficiency, despite the obvious benefits to force and operational protection that are associated with a reduced logistics footprint. By not developing a capability to identify the strategic implications of CB site selection, design, construction, operation, and closure or transfer, the Army will (1) continue to develop CB on an ad hoc basis; (2) persist in propagating unintended impacts on the local population that do not support the mission, particularly with regard to Phase 0 operations; and (3) reduce the overall effectiveness of the force at a time when declining budgets already make maintaining effectiveness a significant challenge.

### **1.3.2 Army-unique nature of the problem**

The Army is the land military operations agent for the U.S. Armed Forces. The new strategic context of persistent conflict renders obsolete the old Army paradigm of “tiered readiness.” Expeditionary capability is the ability to promptly deploy combined-arms forces worldwide into any operational environment and operate effectively on arrival (TRADOC Pam 525-3-1 2010). The Army now requires units that are trained, equipped, organized, and postured for such rapid global deployment in response to the full spectrum of conflict. To achieve this capability, the Army is developing modular forces and a process of Army Force Generation to provide combatant commanders and civil authorities with rapidly deployable, employable, and sustainable force packages tailored to specific mission requirements. Future expeditionary operations will require regional Intermediate Staging Bases to facilitate joint operations and projection of national power (TRADOC PM 525-8-5). The Army needs the capability to plan, design, and construct, deconstruct, operate, manage, and assess CBs in order to maximize the combat effectiveness of deployed forces (DODI 3000.05, U.S. Army 2008, FM 3-0, Aall et al. 2000, DoD 2012, Joint Chiefs 2015, Obama 2015, DoD 2014, Thurman 2008, U.S. Army 2013, ATP 3-37

Based on the Army Capstone Concept, strategic forces will be projected worldwide into any operational setting and will conduct operations immediately upon arrival (TRADOC Pm 525-3-0).

Expeditionary operations require the ability to deploy quickly to austere areas and shape conditions to seize and maintain the initiative. In order to conduct expeditionary operations in often austere conditions, the force needs an appropriately sited CB to project the deployed force (TRADOC

Pm 525-3-0). The Army has established a requirement to develop technologies that will enable automated and autonomous ground and air resupply.

These technologies minimize the logistical footprint, reduce risk to Soldiers, and preserve freedom of maneuver and action. Production at the point of need, such as water generation, increases operational availability and reduces the need for intermediate staging bases (TRADOC Pam 525-3-1 2010).

While CBs are often equated to CONUS installations or small cities, there are significant and distinct differences. Contingency bases may have the following conditions:

- They may utilize pre-existing structures or start from nothing.
- They can expand and contract rapidly.
- They must be operated in hostile environments.
- They may operate with little or no externally supported infrastructure or utilities.
- They often operate with little or no continuity of personnel in key positions.
- They may operate for indeterminate lengths of time.
- They will certainly be located in a multitude of varying climates and geographical locations, with missions that are both dynamic in terms of size and nature of operations.

However, with an investment of research dollars, we can usefully leverage technologies currently available to city planners to address these issues.

#### **1.4 Advantages of this capability**

This project will develop a contingency site selection process that does not currently exist for mission planners. The more efficient siting of CBs will assist in the reduction of materiel demand, footprint, and reduce risk to Soldiers, as well as preserve freedom of maneuver and action. ENSITE will enable expeditionary planning to occur prior to deployment. ENSITE's proposed capability will inform real estate decisions made between the U.S. and a host nation during Phase 0 operations. Its tactical applications will provide the combat commanders with insight into a region prior to engaging in kinetic Phase 2–4 operations. An ecological approach will allow a holistic analysis of potential CB sites within operating environments and

provide information for more realistic mission planning scenarios. It will enable military planners to foresee potential impacts to operational effectiveness due to location, duration, size (area and population), component systems to be employed, personnel requirements, use of resources, effects on sociocultural context, and changes in mission.

A geospatial decision support tool that integrates the operational environment into considerations for CB design can also be used to train future planners, designers, builders, operators, and managers of CBs. Given a capability to display real-time effects that flow from parametric changes, instructors would have the means to prepare students for both expected and unexpected operational situations once they are deployed. This resource would also provide CB operators and managers with a tool to assist in the analysis of their camps' operational effectiveness as well as to test potential operational/design outcomes that are based on available local resources and sociocultural impacts prior to initiating them in practice. The ecological approach that takes into account the physical environment, access to locally procured materials, and sociocultural context increases the likelihood that reliable system impacts will be identified including any 2nd, 3rd, and 4th order effects. In sum, these capabilities provide the combatant commander with force-multiplying effects, as outlined below (JCB 2012):

- Reduced threat due to a smaller logistics footprint needed to maintain the same level of operational capabilities and readiness (access to local water = less water shipments).
- Decreased transition/deconstruction requirements (time, material, equipment, personnel) by utilizing local designs and materials for construction.
- Improved operations management through access to infrastructure, local materials, and labor.
- Reduced logistics cost due to access to locally procured material or infrastructure.
- Increased force protection based on reduced initial entry troop-to-task events.
- Decreased construction operations and maintenance costs over time.
- Reduced unintended consequences of CB operations on the local sociocultural context due to improved awareness of potential impacts of CB on the overall ecology.

## 1.5 Potential cost/benefit

The potential monetary savings associated with this capability is in the 100s of millions of dollars. These savings can be realized through understanding the physical environment of weather and terrain, access to local resources (e.g., water, roads, fuel, power), improved operational training, improved camp operational effectiveness and efficiencies (due to integrated ecological approach across the Joint community), ability to conduct operational simulations, and forecasting prior to deployment.

The magnitude of the potential savings can be illustrated by looking at the possible impacts on the Force Provider System.<sup>6</sup> It has been established that the logistics support for a 600 man Force Provider System, which represents the life support area (housing, foodservice, showers and latrines, laundries, and some medical capabilities) only, is between \$40 million and \$80 million per module per year. [15]<sup>7</sup> Also, these costs do not reflect the requirements of civilian support and their sustainment criteria.

Using the costs of the life support area, and assuming access to local materials and/or resources, operational costs could decrease by 5%–10%. If the geospatial decision support tool were to identify materials that can be acquired rather than shipped to the operational environment, the expected savings could be \$2 million to \$4 million per 600 man unit per year.

Assuming that 5,000 Soldiers are deployed per Brigade Combat Team (BCT) (3,500 per Brigade plus 1,500 in augmentation units) with an equal number of Civilians, then the potential saving (based on 10,000 personnel) would be between \$34 million and \$67 million per year per BCT. The Iraq and Afghanistan missions required 24 BCTs. The savings associated with this level of effort would be \$800 million to \$1.6 billion. The FY2010

---

<sup>6</sup> The Force Provider is a transportable system that provides housing and operation space for a CB for a variety of military missions, ranging from support of a small military outpost to -fully operational, forward-deployed CBs and airbases. The system is a combination of military and commercial products that provide climate-controlled billeting; quality dining facilities; hygiene services; and morale, welfare, and recreation facilities for deployed troops. It is important to note that the Force Provider System does not represent all systems within a CB.

<sup>7</sup> It is important to note that these numbers do not reflect the costs associated with tactical operations or other CB essential operations such as: running the tactical operations center, base defense, base security (entry control points, perimeter lighting, sensors, etc.), base-wide waste management (solid waste, sanitary, hazardous, other), base-wide water management (generation, distribution, storage), base-wide power management (generation, transformation, storage, distribution, controls), warehousing, class IV yards, maintenance facilities, larger dining facilities, communications facilities, medical facilities, administrative offices, and so on.

war request totals \$139 billion, including \$130 billion for DOD for both wars, \$6.4 billion for the DoS's foreign and diplomatic operations, and \$2.1 billion for VA medical costs for OEF and OIF veteran. A 5% improvement in the \$130 billion would result in savings on the magnitude of \$6.5 billion (Krooks et al. 2012).

