STRATEGY RESEARCH PROJECT

IS "REACH BACK" A VIABLE MEANS TO PROVIDE GEOSPATIAL INFORMATION AND SERVICES (GI&S) SUPPORT FOR THE OBJECTIVE FORCE?

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ABSTRACT

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Quantitative advances in technology have enabled the National Imagery and Mapping Agency (NIMA) to completely transform the way it performs its responsibilities as the functional manager for Geospatial Information and Services (GI&S). Similarly, technological advancements are being incorporated into the development of the Army's design for the Objective Force. As the Army transitions to its Objective Force, will these technological advancements, coupled with NIMA's revised operations, enable the Army to reduce its in-theater footprint by using the concept of "reach back" to provide the commander with the timely, accurate, and relevant geospatial information needed to achieve dominant situational understanding of the battlespace? In order to conduct this analysis, we will review the latest in evolving Objective Force concepts and doctrine, NIMA's transition strategy to support the objective force, as well as the Army's topographic engineer support structure in order to determine if "reach back" is a viable mechanism to reduce the footprint in a theater of operation. "Reach back" capabilities will certainly reduce much of the manpower requirements for deployed topographic units, but it will not eliminate the need to deploy some of these assets into a theater of operation.

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IS "REACH BACK" A VIABLE MEANS TO PROVIDE GEOSPATIAL INFORMATION AND SERVICES (GI&S) SUPPORT FOR THE OBJECTIVE FORCE?

One of the recurring trends in force structure development as the Army transforms itself from the current legacy force, through the fielding of the interim force, and into the development of the Objective Force, is a continued desire to reduce the in-theater footprint of its deployed forces.[1] One potential method to reduce this footprint is the concept of "reach back," where units deployed in-theater can electronically tap into CONUS units and agencies to obtain the desired information or support, rather than deploying those units into the theater. Recent and projected technological advancements, particularly in space, may provide improved communications capabilities sufficient to enable a smaller deployed footprint by using "reach back" and "push forward" techniques.[2] This project will provide an assessment of whether using the "reach back" concept will provide the Objective Force commander with the timely, relevant, and accurate geospatial information he requires with a smaller footprint in theater.

GEOSPATIAL INFORMATION AND SERVICES

Geospatial information and services (GI&S) is the collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery, gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymic data accurately referenced to a precise location on the earth's surface.[3] Geospatial information (GI) provides the foundation upon which all other battlespace information is referenced to form a common operational picture (COP). GI&S aid the commander in visualizing the battlespace in order to plan and execute military operations effectively, to navigate, and to target the enemy accurately. The objective of GI&S support is to provide the commander with timely, relevant, and accurate information about the battlespace. GI&S technology forms the cornerstone for information dominance that is critical for a smaller, more agile and lethal Army.[4] Advancements in data collection methods such as the recent Space Shuttle Mission to collect near-global elevation data, large purchases of commercially available terrain data sets, and improved information extraction techniques supported by high-speed computer applications enable GI&S to be a significant contributor to information superiority – the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same, especially through the COP.[5] The common operational picture enables commanders and staffs at all levels to share the same operational picture, greatly increasing common situational understanding.

The GI&S support plays an important role across the full spectrum of military operations and across all battlefield operating systems (BOS). The major emphasis, however, for GI&S support is provided to three of the BOS; Command and Control (C2), Intelligence, and Mobility and Survivability (M&S). GI&S support for C2 enables the commander to visualize the battlefield by providing various accurate two and three dimensional views of an area of operation. Battlefield visualization is the process the commander uses to develop a clear understanding of the current state with relation to the environment and then visualizes the sequence of actions that takes his force from its current state to the desired end state. The commander's ability to visualize the battlespace is an essential leadership attribute of command and is critical for accomplishing missions.[6] Battlefield visualization is learned through training, practice, experience, and available battle-command technologies. It requires the use of operational tools that are derived from science and technology. Battlefield visualization is the heart of battle command.

GI&S support to the Intelligence BOS facilitates the intelligence preparation of the battlefield (IPB).[7] Intelligence analysts use the IPB process to analyze the weather, terrain, and threats in a specific geographic area for all types of operations. This is done to determine and evaluate threat capabilities, vulnerabilities, and probable courses of action (COAs). The terrain analysis portion of the IPB process is critical for determining how the enemy will project its forces within the area of operation. Specific decision support aids, or products, developed during the IPB process include; modified combined obstacles overlay (MCOOs), population status overlays, and overlays that depict the military aspects and effects of terrain such as no-go and slow-go terrain.[8]

GI&S support to the mobility and survivability (M&S) BOS and the maneuver BOS are closely related. Engineers use the engineer battlefield assessment (EBA) as their primary mission planning and decision making process. The engineer analyzes the terrain using the five military aspects of terrain – observation and fields of fire, cover and concealment, obstacles, key terrain, and avenues of approach (OCOKA). From this, the engineer provides advice to the commander on battle positions and engagement area siting as well as information necessary to develop and shape the battle space. The EBA process assists the commander in visualizing the battle space by thoroughly and accurately portraying the military advantages and disadvantages. The GI&S provide the detailed information necessary to understand the battle space with respect to maneuver, mobility, and survivability.[9] The ability of the GI&S systems to provide the commander and his staff planners with accurate GI can greatly assist the force in successful mission accomplishment.

NIMA AS FUNCTIONAL MANAGER OF GI&S

When the National Imagery and Mapping Agency (NIMA) was formed in 1996 by merging the Defense Mapping Agency, the Central Imagery Office, and several other smaller organizations, it was given the mission to provide timely, relevant, and accurate imagery, imagery intelligence, and geospatial information in support of the national security objectives of the United States.[10] After a comprehensive internal and external assessment of the state of GI&S support, NIMA determined that the realities of global politics, ongoing DOD transformation, and rapidly improving commercial technologies necessitated a leap-ahead capability within the GI&S community to better meet the needs of its customers – both Department of Defense organizations and National Agencies. The NIMA leadership determined that they could no longer produce and operate solely with legacy hardcopy mapping and charting products. New collection and processing technologies and techniques would have to be developed to meet the world-wide demand for GI. Thus, NIMA, in coordination with its customers, developed a new strategy where it anticipates terminating production of standard hardcopy maps by FY '03, and will transition to an information service provider. In this role, NIMA will focus on acquiring, generating, and disseminating digital geospatial information capable of supporting visualization and analytical requirements. NIMA will maintain the capability to perform analysis in-house and provide products to its customers, but it will now focus more on the collection and management of the geospatial data and provide that data to the users for their own analysis. Who does this analysis and where this analysis is conducted will be key factors in how the Army provides GI&S support to the Objective Force commander.

At the cornerstone of NIMA's transformation is the concept of foundation-based operations, which is designed to make the best possible use of available resources. Under this concept, NIMA will create a near-global database of trusted geospatial information at the accuracy and resolution typically needed for strategic assessment and operational planning. This information is termed foundation data (FD) and it includes digital terrain elevation data (DTED), cultural and physical features (foundation feature data), 5-meter resolution controlled imagery (CIB5), digital imagery for precision targeting (DPPDB), and safety of navigation information (both air and sea). [See figure 1.] When fully implemented, regardless of mission or location, the foundation data will be available and maintained to provide a consistent, worldwide level of preparedness or readiness.[11]

The second step of NIMA's foundation-based operations is to enhance and refine the foundation data to facilitate tactical operations and planning. The foundation data will be refined

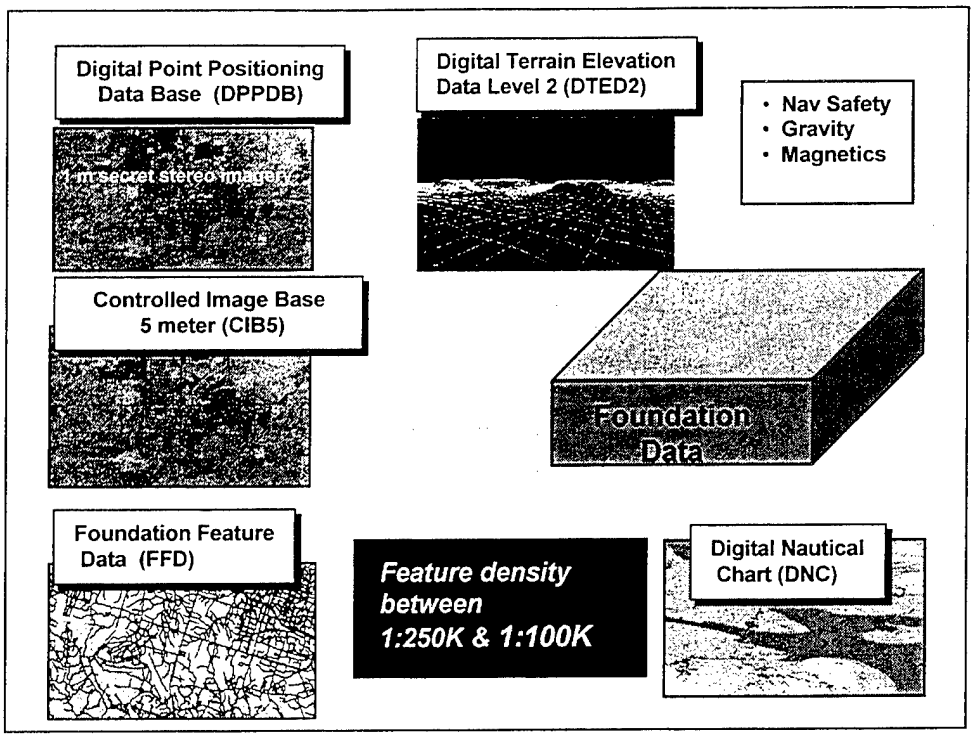

Fig. 1 NIMA Foundation Data Concept

to produce mission-specific data sets (MSDS) to satisfy specific mission information requirements over specified areas where more detail is required. [See Figure 2.] MSDS are more detailed than foundation data and contain more time-sensitive geospatial information in order to meet the needs of the tactical commander. MSDS are critical for crisis response since they are produced "on demand" as a crisis develops and as the geospatial requirements for a specific area become more defined. MSDS can also be generated in advance where military operations are imminent and anticipated lead times are short. The availability of foundation data over an area of interest and NIMA's capability to respond with the creation of MSDS will become the new measures of geospatial readiness.[12]

In summary, as the functional manager of GI&S, NIMA's strategy is to develop a global database of geospatial information at a resolution and scale that facilitates strategic and operational planning and, as required, develop more detailed data only over specific areas to facilitate detailed tactical planning and operations. This should improve readiness across all Unified Commands while still meeting the demands of tactical commanders. NIMA's new focus is on acquiring, generating, and disseminating geospatial information to its customers for their own analysis. In the Army, this analysis is typically performed by Army topographic engineer units.