## 1.6 Technology solution

We propose to research how to develop the assessment methodology for CB site selection, design, construction, operation, and closure or transfer so that the potential impacts of the lifecycle of a CB are taken into account in the mission planning process before CBs are placed on the landscape. Our methodology will be instantiated in a semi-automated decision support tool similar in concept to the "Zillow" application for potential home buyers and renters. Our tool will allow the planner to develop and assess scenarios associated with CB planning and design by not only using design requirements but also by incorporating construction and deconstruction, operations and management, and the potential sociocultural impacts of those processes.

With such a tool, planners (as well as designers, operators, and managers) can rapidly assess possible current and future situations to provide proactive operational control and timely alternative situational analysis while deployed, or to simulate operational responses as part of their training programs. Improvement of the assessment methodology involves the following tasks:

- Developing a conceptual framework to represent the potential impacts of the CB lifecycle on the local context. The framework will include:
  - Physical environmental resources that could reduce logistics during the CB lifecycle,
  - Built environment attributes that could enhance mission effectiveness, and
  - Sociocultural attributes that are affected by the CB lifecycle and in turn, affect mission effectiveness.
- Identifying the appropriate data for measuring these impacts.
- Determining how to measure these impacts, both qualitatively and quantitatively.
- Applying this conceptual framework to evaluate the positive and negative influences on commander's intent of taking various courses of action regarding the lifecycle of a CB.

- Making this methodology and the data that support it accessible to the user.

Our methodology for developing the conceptual framework will be informed by two phases of the social impact assessment process, i.e., characterization of the baseline and consideration of the impacts of change on the baseline (Vanclay and Esteves 2011a, 2011b). Characterization of the baseline entails the development of a description of the context in which the CB will be located. According to principles of social ecology, context includes a consideration of the social, historical, cultural, and institutional aspects of people's lives, and the flow of everyday life (Taylor 2018). To be relevant to the proposed project, we would extend this definition of context to include the physical and built environment, and the political and economic aspects of people's everyday lives.

Development of the baseline characterization resembles the analysis of a situation, which is a process familiar to military analysts when they conduct an assessment for the Army's IPB- or the Joint Forces' JIPOE-. A framework is needed to orient the identification of the relevant attributes within an operational environment. For example, in the case of IPB or JIPOE, analysts employ the framework of PMESII-PT for analysis. In the practice of social science, a framework is organized with reference to the problem to be addressed (Ravitch and Riggan 2012). Our problem is two-pronged: (1) how does a CB function in the ecology of the operational environment throughout its lifecycle, and (2) how do we determine the positive and negative effects on the mission of a CB as it functions?

Research conducted for a Center for the Advancement of Sustainability Innovations (CASI) white paper (Krooks et al. 2012), and during Dr. Calfas' CERL-funded ORISE internship indicate that a framework for characterization of the lifecycle function of a CB includes the following questions:

- Where do we build it?
- What resources are locally available?
- What infrastructure is locally available?
- What do we build?
- How do we build it?
- How do the operations of a CB affect the daily life patterns of a population?
- What is the potential for reuse of buildings and infrastructure?

Our technical solution will include these questions in a framework organized to enable users to think through the characterization of the ecology of the OE for which a CB is planned. The framework thus enables the development of a baseline characterization of the OE.

The second step is to use that baseline characterization to forecast potential impacts of CB lifecycle function on its context, that is, the operational environment. In our consideration of impacts, we will gain an ecological perspective on the OE by including a “social” lens. The introduction of a CB into a local ecology is a social act that exploits physical resources controlled by a community or a nation state; it also has impacts on the indigenous built and sociocultural environments. Our tool will enable consideration of all these factors, and it will thereby give the commander a holistic perspective on the OE.

Therefore, the principles of social impact assessment (SIA), as they evolved in the early 2000s, are apropos to our effort. SIA provides understanding about the social impacts of a proposed action so that policy makers can maximize positive effects and mitigate negative effects on communities and regions (Vanclay and Esteves 2011b; Sairinen 2009) . In our case, we want to identify the range of relevant variables that should be considered when evaluating the impacts of the CB lifecycle on the ecology of the operational environment. Our goal for the framework is to develop a product comparable to what can be seen in Turnley’s (2002) list of social impact indicators for organizing an SIA.

Our intent is for the conceptual framework to function as the driver for identifying variables relevant for assessing the impacts of the CB lifecycle on the ecology in the OE. To complete the assessment process, our methodology will include a means to evaluate the relative importance of these impacts with respect to achieving the commander’s intent for a mission. Turnley’s (2002) review of SIA indicates that the following attributes are used to evaluate the importance of the social impacts of an undertaking:

- First-, second-, n-order impacts
- Duration
- Intensity as a function of time
- Intensity as a function of geography
- Intensity as a function of social dispersion
- Potential for reversibility

Our research will determine what criteria are useful for evaluating the importance of impacts that are necessary for achieving the commander's intent.

We will seek to instantiate our methodology in a prototype decision support tool so that it seamlessly integrates with existing design tools for CB, leverages the decision support capabilities of existing ERDC tools, and is compatible with the military mission analysis process. The primary functional requirements for our tool (derived from ATP3-37.10), are that it performs the following functions:

- Provides high-level categories of impacts from which an analyst can identify a set of impacts that are necessary and sufficient for understanding the lifecycle effects of a CB in a specific context.
- Lays out a set of principles for the selection of specific impacts.
- Provides a method for evaluating the effects of specific impacts on a commander's intent.
- Integrates well with the strategic planning process and course of action (COA) analysis.

### **1.6.1 Innovation level**

There is little understanding of the natural, physical, and sociocultural environmental impacts of the CB lifecycle in their local-to-global context. These types of impacts are generally described in anecdotes associated with journalists' analyses of the situation in theater. This genre of literature focuses on describing the perspective of those experiencing the impacts rather than presenting the impacts in a holistic ecology from a functional, systems view. Army environmental assessment efforts in theater concentrate on describing and evaluating impacts of Army actions on the physical environment and its natural resources. There is no methodology available to the Army that enables (a) the evaluation of the interactions between the physical and sociocultural environment as impacted by the CB lifecycle, (b) how these impacts can support CB and mission objectives, or (c) consideration of the magnitude of influence of these impacts on mission effectiveness.

Our proposed tool gives a more comprehensive approach to strategic CB site selection, design, construction, operation, and closure/transfer that is based on tactical level knowledge of the impacts of the CB lifecycle on context. The capability that we propose currently does not exist for the Army.



Our proposed solution is a unique application of the principles and protocols for social impact assessment and an innovative ecological approach to the analysis of interactions between the physical- human domains.

### **1.6.2 Technology approach**

The goals of the applied research to be conducted in this proposed project are to instantiate the methodology in a prototype decision support tool so that it seamlessly integrates with existing design tools for CB, leverages the decision support capabilities of existing ERDC research efforts, and is compatible with the military mission analysis process. The development of this tool has five major tasks.

**Task 1:** Develop the conceptual framework by determining the variables associated with the physical, built, and sociocultural environments that are relevant for assessing the impacts of the CB lifecycle on the OE when viewed holistically. The CB lifecycle refers to the process of site selection, design, construction, operation and management, and closure or transfer of a CB. The determination of variables to include in the framework will be based on prior research for “Contingency Bases and the Problem of Sociocultural Context” (Krooks et al. 2012), the ORISE internship served by Dr. Calfas, and the ongoing 6.2 Geospatial Research and Engineering (GRE) Human-Infrastructure System Assessment (HISA) for Military Operations, Geospatial Analysis at the Tactical Edge, Violent Events, and and Phase Zero Assessment of Urban Security Threats. Variables will also be determined by a survey of relevant social science literature and case studies. In developing this framework, we will apply the internationally recognized protocol and principles for SIA, as published in Becker and Vanclay 2003 and Vanclay and Esteves 2011b. Our framework will be comprised of impact variables to consider when making CB lifecycle design decisions.