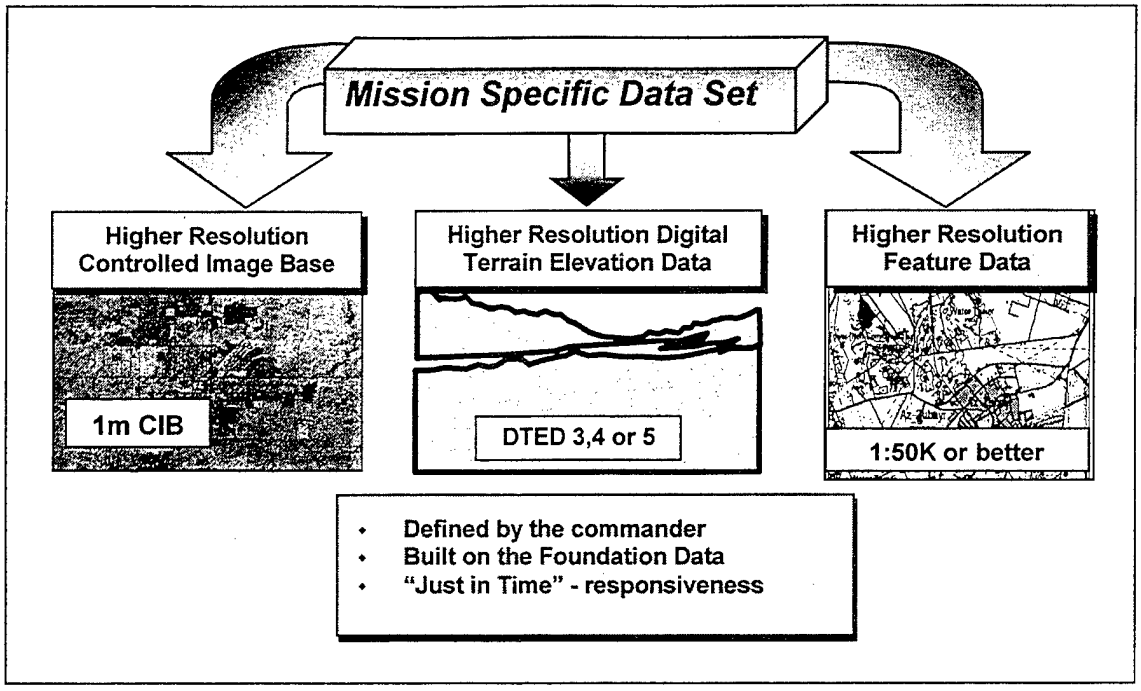

Figure 2. Mission Specific Data Set

ARMY TOPOGRAPHIC UNITS AND SUPPORT

Land combat continues to be the salient feature of conflict. It usually involves destroying or defeating enemy forces or taking land objectives that reduce the enemy's effectiveness or will to fight. Terrain is one of the four characteristics that distinguish land combat (the others being scope, duration, and permanence). Land combat takes place among a variety of natural and manmade features. The complexity of the ground environment contrasts significantly with the relative transparency of air, sea and space. Thus, plans for land combat must account for the visibility and clutter of the terrain and the effects of weather and climate on that terrain.[13]

Army topographic units provide GI&S support to the land commander. These units are capable of combining and analyzing the geospatial information from national and commercial resources and host nations to provide the commander a clearer understanding of the battlespace. Army topographic units are able to access NIMA's vast holdings of digital geospatial information, at times using limited "reach back" capabilities, and perform the analysis on that data to provide usable information and analysis to the land commander. The Army topographer molds the geographic information into map products, tactical decision aids, user-defined topographic analysis products, and precise positioning data. These products can be digitally transmitted or graphically portrayed to enhance the battlefield visualization for commanders and staffs at all levels.[14] This common geospatial framework will also provide the

updated map background for the Army Battle Command System (ABCS), the new digital-based command and control system workstations on the battlefield.

On the modern battlefield, the voluminous amount of digital geospatial information available challenges leaders at all levels.[15] Currently, Army topographic units are organic to digital brigades (terrain section), divisions (terrain platoon), corps (topographic company), and echelon above corps (EAC) (topographic battalion). The topographer is able to assimilate digital geospatial information and represent the terrain and its effects more accurately and faster to help the commander visualize the battlespace. The topographer is charged with taking the terrain data, interpreting it, analyzing it, and transforming it into knowledge. The commander's knowledge of the terrain then allows him to obtain a superior advantage in shaping the battlespace. This is a key portion of situational dominance leading to decision superiority, which can lead to successful operations.

The cornerstone of the Army's digital topographic engineer system is the Digital Topographic Support System (DTSS). [See Figures 3. and 4.] The DTSS comes in various configurations based upon the type and size of unit it supports. The DTSS is highly mobile, rapidly deployable system designed to provide commanders at brigade through echelons above corps with automated terrain analysis, terrain database management, and graphics reproduction in support of IPB, command and control, terrain visualization, and weapons and sensor systems. It is capable of receiving, formatting, creating, manipulating, merging, updating, storing, and retrieving digital topographic data and then processing it into hardcopy or softcopy decision aids for the commander.[16]

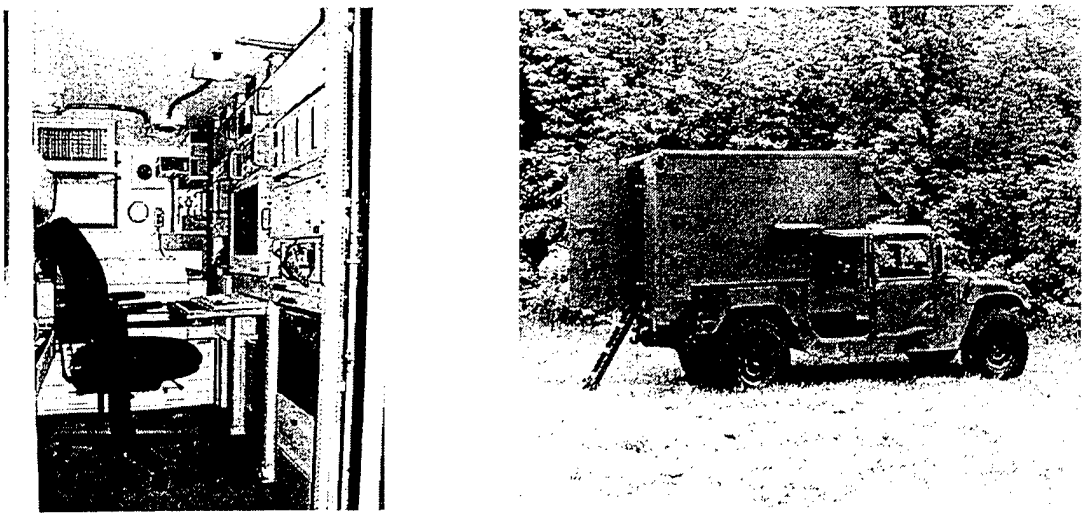

Figure 3. Digital Topographic Support System – Light

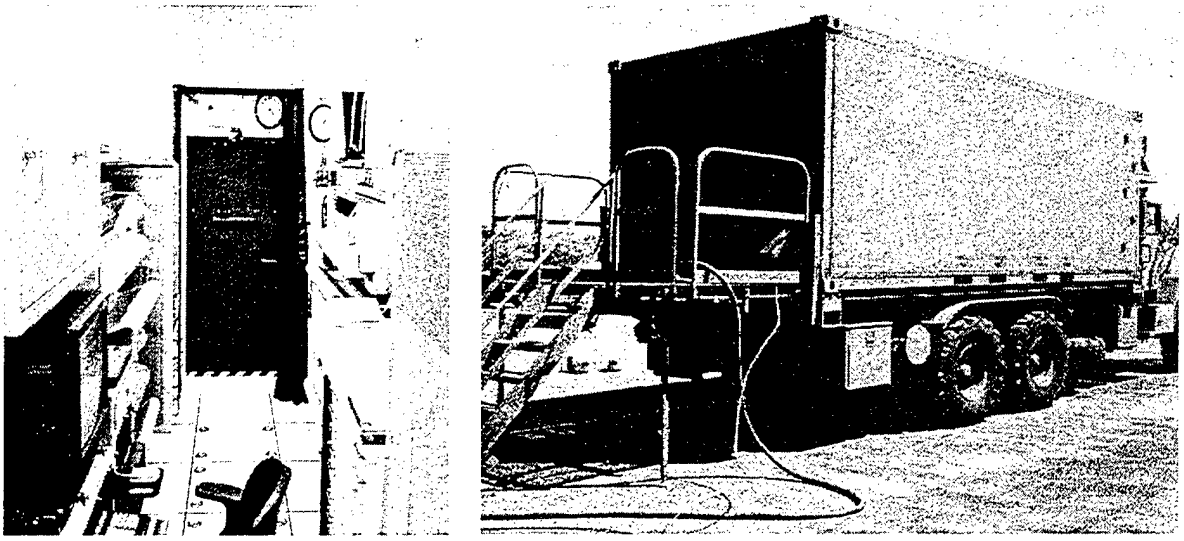

Figure 4. Digital Topographic Support System – Heavy

The Army's current topographic structure is postured well to support the concepts outlined in the new FM 3-0, Operations. With the concept of expanded battlespace, where areas of operation may be contiguous or non-contiguous and linear or non-linear, precise location data and timely analysis of the impacts of the terrain are critical. Army topographic units also support the concept of an expanded battle command by providing the commander effective ways to visualize the operation, describe it in terms of intent and guidance, and direct actions of subordinates within the commander's intent. The topographic units' ability to provide this information to the commander allows him to have the desired level of situational understanding to be effective.[17] Army topographic units are capable of rapidly generating and delivering timely topographic and image-based products to commanders engaged in force projection operations anywhere in the world. Will the current Army topographic structure provide the Objective Force commander with the type of GI&S support he will need? To analyze this, we must first look at the emerging organizational structure and capabilities of the Objective Force.

THE OBJECTIVE FORCE

In the Defense Planning Guidance (DPG), FY 2003-2007, the Army was directed to develop an Objective Force that is capable of operational maneuver from strategic distances, penetrating and sustaining operations in anti-access / area denial environments, and is less dependent upon traditional air and sea ports of debarkation, host nation support and reception infrastructure.[18] Since the release of the DPG, the Army has been engaged in a deliberate and wide-reaching effort to adapt its organizations, soldiers, equipment, and operations to the

mission requirements of a rapidly changing strategic and technological landscape. The concept for this Objective Force is a force capable of achieving strategic dominance across the entire spectrum of operations[19] – to defeat any adversary and control any situation across the full range of military operations. The power of advanced technologies, especially in information technology, will enable the Army to achieve situational dominance and decision making momentum to create a new construct for the application of force.[20]

This future full spectrum force must be organized, trained, and equipped to be more strategically responsive, deployable, agile, versatile, lethal, survivable, and sustainable. Objective Force tactical units will be capable of conducting simultaneous, distributed and continuous combined arms operations, day and night in open, close, complex and all other terrain or weather throughout the battlespace.[21] The Objective Force will be able to; *see first* – through the use of advanced C4ISR and information superiority as portrayed in the common operational picture, *understand first* – through its knowledge based Battle Command system and ability to disseminate information over a global information grid, *act first* – enabled by its situational dominance, and *finish decisively* – by using its increased agility and lethality to destroy an enemy's ability to continue to fight.[22] The Objective Force will be an offensively oriented, combined arms, multi-dimensional maneuver force that will employ revolutionary operational concepts based upon dominant situational understanding at all levels – empowered by new technologies.[23]

In its efforts to develop the objective force, the Army is using the concept of "Echelonment" as it attempts to redesign / refine the organizational structure of the Army. Within this concept, the Army is addressing many factors to include the challenges of span of control, the increasing complexity of operations, the expanding battlespace geometry, the differences in tasks and purpose, interoperability, and the human capabilities of future leaders and staffs at all levels. As an alternative to the existing Army organizational structure of armies, corps, divisions, brigades, and battalions, the Army is using the Unit of Action and the Unit of Employment construct to analyze and determine the appropriate command and control structure for the Objective Force.[24] [See Figure 5.]

The unit of employment will be the campaign force, capable of employing multiple units of action. It will perform tasks and functions typically assigned to current division and higher service or joint headquarters (corps, army, joint task force, etc.). It will link air, ground, and joint forces and can direct ground operations that decide joint campaigns. The unit of employment will also have the capability to assume command of Joint Task Forces. It will be the basis for air-ground task forces. Units of employment resource and execute combat operations;

designate objectives; coordinate with multi-service, interagency, multi-national and non-governmental activities; and employ long range fires, aviation and sustainment; while providing command and control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and tactical direction to units of action.[25]

Units of action are the tactical warfighting echelons of the Objective Force. They will perform tasks typically assigned to current brigade-level organizations. Units of action are the smallest combined arms unit that can be committed independently. Their function is to finish decisively by closing with and destroying enemy forces through integrated fire and maneuver, and tactical assault. Units of action will be made up of from four to six combined arms