**Task 2.** Develop a method for determining the relative importance of the impacts of the CB lifecycle on the operational environment as they relate to the achievement of commander’s intent. Decision makers need to be able to assess and prioritize the potential effects on the commander’s intent of the impact variables that interact with the CB lifecycle. This method will involve the ability to weight the importance of relevant variables for achieving commander’s intent relevant to potential alternative courses of action.

**Task 3.** Identify local population site planning information requirements that may currently be available from prior and current GRE work packages and establish a collaboration link to ENSITE. ENSITE will develop a methodology that will characterize when and where people are likely to congregate and move, and establish risk factors, such as cost and capacity surfaces to site planning and base camp purpose.

ENSITE will apply a theoretical paradigm of anthropology and sociology to forecast potential locations of social gathering and moving. These academic fields bring to bear contemporary ethnographic information regarding a particular location, and the nuanced actions taken by agent and actors. Ethnographic data sources will be compiled to define the dynamic relationships that exist between and within urban subpopulations.

It should be noted that ethnographic data is the backbone of anthropology and sociology, but it is currently not utilized in ERDC-based research efforts.

It should also be noted that once established, the CB becomes an “urban attractor” or “center of gravity” that will provide the local population a locus to congregate. Part of selecting an opportune CB site is understanding how the influx of American forces will alter the location’s population and, if planned for in advance, knowing chaotic situations can be avoided.

To accomplish the task of site selection, ENSITE will identify answers to the following questions:

- When do people occupy these places and in what density—during the daily routine or, if seasonal, as a result of some cycle of migration?
- Where and under what circumstances (e.g., riots, protests, parades, pilgrimages, gang wars, markets, Sunday in the park) do people congregate for special events?
- Where are the urban growth areas?

**Task 4.** Design and build the prototype for the decision support tool. The output of Tasks 1 and 2 will reveal causal or conceptual linkages between the CB lifecycle and the OE as viewed holistically, and it will reveal their positive or negative, and direct or indirect impacts on commander’s intent. The goal of Task 4 is to utilize the results of the impact assessment developed in Task 1 and Task 2 to inform CB design decisions.

The mechanism for informing design decisions is to build a decision support tool as a module added to ERDC's Virtual Forward Operating Base (VFOB) suite of tools to correctly plan for ideal building materials and evident contingency site closure. The current VFOB tool supports the design of CBs after the location has been selected. However, our proposed project can leverage existing mechanisms in VFOB to enable site selection itself. To do this, it will query the user/CB designer about the mission, location, and other operational variables that together form the CB system's requirements. For example, VFOB represents existing standards for base camp design and operations, lifecycle design decisions, and commander's intent regarding CB functionality.

Environmental data analysis can be accomplished by leveraging ERDC's Army Terrestrial-Environmental Modeling and Intelligence System (ARTEMIS) for climatic considerations.

We will additionally utilize output from Task 1 to identify the types of additional design scenario variables that relate to the social, cultural, economic, and political conditions (contexts) into which the prospective CB is to be inserted and communicate these variables to the decision support tool. We will use the output from Task 2 to define the relevance of the available objects within the ecosystem and apply a mathematical weighting algorithm to quantify a total assessment metric. Finally, we will encode the algorithms that consider both CB system requirements and operational context, and translate these into actionable recommendations or lists of considerations that support CB design decisions.

**Task 5.** Conduct a test of our assessment methodology by using two different scenarios of CB site selection. Conducting these scenarios will function as training events for the application of the methodology in that it will point to what works and what needs more research, and how to best represent it in the tool. One scenario could describe a more kinetic situation in which a shorter-term engagement would result in logistical and force protection requirements being more of a priority than building relations with the local population.

Another scenario could describe a situation in which a longer-term engagement for a civil-military or humanitarian assistance or disaster relief (HA/DR) operation would result in impacts to social, cultural, economic, and political conditions that could directly influence mission success. We

will show how impact assessment can be enhanced with the use of quantitative and qualitative modeling that employs open source data.

The intent is to display the output of this project in a geospatially enabled collaborative mission planning environment—supplying capabilities for service, data, and information to Army planners, staffs, and leaders. The Map Based Planning Services (MBPS) project, currently under development as an ERDC business area, will allow for mission planning capabilities with respect to collection, processing, storing, displaying, and sharing authoritative data/information in a map environment. Work will leverage the Army Geospatial Enterprise (AGE) and incorporate ERDC-developed Geo-Enabled Mission Command Enterprise tools and analytical capabilities.

## **1.7 Technical feasibility**

In developing the conceptual framework for assessing the impacts of the CB lifecycle on the ecology of the OE, we will apply the principles and protocols of SIA. For example, during FY 14, in conjunction with the 6.2 HISA project, we applied these principles and protocols to the problem of assessing the sociocultural impacts of the function of infrastructure when the Army decides to destroy, preserve, or rebuild infrastructure in the OE. We developed an SIA framework that follows the internationally recognized protocols for social impact assessment (Turnley 2002), which is similar in concept to what we are planning to do in this proposed project.

In developing our method for determining the importance of impacts of CB lifecycle design decisions on commander's intent, we will investigate how such weighting is accomplished in environmental and social impact assessment and other assessment systems as well as rely on the computational expertise of team members to craft a solution appropriate for our problem. In creating the rationale and mock up for the prototype decision support tool, we will leverage criteria for commander's intent and standards for CB design and operations from VFOB and from team experience with programming for tool development. For the two training scenarios that are discussed in Task 4 above, we will use available open source data. In previous 6.2 research projects, we explored how to exploit open source data to solve a variety of Army problems such as monitoring changes in types and levels of conflict in urban neighborhoods, modeling food security, creating a knowledge map of social science literature on insurgency,

and assessing urban security challenges and the impacts to the sociocultural function of infrastructure when it is destroyed, preserved, or rebuilt in the operational environment.

None of these issues are beyond the feasible capability to complete. What is needed is a concerted effort to understand the pertinent systems and their interdependencies in order to establish the degree of dampening or enhancing effects that each system might exert. Once these effects are established, the work of creating the algorithms that represent the integrated complex adaptive system can move forward.

## **1.8 Transition plan**

The ERDC research portfolio has developed numerous resources for military planners to utilize. The databases incorporated in these ERDC projects can be utilized as inputs or output sources for ENSITE. To eliminate duplication of efforts, the ENSITE team has contacted program managers to discern database structures that research team members that can utilize during ENSITE development. The following ERDC projects have been contacted during the initial planning phases of ENSITE development: VVFOB, Engineer Tool Kit, Geospatial Analysis at the Tactical Edge (GATE), HISA, MPBS, Phase Zero Assessment of Urban Security Threats, and Spatial Analysis for Humanitarian Assistance Resource Allocation (SAHARA).

Additionally, the project team has been in contact with Army communities of practice and centers of excellence in an effort to understand the warfighter's needs. Currently the project has garnered endorsements from the Maneuver Center of Excellence (MCoE), Maneuver Support Center of Excellence (MSCoE), Army Facilities Component System (AFCS), Program Manager for Force Sustainment Systems, and Program Manager for Force Sustainment (see Appendix B for example endorsements). These organizations will be engaged throughout the research project and are viewed as consumers of the products developed throughout the course of research.

The project team has also initiated conversations with Pacific Command and Europe Command; both of these organizations have expressed a need for a CB site selection tool, and they likely have current data and resource needs that will allow for immediate acceptance by the warfighter community. These interactions will allow for spiral transition, and targeted opportunities to be considered are as follows:

- User tool kits for developing an integrated ecological approach.
- Alpha testing with user groups.
- Algorithmic relationships scaled for use for smaller encampments or larger theater wide applications.
- Use of algorithms in training efforts for CB planning, design, operations and management.
- Development of an online application, downloadable application, or online links to established databases for component system models.
- Development of open source capability such that impacts on the ecological approach from other sources can be included (environment, economics, cultural and political, etc.).
- Interaction with other military services (e.g., U.S. Air Force and U.S. Marine Corps) and other governmental organizations (e.g., Department of Homeland Security [DHS], Federal Emergency Management Administration [FEMA], and Department of State - United States Agency for International Development [USAID]).

Once funded, the project manager will continue to engage with Army and Joint Organizations; those currently on the action list are as follows:

- AFCS
- TRADOC (Combined Arms Center [CAC], MSCoE)
- Installation Management Command (IMCOM)
- U.S. Army Corps of Engineers (USACE)
- Army Reserves
- National Guard Bureau
- Army Component Commands
- Army Modeling and Simulation Office
- Joint Forces Command
- Joint Operations Engineer Board

The integration of varied technologies into coherent systems that are interconnected in a network brings with it an immense potential for creating new spin-off products (Dallal-Shwartz et al. 2009).

## **1.9 Potential Army proponents**

Army proponents for this geospatial decision support tool are G-4 at the executive level and MSCoE (through TRADOC) for the requirements and capability levels. Acquisition community organizations as well as other research organizations will also benefit from this technology as it will allow

them to perform system analysis on new component systems and determine impacts on the CB as a whole. Army Facilities Component System, U.S. Army Reserves - Regional Support Groups as well as the Army Service Component Commands (ARCENT, USAEUR, USARAF, USARNO, USARSO, USARPAC)<sup>8</sup> will be end users of this technology in support of mission training, planning and operations, and new component system analysis. Joint Command and the Combatant Commands (CCMDs) would have similar uses for this technology.

### **1.9.1 Opportunities**

The following are organizations most likely to be engaged for support and long-term operations:

- AFCS
- TRADOC (CAC, MSCoE)
- MCoE
- Intelligence Center of Excellence (ICoE)
- Army Reserves and National Guard Bureau
- G-4 (Logistics)
- Assistant Chief of Staff for Installation Management (ACSIM)/IMCOM
- Program Executive Office, Combat Support & Combat Service Support (PEO CS&CSS)
- USACE
- Project manager of Force Sustainment Systems Program Directorate, Contingency Base Integration
- Research, Development and Engineering Command (RDECOM)

Army Headquarters (HQDA) Department of the Army Management (DAMO) Special Security Office (SSO) G3/5/7 may be an avenue for additional funding once initial modeling and simulation capabilities knowledge is identified and established as a resource ready for exploitation.

IMCOM has expressed interest in the capability to model forward CBs in order to address operating requirements for training, planning, and management purposes. Funding may be available once the operational concept is demonstrated. Interaction will be through the CB operations working

---

<sup>8</sup> U.S. Army Central Command, U.S. Army Europe Command, U.S. Army Africa, U.S. Army Northern Command, U.S. Army Southern Command, and U.S. Army Pacific Command.

group initially and will follow on with the organizational structure being developed by IMCOM to address CB camp operations.

U.S. Army Reserves have developed Regional Support Groups to provide operational management for CB operations for IMCOM. Their personnel will need training tools and operational decision-making tools that address CBs from an integrated ecology software tool.

USACE designs CBs and trains personnel to plan, design, build, operate, and manage them. The Joint Construction Management System (JCMS) that USACE manages through the AFCS would be further enhanced by the technology that presents CB operations as integrated, complex, adaptive systems. The decision-making capability that this algorithm provides would be useful in future CB designs and scheduling of materials.

### **1.9.2 Execution potential**

ERDC has the in-house expertise to analyze the natural, physical, and sociocultural ecology and to conduct the necessary analysis of their interrelationships. Additionally, ERDC supports software development and this project will utilize staff from the Information Technology Laboratory (ITL) and Geospatial Research Library (GRL) offices. Integration of the ecological approach into existing tools, algorithm development, the development of software interfaces and toolkits, and the integration of open source data may require specific support. Additional support will be handled in a combination of the following four ways:

1. Hiring personnel with specific skill sets.
2. Partnering with other laboratories.
3. Partnering with academic institutions.
4. Contracting specific services.

Technology development partners and agents include the following:

- AFCS
- Assistant Secretary of the Army (Installations, Energy, and Environment (ASA(IE&E))
- Assistant Secretary of the Army (Acquisition, Logistics, and Technology (ASA(AL&T))
- PM Force Sustainment Systems



- TRADOC (Army Capabilities Integration Center [ARCIC], CAC, MScOE)
- Army Reserves
- National Guard Bureau
- OACSIM/IMCOM
- University of Illinois Urbana-Champaign (visualization, geology, geography, anthropology, sociology)

## References

- Aall, Pamela, LtCOL Daniel Miltenberger, and Thomas G. Weiss. 2000. *Guide to IGOs, NGOs, and the Military in Peace and Relief Operation*. Washington, DC: United States Institute of Peace Press.
- ADRP 3-0. Unified Land Operations. Army Doctrine Reference Publication Washington, DC: Headquarters, Department of the Army.
- ATP 3-37-10. 2016. Base Camps. Army Techniques Pamphlet. Washington, DC: Department of the Army.
- AUSA. April 2017. *Army Intelligence: Focus Areas for Science and Technology*. ILW Spotlight 17-1. Arlington, VA: Association of the United States Army (AUSA), Institute of Land Warfare.
- Becker, Henk A., and Frank Vanclay, eds. 2003. *The International Handbook of Social Impact Assessment: Conceptual and Methodological Advances*. Northampton, MA: Edward Elgar Publishing, Inc.
- Dallal-Shwartz, I., A. Notea, and G. Rabinowitz. 2009. “‘Fan-Out’ Model and Methodology for ‘System of Systems’ Development,” Presented at 3rd Annual IEEE International Systems Conference (IEEE SysCon 2009) held March 23–26 in Vancouver, Canada.
- DoD. Jan. 2012. *National Defense Strategy*. Washington, DC: Department of Defense.
- \_\_\_\_\_. March 2014. *Quadrennial Defense Review (QDR)*. Washington, DC: Department of Defense, Office of the Secretary of Defense.
- GAO. Feb. 2009. DEFENSE MANAGEMENT: DOD Needs to Increase Attention on Fuel Demand Management at Forward-Deployed Locations. GAO-09-300. Report to the Subcommittee on Readiness, Committee on Armed Services, U.S. House of Representatives. Washington, DC: U.S. Government Accountability Office.
- DoDI 3000.05. 2009. Stability Operations. Department of Defense Instruction. Washington, DC: Department of Defense.
- FM 3-0. . 2017. Operations. Field Manual. Fort Eustis, VA: Combined Arms Doctrine Directorate of U.S. Army Training and Doctrine Command Mission Command Center of Excellence.
- Hager, LTC Daryl P. 2009. “PM Force Sustainment Systems.” Presented to the IMCOM Northeast Region Garrison Commanders Conference, 01 April.
- JCB. August 2012. Initial Capabilities Document (ICD) for Contingency Basing. Catalog of Approved Requirement Documents (CARD) #16155. Washington, DC: Department of Defense, Joint Capabilities Board.
- JFCOM. Feb 2010. Joint Operating Environment (JOE). Hampton Roads, VA: U.S. Joint Forces Command.