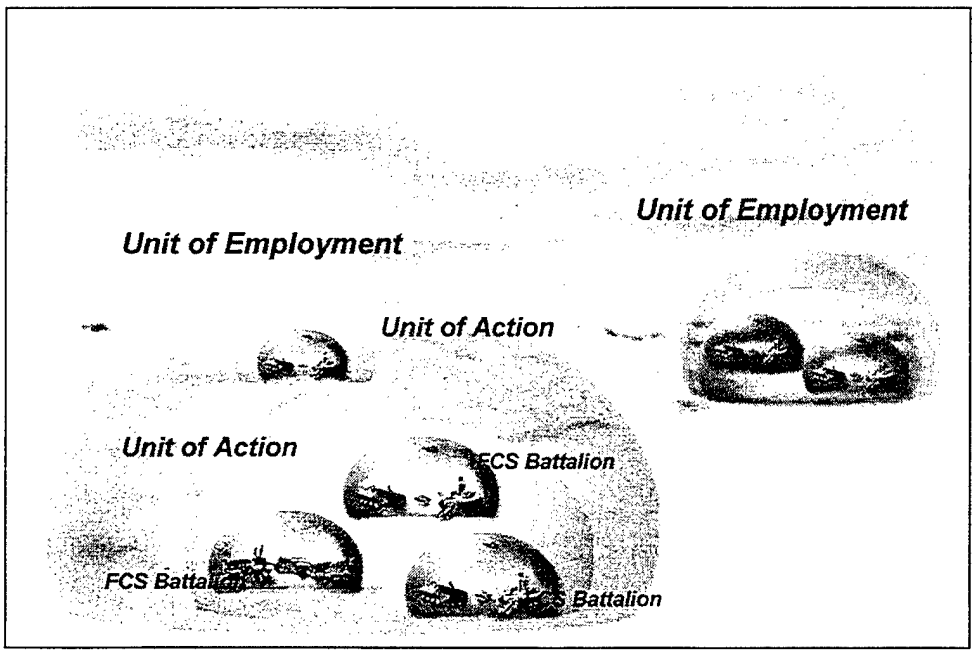

Figure 5. Objective Force Units

combat battalions. Units of action are expected to employ most combat battalions in dispersed yet integrated engagements while periodically cycling individual units into and out of contact to sustain operational momentum.[26] Units of action are sized to enable massing of effects without massing forces. They are designed to be deployable anywhere in the world within 96 hours.[27]

The Objective Force concept describes how the future Army will conduct prompt and sustained combat operations. The concept envisions a skilled, knowledge-based force capable of exploiting the revolutionary potential of information superiority and dominant situational understanding brought about by networked sensors, shooters, supporters, and decision

makers. A critical component of dominant situational understanding is the underlying situational awareness brought about by the common operational picture, and geospatial information provides the common geographic base for the COP. It will be crucial for the Objective Force commander to have the timely, accurate, and relevant geospatial information available to him.

GI&S SUPPORT FOR THE OBJECTIVE FORCE COMMANDER

With the increased technological capabilities of the Objective Force, the commander and staff will have access to extremely large amounts of data and information. Objective Force commanders must know how to conduct rapid operational and tactical decision making. This may mean changing from plan-centric to intent-centric operations; changing from physical rehearsals to virtual ones; and changing from static command posts to situational awareness on the move.[28] To avoid over-burdening the Objective Force commanders, it will be essential for the staff to determine what information is key for the commander to have and what are the characteristics of that information. What geospatial information can be provided to the Objective Force commander to enable him to see first, understand first, act first, and finish decisively?

There are three main characteristics of geospatial information that enable it to be useful to the Objective Force commander. The information must be timely, accurate, and relevant. Simply put, to be timely, geospatial information must be available to the commander when he needs it. Timely information enables the commander to anticipate events in the area of operation and direct forces if necessary to influence the outcome. For the information to be timely, there must be time to analyze the information prior to providing a recommendation to the commander.

For geospatial information to be accurate, it must be factually correct and as complete as possible. Geospatial information must answer the commanders questions about the area of operation to the fullest extent possible and at the scale and resolution required for the current mission. Initially, the information may be small scale and low resolution, as long as it can be used to facilitate planning for higher echelon forces, but as the situation develops, increased scale and resolution will be needed for tactical planning and execution. Even with all the expected technological advancements, it is very likely that there will be gaps in the available terrain data over a specific area. Thus, not only must the geospatial information provide the commander information that is known about the area of operation, but it must also tell the commander what remains unknown about the area.

Finally, geospatial information must also be relevant. It must pertain to the planning and/or execution of the operation at hand. Geospatial information must contribute to the

commander's understanding of the situation without burdening him with information of minimal or no importance to the current mission. The geospatial information should be tailored to be applicable to the commander's area of interest. It must help the commander decide how to accomplish the assigned mission without being unduly hindered by the enemy.

One of the emerging doctrinal concepts being developed along with the Objective Force is the expanded concept of Battle Command. Battle Command applies the leadership element of combat power. It is primarily an art, rather than a science, that uses skills developed through professional study, constant practice, and considered judgment. The Objective Force commander, assisted by the staff, visualizes the operation, describes it in terms of intent and guidance, and directs the actions of subordinates within their intent. Within this expanded battle command framework of visualize, describe, and direct, what types of geospatial information and services does the Objective Force commander need? The Objective Force commander needs timely, accurate, and relevant geospatial information to visualize the battlefield. One of the key pieces of geospatial information the commander needs to visualize the operation is a thorough understanding of the terrain within the area of operation. The commander requires the ability to see the battle space where his units and the enemy will deploy, maneuver, and fight.

> *"The ability to move information rapidly and process it will likely change the way we command military operations. It will greatly influence force organization, command procedures, and staff systems. Maneuver, combat support, and combat service support leaders, horizontally linked by common information, will, for the first time, have a means to visualize how they will execute in harmony, integrated by a shared vision of the battle space. Individual soldiers will be empowered for independent action because of enhanced situational awareness, digital control, and a common view of what needs to be done."*
>
> From TRADOC Pam 525-70

While the scale and resolution of the required terrain data may change based on the type of unit, the resolution required at lower echelons may include terrain slope and elevation, trafficability, vegetation, natural and man-made features, and line of sight analyses. Advancements in technology will provide the Objective Force commander with an increased ability to see a portion of the earth's surface. Terrain visualization products assist the commander and staff during all phases of the operation. Terrain visualization is especially important in the current era of force projection. Units will be deploying to areas where they have not physically been before and where they have not had the opportunity to walk the terrain to

get a real appreciation of the battlefield. New geospatial information capabilities must be leveraged to provide the battle commanders with the fundamental knowledge of the terrain during planning, before operations commence, and continually providing real-time updates if the situation changes during the conduct of the operation. As forces on the ground gather intelligence about a particular place, they will be able to update the information immediately to provide more accurate information to the commander.

Another key piece of geospatial information required by the Objective Force commander is a common terrain or map background that forms the base of the common operational picture. Digital terrain data will provide the foundation that supports the battlefield visualization tools found resident on the Army's new command and control system, ABCS. Visual displays merging geospatial information and real-time intelligence provide sophisticated perspectives and make rapid, in-depth analysis possible. Upon this common geospatial background, staffs can overlay friendly and enemy force locations, command and control nodes, and operational graphics and control measures to facilitate a common situational understanding between commanders which, in turn, speeds up planning and decision making. The COP facilitates both parallel and collaborative planning. Parallel planning is two or more echelons planning for a particular operation at the same time, while collaborative planning is the real-time interaction between commanders and staffs at two or more echelons developing plans for a particular operation. Both parallel and collaborative planning are greatly enhanced by the COP on ABCS.