- Joint Chiefs of Staff. June 2015. *The National Military Strategy of the United States of America*. Washington, DC: U.S. Department of Defense.
- Krooks, David A., Lucy A. Whalley, and H. Garth Anderson. 2012. "Contingency Bases and the Problem of Sociocultural Context." White Paper for ERDC's Center for the Advancement of Sustainability Innovations (CASI). ERDC/CERL TN-12-2. Champaign, IL: ERDC-CERL. <http://www.dtic.mil/dtic/tr/fulltext/u2/a568613.pdf>.
- NRC (National Research Council) Policy Division Board on Sustainable Development. 1999. *Our Common Journey: A Transition Toward Sustainability*. Washington, DC: National Academy Press.
- Obama, President Barack. Feb. 2015. *National Security Strategy*. Washington, DC: Office of the President.
- Ravitch, Sharon M., and Matthew Riggan. 2012. *Reason and Rigor: How Conceptual Frameworks Guide Research*. Thousand Oaks, CA: SAGE Publications, Inc.
- Sairinen, Rauno. 2009. Social Impact Assessment for Environmental Disaster Management. In *Building Safer Communities: Risk, Governance, Spatial Planning and Responses to Natural Hazards*, edited by Urbano Fra Paleo, NATO Science for Peace and Security Studies E: Human and Societal Dynamics, Vol. 58:137–147. Washington, DC: IOS Press.
- Taylor, Dave. 2018. "Conceptual Social Ecology, School of Social Ecology." Irvine, CA: University of California, Irvine. <http://socialecology.uci.edu/pages/conceptual-social-ecology>.
- Thurman, LTG James D. 2008. *Stability Operations in an Era of Persistent Conflict*. Washington, DC: Department of the Army, Deputy Chief of Staff, G3/5/7.
- TRADOC G-2. Aug. 2012. *Operational Environments to 2028: The Strategic Environment for Unified Land Operations*. Fort Eustis, VA: U.S. Army Training and Doctrine Command, G2.
- TRADOC Pamphlet 525-3-0. Dec. 2012. *Army Capstone Concept*. Fort Eustis, VA: U.S. Army Training and Doctrine Command.
- TRADOC Pamphlet 525-3-1. 2010. *The U.S. Army Operating Concept: 2016–2028*. Fort Eustis, VA: U.S. Army Training and Doctrine Command.
- TRADOC Pamphlet 525-3-6. Feb. 2017. *US Army Functional Concept for Movement and Maneuver: 2020–2040*. Fort Eustis, VA: U.S. Army Training and Doctrine Command.
- TRADOC Pamphlet 525-8-5. Feb. 2014. *U.S. Army Functional Concept for Engagement*. Fort Eustis, VA: U.S. Army Training and Doctrine Command.
- Turnley, Jessica Glicken. 2002. "Social, Cultural, Economic Impact Assessments: A Literature Review." Prepared for The Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. Albuquerque, NM: Galisteo Consulting Group.

U.S. Army. 2008. *Engineer Operations: Operation Iraqi Freedom, August-September 2008*. Initial Impressions Report. Fort Leavenworth, KS: Center for Army Lessons Learned, Collections and Analysis Team (CAAT).

Vanclay, Frank, and Ana Maria Esteves. 2011a. "Current Issues and Trends in Social Impact Assessment." In *New Directions in Social Impact Assessment: Conceptual and Methodological Advances*, 3–19. Northhampton, MA: Edward Elgar Publishing, Inc.

\_\_\_\_\_. 2011b. *New Directions in Social Impact Assessment: Conceptual and Methodological Advances*. Northhampton, MA: Edward Elgar Publishing, Inc.

## **Appendix A: Drivers/Mission Requirements**

### **TRADOC Pam 525-8-5, *U.S. Army Functional Concept for Engagement (2014, paras 1- 1(h) (2), 2-3(e), 3-4(b) (1), 3-5(c) (2)) and Joint Concept for Entry Operations (Executive Summary)***

1-1(h) (2) “Future Army forces understand the human aspects of an operational environment and determining the opportunities and resource requirements necessary to influence the solutions to achieve a suitable end state.”

2-3(e) “To assess, shape, deter, and influence the behavior of a people, foreign security forces, and governments, commanders must understand the operational environment. This allows commanders to visualize and describe the environment, make and articulate decisions, and direct, lead, and assess operations. Understanding the relationships between actors and influencers, their allegiances and behaviors, and trends that shape their interaction, will be critical to understanding the complexity of the operating environment.”

3-4(b) (1) “Civil-military operations (CMO). CMO is the inherent responsibility of all Army commanders and comprise activities that establish collaborative relationships among military forces, governmental and nongovernmental civilian organizations and authorities, and the civilian populace in a friendly, neutral, or hostile operational environment. At the strategic, operational, and tactical levels and across the range of military operations, CMO is a military instrument primary, used to synchronize military and nonmilitary instruments of national power, particularly in support of stability, counterinsurgency, developing governance and rule of law.”

3-5(c) “Human aspects of conflict and war. Unified land operations must consider the context of conflict, such as cultural and social elements, as well as the traditional domains of land, maritime, air, space, and cyberspace. Therefore, future Army forces must develop critical capabilities and associated doctrine to prepare Soldiers to work among diverse populations in a culturally and regionally attuned manner. The success of any future military operation or campaign depends on the application of capabilities

designed to influence the physical, cultural, psychological, and social elements of human behavior to prevent, shape and win in population-centric conflicts.”

*TRADOC Pam 525-8-5 provides the following points:*

4-2.b. In preventing conflict, the Army expects to operate in ...“politically sensitive, austere, and non-contiguous environments.”

4-3.d. For shaping the operational environment, “future Army forces will require assessment capabilities to identify the strengths and deficiencies in a nation-state's ability for governance, economic development, essential services, rule of law, and other critical functions.”

4-3.f. “During shaping operations, future Army forces will conduct analysis of or obtain access to political, military, economic, social, infrastructure, and information aspects of the operating environment. Commanders will use the integrated employment of information-related capabilities to influence directly or indirectly a host nation’s ability to stabilize, secure, and strengthen bilateral and multilateral relations.”

*Related capabilities required under the Army Capstone Concept (as presented in TRADOC Pam 525-8-5, Appendix B) include the following:*

B-2.d “Future Army forces require the capability to conduct intelligence analysis of requirements and collected information at all echelons down to company level and below using all available data, information, and products in home station and complex environments to assist commanders in understanding the operational environment and decisionmaking in support of unified land operations.”

B-2.e “Future Army forces require the capability to execute technical and human collection across the doctrinal intelligence disciplines, interagency and nongovernmental organizations as a result of the conduct of combined arms, air and ground reconnaissance, surveillance, security, and intelligence operations within the operational environment to support commanders' situational understanding and decisionmaking in support of unified land operations.”

B-2.g “The future Army requires the capability to provide decentralized sustainment in anti-access and area denial environments to all echelons of conventional and unconventional forces that enables decisive action by leaders at lower echelons to provide commanders with operational adaptability in support of unified land operations.”

*Related capabilities required under the Army Operating Concept (as listed in TRADOC Pam 525-8-5, Appendix B) include the following:*

B-3.e. “Future Army forces require the capability to conduct analysis of political, military, economic, social, infrastructure, and information aspects of the operating environment at all echelons to allow commanders at all levels to conduct operations in a decentralized manner in cooperation with partners.”

B-3.i. “Future Army forces require the capability to integrate gathered data and previously produced intelligence, including threat, military and physical environments, and social, political, and economic factors to provide commander(s) decisionmakers possible courses of actions.”

B-3.j. “Future Army forces require the capability to determine enemy and friendly capabilities, hostile intent, and enemy likely courses of action to preserve the force.”

### **Joint Operational Access Concept (JOAC) (DoD 2012, Version 1, Section 4 and Section 8)**

From Section 4: “Historically, a key way to mitigate the degrading effects of distance has been to establish forward bases in the anticipated operational area, thereby maintaining some of the capabilities of a home base at a distant location. The more capability and capacity that a military can amass at the forward base, the more it can mitigate the effects of distance. Moreover, permanent or long-term forward bases can assure partners and deter adversaries. The ability to establish new expeditionary bases, or to improve those already in existence, also can serve as deterrent options. Conversely, a forward base becomes a resource requiring protection and sustainment and can even become a political liability, often by causing friction with the host nation or within the region.”