Another significant capability enabled by the COP is the ability to conduct mission rehearsals via simulation using the actual terrain data in the area of operation. This will provide the capability to conduct virtual rehearsals while forces are enroute to the area, greatly increasing their responsiveness to any particular situation.

Precise coordinates are another key element of geospatial information that will be required by the Objective Force commander. The improved weapons systems of the Objective Force will require precise coordinates for accurately targeting the enemy. These advanced weapon systems use geospatial information for accurate inertial guidance and for precise locations of their targets. On-board navigation systems use digital geospatial information in conjunction with the Global Positioning System (GPS) to plot courses and track locations. Improved weapons capabilities and improved unmanned aerial vehicle capabilities will enable the Objective Force commander to engage enemy forces at times and places previously impossible. Also, with the ever-increasing desire to limit collateral damage, the Objective Force must be able to use precision guided munitions when required. These munitions require precise coordinates for guidance and targeting.

The Objective Force commander will also require customized geospatial products to support the commander's critical information requirements (CCIR). These products may be produced from standard data but they are tailored to support the commander's need to visualize and exploit the terrain in a specific area. Recent history indicates that the only geospatial data that is available for every contingency is imagery from national and commercial sources. The Objective Force commander will want to have available imagery and imagery derived products for his use. These imagery products are very useful tools to facilitate operational and tactical level understanding of the battle space.

Superior information and knowledge inside the decision cycle of our adversaries will create a decided advantage for the Objective Force commanders – from the strategic to the tactical level. The ability to provide the Objective Force commander with the key pieces of accurate, relevant, and timely geospatial information he needs will greatly enhance his capabilities. The advantages of an integrated environment united by geospatial information are limitless and vital for information superiority and, ultimately, decision superiority – where good decisions are made faster than an opponent can react or, in a non-combat situation, at a tempo that allows the commander to shape the situation or react quickly to changes and accomplish the mission.[29]

CONCLUSIONS AND RECOMMENDATIONS

Will the anticipated technological advancements allow "reach back" to be used to provide the required geospatial information to the Objective Force units? Will "reach back" capabilities be able to provide the Objective Force commander with timely, accurate, and relevant geospatial information? There are clearly some significant advantages associated with using "reach back". With the robust communications infrastructure available in CONUS, using "reach back" allows the commander to tap into a vast database of geospatial holdings. Under NIMA's strategic plan, they will be able to provide seamless, web-based access to numerous other agencies or organizations, such as the United States Geological Survey (USGS), the Central Intelligence Agency (CIA), the National Oceanic and Atmospheric Administration (NOAA), the Department of Energy (DOE), and various colleges and universities that maintain databases of geospatial information. This may greatly increase the amount of data available for a particular operation.

Another advantage provided by using "reach back" is the capability of accessing a much greater base of technical support. There are numerous organizations with significant GI&S capabilities that can easily be accessed electronically from the states and brought to bear on a particular problem or situation. Also, because of this great technical capability, the information

or products developed by these experts will typically be more accurate than those same items prepared in more austere conditions typically found during a deployment. This increased accuracy can be attributed to the extensive training and experience base of these technicians, or to the technologically advanced systems available to them, or a combination of all three.

Ultimately, however, the greatest advantage "reach back" provides is the elimination, or reduction, in the number of troops and amount of equipment that must be deployed into the theater of operation. This would make the force more deployable and more responsive. This reduced footprint would also make these forces more survivable since fewer troops would be deployed in harms way.

There are also some significant disadvantages associated with using "reach back" to provide the Objective Force commander with his geospatial information requirements. First and foremost among these disadvantages is the inability to electronically transmit such large amounts of digital geospatial information. Geospatial data files are extremely large and even with the expected communications advancements, the available communications bandwidth at the national, theater, and tactical levels will continue to lag behind imagery and geospatial information capacity and performance needs. (Bandwidth is the rate at which data can be transmitted over a given communications circuit or medium.)[30] In addition, competition for the limited bandwidth available will continue to be intense.[31] This bandwidth limitation could have a very negative impact on the ability to provide the Objective Force commander with timely geospatial information.

Another potential disadvantage associated with using "reach back" may be a loss of flexibility or responsiveness for the Objective Force units. The commander's geospatial information requirements would have to be developed and transmitted back to CONUS-based analysts and then the information transmitted back to the field. This takes precious time, and in the future strategic environment that is envisioned, time will be critical. Another factor in the timeliness will be the ability of the commander to prioritize the analysis of his desired information. He may be competing with other commanders for the analysts time and effort. Analysts so far removed from the fight may not have the proper appreciation for the urgency of information. The ability of the Objective Force units to act inside the decision cycle of the enemy will be crucial. As discussed earlier, the Objective Force commanders will tend to conduct intent-centric, rather than plan-centric, operations. Thus, the commander's intent is crucial to accomplishing the mission's objectives. The commander's intent will be much more readily understood by a GI&S element co-located with the force than it would be to an expert technician remote from the battlefield. Transmitting this intent to an analyst stateside will be

difficult at best. The analysis of geospatial data must be done in light of the specific operation at hand. Different facts can mean different things to different people. The best way to synthesize the analysis for use in the commander's intent for the operation is with the GI&S support provided by forces operating with the Objective Force commander. Also, in the fluid battle space expected in the future, with linear and non-linear and contiguous and non-contiguous areas of operation, missions may change often and without much notice. Flexible and responsive GI&S support to the Objective force commander will provide him with the relevant geospatial information he needs to ensure situational dominance.

Another significant limitation of using "reach back" is the inability of the deployed forces to add to or update the information in the database. As scouts, or any other unit on the battlefield encounter a situation that is different than what is depicted on the COP – whether a bridge is intact or destroyed, or if a plot of land has significant vegetation on it or is relatively open – this intelligence would be more difficult to update in the system since it, too, would have to be transmitted back to the consolidated geospatial database to be input into the COP. A system that is easier to update locally with real-time intelligence will greatly increase the accuracy of the data portrayed in the COP.

Defining and acquiring geospatial requirements necessitates another key aspect to consider. What is the inherent trust and confidence the Objective Force commander will have in geospatial information maintained and provided by a remotely located organization versus information maintained and provided by a unit he commands in the field and with which he routinely trains. The mutual trust and confidence that develops from planning, training, and operating together on a routine basis cannot be replicated by a unit or organization remotely located.[32]

Finally, using "reach back" as the sole means of providing GI&S support to the Objective Force does not provide any redundancy in the system. It would be catastrophic if an enemy were able to cut off or destroy the satellite feeds providing the geospatial data link. As U.S. forces become increasingly dependent on space systems for transmission of information, the fear is that its potential adversaries will develop the means to attack the systems. Regional powers are developing the capability to threaten the flow of vital information and communications that rely on space-based systems.[33] Without some level of redundancy, there would be no way to provide the Objective Force with the geospatial information it requires. A database that can be deployed and used in the theater as the primary database enables the national database to act as a back-up capability in the event the in-theater database is destroyed or corrupted.

Ultimately, the best way to ensure the Objective Force commanders have the timely, accurate, and relevant geospatial information they will need will be some combination of topographic forces deployed in theater augmented or enabled through the use of "reach back" capabilities. This will take advantage of the vast capabilities of a consolidated geospatial database and increased pool of GI&S technical experts, yet also remain flexible and responsive to the commanders needs. It will also enable fewer topographic forces to have to be deployed resulting in a reduced in-theater footprint.

What capabilities are needed at each level of organization (units of employment and units of action) within the Objective Force? The main effort, or "heavy lifting," of GI&S support to the Objective Force should reside at the unit of employment. Topographic support to the unit of employment should focus on two main objectives – development and maintenance of the relevant digital geospatial database, and terrain analysis in support of the commander's decision making process.

The geospatial database must be deployable and should be focused on the commanders area of operation. The topographic element supporting the unit of employment would deploy into the theater with the regional database and would be able to use "reach back" to national sources for any new or updated information as it becomes available. This will greatly reduce communications bandwidth requirements by only having to transmit updates rather than larger databases or products each time it is needed. The impact can be even further mitigated by doing the actual transmission during non-peak usage times unless the information is time critical. The topographic element in the unit of employment will serve as the "gateway" for exchanging data updates between terrain data producers in CONUS, and the terrain data users in the field. The topographic element should also provide and manage the digital geospatial information that forms the common map background on the command and control systems for the COP. They should be able to integrate real-time intelligence updates into the common database.

The topographic element of the unit of employment must also be able to provide terrain analysis support to the commander during the decision making process. Being a part of the unit will facilitate the trust and confidence of the commander while also providing him with the timely, accurate, and relevant geospatial information needed to establish and maintain dominant situational understanding leading to decision superiority.

GI&S support for Objective Force units of action should be focused on two main areas. The topographic element must provide relevant terrain analysis products and recommendations based upon the IPB and EBA portions of the decision making process and they must also be

able to integrate real-time intelligence collected on the battlefield into the geospatial backbone of the COP. By being located within the unit of action, these elements are much more flexible and responsive to the commander's needs. If there is a change of mission, they have immediate access to the geospatial database for the commander to use in formulating his plan. They are also better able to anticipate the commanders requirements and develop tactical decision aids to facilitate timely decision making.

Having these topographic assets deployed in-theater as part of the Objective Force provides significant advantages to the commander. These in-theater assets provide the timely, accurate, and relevant geospatial information that the Objective Force commander will need to ensure decision superiority on the battlefield. "Reach back" technology and capabilities will be used to provide access, as required, to the vast database of information produced in CONUS as well as provide access to the wide range of expert technical support organizations. "Reach back" capabilities will certainly reduce much of the manpower requirements for deployed topographic units, but it will not eliminate the need to deploy some of these assets into a theater of operation. The combination of fewer deployed forces enhanced through the use of "reach back" capability will ensure that the Objective Force commander has the timely, accurate, and relevant geospatial information he needs to ensure information dominance across the entire spectrum of operations.

Word Count = 6,170

ENDNOTES

[1] LTG John M. Riggs, "Transforming the Army to the Objective Force", briefing slides with scripted commentary, Carlisle Barrack, U.S. Army War College, 28 January 2002.

[2] Department of the Army, Concepts for the Objective Force, Chief of Staff White Paper (Washington, D.C.: U.S. Department of the Army, undated), 16.

[3] Department of the Army, Geospatial Information and Services, Army Regulation 115-11 (Washington, D.C.: U.S. Department of the Army, 10 December 2001), 21.

[4] Department of the Army, Field Manual 3-34.230: Topographic Operations, (Washington, D.C.: U.S. Department of the Army, 3 August 2000), vi.

[5] National Imagery and Mapping Agency, Geospatial Transition Plan, NIMA Geospatial Information Infrastructure Implementation Integrated Product Team (Washington, D.C.: NIMA August 2001), GTP 2 and CONOPS 1.

[6] Department ofthe Army, Field Manual 3-34.230: Topographic Operations, 1-3.

[7] Ibid., 1-2

[8] Ibid., 3-3

[9] Ibid., 3-4

[10] Department of Defense, National Imagery and Mapping Agency (NIMA), Department of Defense Directive 5105.60 (Washington D.C.: Department of Defense, 11 October 1996), 2.

[11] NIMA, Geospatial Transition Plan, GTP 2.

[12] NIMA, Geospatial Transition Plan, GTP 3.

[13] Department of the Army, Field Manual 3-0: Operations, (Washington, D.C.: U.S. Department of the Army, 14 June 2001), 1-11.

[14] Department of the Army, Field Manual 3-34.230: Topographic Operations, vi.

[15] Ibid., 2-7

[16] Defense Daily, "Digital Topographic Support System (DTSS)," undated; available from <http://www.defensedaily.com/progprof/army/dtss.pdf>; accessed 10 January 2002.

[17] Department of the Army, "Mission Need Statement for Future Combat Systems (FCS)," (Washington, D.C.: Objective Force Task Force,2 Nov 2001), 1.

[18] Department of the Army, "The Army Vision," (Washington, D.C.: U.S. Army Chief of Staff, undated), 1.

[19] Department of the Army, Concepts for the Objective Force, 3-4.

[20] U.S. Army Training and Doctrine Command, Draft TRADOC PAM 525-3-91 v. 2: The U.S. Army Objective Force: Tactical Operational and Organizational Concept for Maneuver Units of Action, (Fort Monroe, Virginia: U.S. army Training and Doctrine Command, 6 November 2001), 2.

[21] Riggs.

[22] Department of the Army, Concepts for the Objective Force, 6-8.

[23] Ibid., 1.

[24] Ibid., 17-18.