From Section 8: “Not all forces will be able to deploy directly into combat, however, and sustained operations eventually will require robust bases in

the operational area. Several options exist for resolving this dilemma. The first option is to protect and harden permanent bases so they can withstand attack and retain their functionality. The loss of a forward base could be catastrophic, and since abandoning a base generally is not politically viable, forward bases must be protected. A second option is to disaggregate large bases into a greater number of smaller bases, decreasing vulnerability through redundancy and complicating the enemy's targeting efforts. This option, however, tends to increase the logistical burden and protection requirements. A third option, in conjunction with disaggregation, is to employ austere temporary bases as opposed to sophisticated permanent bases. The ability to operate effectively from such locations can confer a significant advantage to a joint force. Especially for small or specialized forces, this can include the use of remote or even abandoned bases, airfields, ports, or other military or civilian facilities. Such locations present a less lucrative and less obvious target for the enemy, improving survivability and complicating the enemy's targeting. Moreover, the ability to dismantle and relocate facilities also can improve security and operational flexibility. The disadvantage of such locations is that they tend to lack the capabilities and capacity of permanent installations. The greater the proportion of the force able to operate from austere forward locations, the less will be the threat posed by enemy attack against permanent forward bases—and the greater will be the operational choices. A fourth option is the use of seabasing, which reduces sovereignty issues that often can preclude the establishment of forward bases.”

***Joint Concept for Entry Operations (DoD April 2014, Section 5 [esp. Footnote 8] and Executive Summary)***

From the document's executive summary, we see the following points:

- Joint forces want to reduce uncertainty in hostile and often austere and degraded environments.
- ...“geographic and infrastructure impediments may significantly inhibit the deployment and entry of joint and multinational forces into an operational area.”
- Joint forces want knowledge of pre-existing conditions, which includes the state of austere or degraded infrastructure.
- Planning is thought to be important (i.e., ...“success in entry often will depend on efforts to gain access and set entry conditions in advance...”
- Local-level knowledge of the built environment will ensure that the force can ...“employ opportunistic, unpredictable maneuver, in and



across multiple domains, in conjunction with the ability to attain local superiority at multiple entry points to gain entry and achieve desired objectives.”

Section 5 of the main text provides the following:

Section 5: “During the joint operational planning process for an entry operation, commanders should focus on key entry operational characteristics. While these operational characteristics apply broadly to all military operations, they tend to be more critical during entry and serve as a useful method to analyze requirements for successful execution of these complex operations (*footnote 8 here*). These operational characteristics include:

- Purposes for entry operations
- Geographic and infrastructure challenges
- Capacity for entry operations
- Evolving threats
- Social media, cultural factors, and commercial capabilities
- Whole of government approach
- Multinational and coalition interface and interoperability”

Footnote 8: “Success in military action is predicated on deliberate, persistent efforts to better understand the mission, threat, environment, and whole of government actions. Through education, immersion, and the study of regional responses to our actions, the Joint Force must continually seek a more thorough understanding of those cultural, geographic, and threat challenges throughout the regions which it expects to influence. Without understanding, there is the potential for significant missteps, some of which may be unrecoverable for extended periods. With understanding, the Joint Force applies force or influence at the point of greatest effect. Complete understanding of the operational environment is impossible in a fluid world. As such, the Joint Force should constantly seek to improve understanding of the adversary and environment to leverage the benefits it provides. Additionally, the Joint Force must develop and enhance this understanding through whole of government efforts in order to expand its impact on regional efforts.”

**TRADOC Pam 525-3-1, The U.S. Army Operating Concept: 2016–2028  
(2010, paras 1-3(b)(1) and (b)(3), 2-1(b), and 3-4(a))**

“1-3(b)(1) “Uncertainty in the future operational environment will continue to increase as political, economic, informational, and cultural systems become more complex and interconnected.”

1-3(b) (3) “U.S. forces will operate in environments where land, air, space, maritime and cyberspace superiority is increasingly contested by an ever widening set of state and nonstate actors with sophisticated capabilities.”

2-1(b). “As the nation’s principal land force, the Army defends national interests by conducting military engagement and security cooperation; deterring aggression and violence by state, nonstate, and individual actors to prevent conflict; and compelling enemies to submit to national will through the defeat of their land forces and the seizure, occupation, and defense of land areas. The total Army provides national and state leadership with capabilities across the range of military operations in both domestic and foreign contexts. The Army supplies forces through a rotational, cyclical readiness model to provide a predictable and sustainable supply of modular forces to combatant commanders with a surge capacity for unexpected contingencies. To fulfill its purpose, the Army must prepare for a broad range of missions and remain ready to conduct full- spectrum operations to contribute to the attainment of national policy aims.”

3-4(a) “The human, psychological, political, and cultural dimensions of conflict and the uniqueness of local conditions make military operations on land inherently complex and uncertain. To seize, retain, and exploit the initiative under conditions of uncertainty and complexity, Army forces must act and respond faster than the enemy.”

## **Appendix B: Endorsements**

The following pages reproduce communications received in support of this project.



REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
U.S. AMANUEVER SUPPORT CENTER OF EXCELLENCE  
14000 MSCOE LOOP, SUITE 316  
FORT LEONARD WOOD, MISSOURI 65473-8929

ATZT-CD

JUN 02 2015

MEMORANDUM THRU: Director (Dr. Adiguzel), U.S. Army Engineer Research & Development Center (ERDC), Construction Engineering Research Lab (GERL), 2902 Newmark Drive, Champaign, IL 61826-9005

MEMORANDUM FOR: Director (Dr. Holland), U.S. Army Engineer Research & Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

SUBJECT: Endorsement of Proposed Work Package: Tactical Operational Environmental Consideration Assessment Tool

1. Scope of Research.

a. Create algorithm to subdivide a large area of operations into smaller districts that allow for CB site selection based upon the commander's intent.

b. Develop the conceptual framework by determining the variables associated with the physical, built, and sociocultural environments that are relevant for assessing the impacts of the CB lifecycle on the ecology of the operational environment.

c. Develop a method for determining the importance of the impacts of the CB lifecycle on the ecology of the operational environment as they related to the achievement of commander's intent.

d. Design and build the prototype for Contingency Base site selection decision support tool.

2. Linkage to Requirements, Capability Needs Analysis (CNA), and Army Warfighting Challenges (AWFC).

a. This work package indirectly supports the ICD for Contingency Basing which seeks to answer "Location-related gaps to address climate and terrain constraints, proximity to a civilian population, proximity to construction materials, etc."

b. This effort supports the following gaps in the FY2014 CNA database:

1) The Army lacks proficient geospatial intelligence analysts and geospatial engineers to conduct detailed collaborative and comprehensive geospatial analysis and

ATZT-CD

SUBJECT: Endorsement of Proposed Work Package: Tactical Operational Environmental Consideration Assessment Tool

prepare geospatial products, such as mensurated composite products and mosaics, under ULO conditions with an acceptable error of less than 15 percent. (16-20 Gap#: 203092)

2) The IBCT lacks the sufficient fuel storage and distribution capabilities to support unified land operations under widely dispersed and decentralized operations to Provide the right quantity of fuel at the right time to the correct location to maintain freedom of movement and maneuver(16-20 Gap#:202182)

c. This effort supports Army Warfighting Challenge #16, Set the Theater, Sustain Operations, and Maintain Freedom of Movement.

d. This effort supports the following gaps in the Army DOTmLPP Integrated Capabilities Recommendation for Base Camp Strategic Integration.

1) Develops doctrine that accurately defines estimates for base camp developmental planning and impacts on land use.

2) Develops doctrine for site selection of base camps for use by operational forces that support transition to future land acquisition by contingency real estate teams (CREST). This training will include the following engineering considerations: geospatial analysis, host nation requirements, and environmental baseline studies (EBS). MSCoE develops doctrinal integrated base camp reconnaissance collection plans and real estate reports to support planning and design.

3) Develops doctrine to conduct life cycle analyses of base camp planning, design, operations, and management for the four doctrinal base camp categories outlined in Army Tactical Publication (ATP) 3-37.10 (Draft).

4) Revises doctrine on retrograde and disposal operations for all base camps.

5) Develops training on information availability and integration of geospatial methods including the use of the field survey kit.

6) Adapt or modify the Virtual Forward Operating Base (V-FOB) simulation to interoperate with the Virtual Battlespace 2 (VBS2) simulation to support training for base camp planning and systems, facilities, and utilities management.

7) Revises AR 415-16, Army Facilities Components System (AFCS), to address the life cycle development of base camps from initial planning through closure.

8) Establishes or changes Army policy for sustainment operations in support of base camps.

ATZT-CD

SUBJECT: Endorsement of Proposed Work Package: Tactical Operational Environmental Consideration Assessment Tool

9) Establishes or changes Army policy for environmental and health considerations for base camps.

10) Establishes or changes policy for the transfer and closure of base camps.

11) Evaluate force structure requirements for the well drilling ASI to meet base camp requirements. Continue to utilize contracted U.S. Geological Survey and USACE hydrologists and geological expertise to locate potential sites for drilling water wells.

3. The Maneuver Support Center of Excellence (MSCoE) Capability Development and Integration Directorate (CDID) endorses the proposed work package titled Tactical Operational Environmental Consideration Assessment Tool. This effort was briefed to MSCoE CDID Leadership on 2 Jun 15. This work package will develop new technologies that will enable unit planners the ability conduct Contingency Base site selection based upon ecological, physical, and cultural environments. The end-state of this program is to design a prototype site selection decision support tool for Contingency Basing that will be transitioned into integration and demonstration research programs within the Army ERDC and the Army Facility Component System.

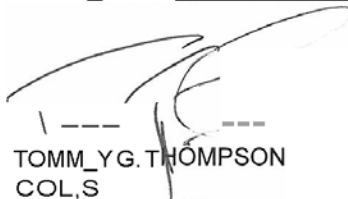
4. The potential monetary savings associated with this capability is in the 100s of millions of dollars. These savings can be realized through an understanding the physical environment of weather/terrain, access to local resources (water/roads/fuel/power), improved operational training, improved camp operational effectiveness and efficiencies due to integrated ecological approach across the Joint community, ability to conduct operational simulations, and forecasting prior to deployment.

5. It is the desire of MSCoE CDID that ERDC accomplish the following:

a. Provide CDID leadership with an annual update on the effort

b. Provide the Maneuver Support Battle Lab (MSBL) with a close out report upon completion of the effort.

6. The point of contact is Dennis Hutchinson at [dennis.g.hutchinson.civ@mail.mil](mailto:dennis.g.hutchinson.civ@mail.mil) or (573).563.5253.



TOMM\_Y.G. THOMPSON  
COL, S

Director Capability Development and  
Integration Directorate



DEPARTMENT OF THE ARMY  
ENGINEER RESEARCH AND DEVELOPMENT CENTER, CORPS OF ENGINEERS  
CONSTRUCTION ENGINEERING RESEARCH LABORATORY  
P.O. BOX 9005  
CHAMPAIGN, ILLINOIS 61826-9005

CEERD-IL-CNE

9 July 2015

MEMORANDUM THRU: Director (Dr. Adiguzel), U.S. Army Engineer Research & Development Center (ERDC), Construction Engineering Research Lab (CERL), 2902 Newmark Drive, Champaign, IL 61826-9005

MEMORANDUM FOR: Director (Dr. Holland), U.S. Army Engineer Research & Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

SUBJECT: Army Facilities Component System (AFCS) Endorsement of Proposed Work Package: Contingency Base Site Evaluation for the Tactical Environment

1. The Army Facilities Component System (AFCS) Program Management Office (PMO) has reviewed the Contingency Base Site Evaluation for the Tactical Environment proposed work package. AFCS endorses this research and will support the effort by providing guidance, subject matter expertise, and reviews of deliverables. This will be an important capability to add to the Joint Construction Management System (JCMS) suite of contingency base planning, analysis, and management tools. Upon successful development and demonstration of CB-SITE, AFCS can serve as the technology transfer platform.

2. Scope of Research.

- a. Create algorithm to subdivide a large area of operations into smaller districts that allow for CB site selection based upon the commander's intent.
- b. Develop the conceptual framework by determining the variables associated with the physical, built, and sociocultural environments that are relevant for assessing the impacts of the CB lifecycle on the ecology of the operational environment.
- c. Develop a method for determining the importance of the impacts of the CB lifecycle on the ecology of the operational environment as they related to the achievement of commander's intent.
- d. Design and build the prototype for Contingency Base site selection decision support tool.

2. Linkage to Requirements, Capability Needs Analysis (CNA), and Army Warfighting Challenges (AWFC).

- a. This work package indirectly supports the Initial Capabilities Document (ICD) for Contingency Basing which seeks to answer "Location-related gaps to address climate and terrain constraints, proximity to a civilian population, proximity to construction materials, etc."
- b. This effort supports the following gaps in the FY2014 CNA database:

1) The Army lacks proficient geospatial intelligence analysts and geospatial engineers to conduct detailed collaborative and comprehensive geospatial analysis and prepare geospatial products, such as mensurated composite products and mosaics, under ULO conditions with an acceptable error of less than 15 percent. (16-20 Gap#: 203092)

2) The IBCT lacks the sufficient fuel storage and distribution capabilities to support unified land operations under widely dispersed and decentralized operations to provide the right quantity of fuel at the right time to the correct location to maintain freedom of movement and maneuver(16-20 Gap#: 202182)

c. This effort supports Army Warfighting Challenge #16, Set the Theater, Sustain Operations, and Maintain Freedom of Movement.

d. This effort supports the following gaps in the Army DOTmLPF Integrated Capabilities Recommendation for Base Camp Strategic Integration.

1) Develops doctrine that accurately defines estimates for base camp developmental planning and impacts on land use.

2) Develops doctrine for site selection of base camps for use by operational forces that support transition to future land acquisition by contingency real estate teams (CREST). This training will include the following engineering considerations: geospatial analysis, host nation requirements, and environmental baseline studies (EBS). Maneuver Support Center of Excellence (MSCoE) develops doctrinal integrated base camp reconnaissance collection plans and real estate reports to support planning and design.

3) Develops doctrine to conduct life cycle analyses of base camp planning, design, operations, and management for the four doctrinal base camp categories outlined in Army Tactical Publication (ATP) 3-37.10.

4) Revises doctrine on retrograde and disposal operations for all base camps.

5) Develops training on information availability and integration of geospatial methods including the use of the field survey kit.

6) Adapt or modify the Virtual Forward Operating Base (V-FOB) simulation to interoperate with the Virtual Battlespace 2 (VBS2) simulation to support training for base camp planning and systems, facilities, and utilities management.

7) Adds capability to the Joint Construction Management System (JCMS) as a part of the Army Facilities Components System (AFCS) under AR 415-16, to address the life cycle development of base camps from initial planning through closure.

8) Establishes or changes Army policy for sustainment operations in support of base camps.

9) Establishes or changes Army policy for environmental and health considerations for base camps.

10) Establishes or changes policy for the transfer and closure of base camps.



11) Evaluate force structure requirements for the well drilling ASI to meet base camp requirements. Continue to utilize contracted U.S. Geological Survey and USACE hydrologists and geological expertise to locate potential sites for drilling water wells.

3. The AFCS PMO endorses the proposed work package titled Tactical Operational Environmental Consideration Assessment Tool. This effort was briefed to the AFCS PMO on 2 Jun 15. This work package will develop new technologies that will enable unit planners the ability conduct Contingency Base site selection based upon ecological, physical, and cultural environments. The end-state of this program is to design a prototype site selection decision support tool for Contingency Basing that will be transitioned into integration and demonstration research programs within the Army ERDC and AFCS.

4. The potential monetary savings associated with this capability is in the 100s of millions of dollars. These savings can be realized through an understanding the physical environment of weather/terrain, access to local resources (water/roads/fuel/ power), improved operational training, improved camp operational effectiveness and efficiencies due to integrated ecological approach across the Joint community, ability to conduct operational simulations, and forecasting prior to deployment.

5. It is the desire of the AFCS PMO that ERDC accomplish the following:

- a. Provide AFCS an annual update on the effort
- b. Include AFCS in reviews of interim products
- c. Provide AFCS a close out report upon completion of the effort.

6. The AFCS PMO point of contact is Martin Jung at [Martin.J.Jung@usace.army.mil](mailto:Martin.J.Jung@usace.army.mil), by phone at 314-239-3468.