[25] Department of the Army, Draft TRADOC PAM 525-3-91 v. 2, The U.S. Army Objective Force: Tactical Operational and Organizational Concept for Maneuver Units of Action, 3-4.

[26] Ibid., 4.

[27] Riggs.

[28] Department of the Army, Concepts for the Objective Force, v.

[29] Chairman of the Joint Chiefs of Staff, Joint Vision 2020, (Washington, D.C.: U.S. Department of Defense, June 2000), 8.

[30] Chairman of the Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms, Joint Publication 1-02, (Washington, D.C.: U.S. Department of Defense, 23 January 2002), 46.

[31] NIMA, Geospatial Transition Plan, CONOPS 7.

[32] Chairman of the Joint Chiefs of Staff, Unified Action Armed Forces (UNAAF), Joint Publication 0-2, (Washington, D.C.: U.S. Department of Defense, 10 July 2001), III-16.

[33] Chairman of the Joint Chiefs of Staff, Joint Warfare of the Armed Forces of the United States, Joint Publication 1, (Washington, D.C.: U.S. Department of Defense, 14 November 2000), II-2.

BIBLIOGRAPHY

Chairman of the Joint Chiefs of Staff. Joint Vision 2020. Washington, D.C.: U.S. Department of Defense, June 2000.

Chairman of the Joint Chiefs of Staff. Geospatial Information and Services Supplemental Instruction to Joint Strategic Capabilities Plan FY 1998. Chairman of the Joint Chiefs of Staff Instruction 3110.08B. Washington, D.C.: U.S. Department of Defense, 21 June 1998.

Chairman of the Joint Chiefs of Staff. Requirements for Geospatial Information and Services. Chairman of the Joint Chiefs of Staff Instruction 3901.01A. Washington, D.C.: U.S. Department of Defense, 26 July 1999.

Defense Daily. "Digital Topographic Support System (DTSS)." Defense Daily Online. Available from http://www.defensedaily.com/progprof/army/dtss.pdf; Internet; accessed 10 January 2002.

Franke, Henry. "Objective Force Maneuver Support Concept Development." Briefing slides. Fort Leonard Wood: U.S. Army Maneuver Support Center, 14 November 2001.

National Imagery and Mapping Agency. Geospatial Transition Plan. National Imagery and Mapping Agency Geospatial Information Infrastructure Implementation Integrated Product Team. Washington, D.C.: August 2001.

National Imagery and Mapping Agency. Statement of Strategic Intent. January 2002.

NIMA Mission, Vision, and Core Values. Available from http://164.214.2.59/org/mission.html. Internet; accessed 12 December 2001.

Office of the Joint Chiefs of Staff. Department of Defense Dictionary of Military and Associated Terms. Joint Publication 1-02. Washington, D.C.: U.S. Department of Defense, 23 January 2002.

Office of the Joint Chiefs of Staff. Engineer Doctrine for Joint Operations. Joint Publication 3-34. Washington, D.C.: U.S. Department of Defense, 5 July 2000.

Office of the Joint Chiefs of Staff. Joint Tactics, Techniques and Procedures for Geospatial Information and Services Support to Joint Operations. Joint Publication 2-03. Washington, D.C.: U.S. Department of Defense, 31 March 1999.

Office of the Joint Chiefs of Staff. Joint Warfare of the Armed Forces of the United States. Joint Publication 1. Washington, D.C.: U.S. Department of Defense, 14 November 2000.

Office of the Joint Chiefs of Staff. Unified Action Armed Forces (UNAAF). Joint Publication 0-2. Washington, D.C.: U.S. Department of Defense, 10 July 2001.

Report of the Independent Commission on the National Imagery and Mapping Agency, http://www.nimacommission.com/index.htm. Accessed 20 December 2001.

Riggs, John M., Director, Objective Force Task Force, "Transforming the Army to the Objective Force." Briefing slides with scripted commentary. Carlisle Barracks: U.S. Army War College, 28 January 2002.

U.S. Army Training and Doctrine Command. The U.S. Army Objective Force: Tactical Operational and Organizational Concept for Maneuver Units of Action. Draft TRADOC Pamphlet 525-3-91 v.2. Fort Monroe, Virginia. 6 November 2001.

U.S. Army Training and Doctrine Command. Topographic Support for Terrain Visualization, Operations Concept. TRADOC Pamphlet 525-41. Fort Monroe, Virginia. 1 April 1997.

U.S. Army Training and Doctrine Command. Operational Capability Requirements. TRADOC Pamphlet 525-66. Fort Monroe, Virginia. 1 December 1995.

U.S. Army Training and Doctrine Command. Battlefield Visualization Concept. TRADOC Pamphlet 525-70. Fort Monroe, Virginia. 1 October 1995.

U.S. Department of Defense. National Imagery and Mapping Agency (NIMA). Department of Defense Directive 5105.60. Washington, D.C.: 11 October 1996.

U.S. Department of the Army. "2001 End of Year Review." Objective Force Task Force. Washington, D.C.: undated.

U.S. Department of the Army. Concepts for the Objective. Chief of Staff White Paper. Washington, D.C.: U.S. Department of the Army, undated.

U.S. Department of the Army. Geospatial Information and Services. Army Regulation 115-11. Washington, D.C.: U.S. Department of the Army, 10 December 2001.

U.S. Department of the Army. "Mission Need Statement for Future Combat Systems (FCS) Potential ACAT 1." Objective Force Task Force. Washington, D.C.: 2 November 2001.

U.S. Department of the Army. "Statement of Required Capabilities Future Combat Systems of Systems (FCS)." Objective Force Task Force. Washington, D.C.: 2 November 2001.

U.S. Department of the Army. Concepts for the Objective. Chief of Staff White Paper. Washington, D.C.: U.S. Department of the Army, undated.

U.S. Department of the Army. The Army Vision. U.S. Army Chief of Staff. Washington, D.C.: U.S. Department of the Army, undated.

U.S. Department of the Army. Topographic Operations. Field Manual 3-34.230. Washington, D.C.: U.S. Department of the Army, 3 August 2000.

U.S. Department of the Army. Operations. Field Manual 3-0. Washington, D.C.: U.S. Department of the Army, 14 June 2001.

U.S. Department of the Army. Intelligence Preparation of the Battlefields. Field Manual 34-130. Washington, D.C.: U.S. Department of the Army, 8 July 1994.