H. GARTH ANDERSON, PE  
Army Facilities Component System  
Deputy Program Manager



MEMORANDUM THRU: Director (Dr. Adiguzel), U.S. Army Engineer Research & Development Center (ERDC), Construction Engineering Research Lab (CERL), 2902 Newmark Drive, Champaign, IL 61826-9005

MEMORANDUM FOR: Director (Dr. Holland), U.S. Army Engineer Research & Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

SUBJECT: Endorsement of Proposed Work Package: Contingency Base Site Evaluation for the Tactical Environment

1. Scope of Research.

a. Create algorithm to subdivide a large area of operations into smaller districts that allow for Contingency Base (CB) site selection based upon the commander's intent.

b. Develop the conceptual framework by determining the variables associated with the physical, built, and sociocultural environments that are relevant for assessing the impacts of the CB lifecycle on the ecology of the operational environment.

c. Develop a method for determining the importance of the impacts of the CB lifecycle on the ecology of the operational environment as they related to the achievement of commander's intent.

d. Design and build the prototype for Contingency Base site selection decision support tool.

2. Linkage to Requirements, Capability Needs Analysis (CNA), and Army Warfighting Challenges (AWFC).

a. This work package indirectly supports the JICD for Contingency Basing which seeks to answer "Location-related gaps to address climate and terrain constraints, proximity to a civilian population, proximity to construction materials, etc."

b. This effort supports the following gaps in the FY2014 CNA database:

1) The Army lacks proficient geospatial intelligence analysts and geospatial engineers to conduct detailed collaborative and comprehensive geospatial analysis and prepare geospatial products, such as mensurated composite products and mosaics, under ULO conditions with an acceptable error of less than 15 percent. (16-20 Gap#:

ATZT-CD

SUBJECT: Endorsement of Proposed Work Package: Contingency Base Site Evaluation for the Tactical Environment

203092)

2) The IBCT lacks the sufficient fuel storage and distribution capabilities to support unified land operations under widely dispersed and decentralized operations to provide the right quantity of fuel at the right time to the correct location to maintain freedom of movement and maneuver (16-20 Gap#: 202182)

c. This effort supports Army Warfighting Challenge #16, Set the Theater, Sustain Operations, and Maintain Freedom of Movement.

d. This effort supports the following gaps in the Army DOTmLPP-P Integrated Capabilities Recommendation for Base Camp Strategic Integration.

1) Develops doctrine that accurately defines estimates for base camp developmental planning and impacts on land use.

2) Develops doctrine for site selection of base camps for use by operational forces that support transition to future land acquisition by contingency real estate teams (CREST). This training will include the following engineering considerations: geospatial analysis, host nation requirements, and environmental baseline studies (EBS). Maneuver Support Center of Excellence (MSCoE) develops doctrinal integrated base camp reconnaissance collection plans and real estate reports to support planning and design.

3) Develops doctrine to conduct life cycle analyses of base camp planning, design, operations, and management for the four doctrinal base camp categories outlined in Army Tactical Publication (ATP) 3-37.10.

4) Revises doctrine on retrograde and disposal operations for all base camps.

5) Develops training on information availability and integration of geospatial methods including the use of the field survey kit.

6) Adapt or modify the Virtual Forward Operating Base (V-FOB) simulation to interoperate with the Virtual Battlespace 2 (VBS2) simulation to support training for base camp planning and systems, facilities, and utilities management.

7) Revises AR 415-16, Army Facilities Components System (AFCS), to address the life cycle development of base camps from initial planning through closure.

8) Establishes or changes Army policy for sustainment operations in support of base camps.

ATZT-CD

SUBJECT: Endorsement of Proposed Work Package: Contingency Base Site Evaluation for the Tactical Environment

9) Establishes or changes Army policy for environmental and health considerations for base camps.

10) Establishes or changes policy for the transfer and closure of base camps.

11) Evaluate force structure requirements for the well drilling ASI to meet base camp requirements. Continue to utilize contracted U.S. Geological Survey and USACE hydrologists and geological expertise to locate potential sites for drilling water wells.

3. The Product Director Contingency Base Infrastructure (PdD CBI) endorses the proposed work package titled Contingency Base Site Identification and Terrain Evaluation (CB SITE). This effort was briefed to PdD CBI Leadership on 24 Jun 15. This work package will develop new technologies that will enable unit planners the ability to conduct Contingency Base site selection based upon ecological, physical, and cultural environments. The end-state of this program is to design a prototype site selection decision support tool for Contingency Basing that will be transitioned into integration and demonstration research programs within the Army ERDC and the Army Facility Component System.

4. The potential monetary savings associated with this capability is in the 100s of millions of dollars. These savings can be realized through an understanding the physical environment of weather/terrain, access to local resources (water/roads/fuel/power), improved operational training, improved camp operational effectiveness and efficiencies due to integrated ecological approach across the Joint community, ability to conduct operational simulations, and forecasting prior to deployment.

5. It is the desire of PdD CBI that ERDC accomplish the following:

- a. Provide PdD CBI leadership with an annual update on the effort
- b. Provide the PdD CBI with a close out report upon completion of the effort.

6. The point of contact is:

Bill Berklich  
Deputy Product Director PdD CBI (Acting)  
Warren, MI 48397-5000  
DESK: 586-282-8180  
NIPR: louis.w.berklich.civ@mail.mil

Endorsed by:

**A.**                      \ **b**                      ti D11:  
Kaleefi Lytle  
Product Director Contingency Base Infrastructure (CBI)  
PEO CS&CSS, PM E2S2

# REPORT DOCUMENTATION PAGE

*Form Approved*  
**OMB No. 0704-0188**

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

<b>1. REPORT DATE (DD-MM-YYYY)</b> December 2017		<b>2. REPORT TYPE</b> Final		<b>3. DATES COVERED (From - To)</b>	
<b>4. TITLE AND SUBTITLE</b> Proposal for Funding the ENSITE Project: Under ERDC Environmental Quality & Installations and Geospatial Research and Engineering Business Areas				<b>5a. CONTRACT NUMBER</b>	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b> Funding proposal (6.2)	
<b>6. AUTHOR(S)</b> George W. Calfas				<b>5d. PROJECT NUMBER</b> Under ERDC Environmental Quality & Installations and Geospatial Research and Engineering Business Areas	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> U.S. Army Engineer Research and Development Center (ERDC) Construction Engineering Research Laboratory (CERL) PO Box 9005 Champaign, IL 61826-9005				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> ERDC/CERL MP-17-6	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Engineer Research and Development Center 3909 Halls Ferry Rd Vicksburg, MS 29180-6199				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> ERDC	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release. Distribution is unlimited.					
<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b>  Although the U.S. Army recognizes the importance of strategically siting its contingency bases (CBs), there remains a gap in capability to acquire, analyze, and understand implications and risks to site location and population response. CBs can be thought of as operating in an ecology that en-compasses a local context comprised of physical, built environment, and sociocultural systems. The construction and operation of a CB can have local to global effects on the physical and sociocultural systems within this ecology. Having the capability to anticipate CB impacts during the site planning stage allows the military planners to consider the impacts that siting and operating a CB will have on the local context, and to con-sider the effects of the site on the operation of a CB. This proposal applies the principles of ecology and social impact assessment to develop a methodology that will be instantiated in a visualization system designed to in-form a characterization and prioritization of the potential natural, physical, and sociocultural impacts of a CB's lifecycle upon the operational environment. ERDC capabilities also support integration of the ecological approach into existing tools, algorithm development, the development of software interfaces and toolkits, and the integration of open source data.					
<b>15. SUBJECT TERMS</b> Sociology, Military; Military bases; Military planning; Computer programs; Geospatial data; Data curation; Engineer Site Identification for the Tactical Environment (ENSITE)					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>
<b>a. REPORT</b> Unclassified	<b>b. ABSTRACT</b> Unclassified	<b>c. THIS PAGE</b> Unclassified			<b>19b. TELEPHONE NUMBER (include area code)</b>
			UU	53	