FM 3-34.400 (FM 5-104)

GENERAL ENGINEERING

December 2008

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HEADQUARTERS, DEPARTMENT OF THE ARMY

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***FM 3-34.400 (FM 5-104)**

Field Manual
No. 3-34.400 (5-104)

Headquarters
Department of the Army
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General Engineering

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***This publication supersedes FM 5-104, 12 November 1986.**

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Preface

Field Manual (FM) 3-34.400 is the primary implementing manual for the engineer function that bears its name (the others being combat and geospatial engineering). This FM provides the linkage between the engineering doctrine contained in FM 3-0, FM 3-34, and Joint Publication (JP) 3-34. It specifically draws from the material presented in the Army's keystone engineer manual (FM 3-34) and should always be used with an understanding of its relationship to that manual and its role as the keystone engineer manual. As the implementing manual for the engineer function of general engineering (GE), FM 3-34.400 describes the operational environment (OE) and how to apply and integrate GE principles in support of full spectrum operations and the linkage of GE to assured mobility. This FM focuses on the establishment and maintenance of lines of communications (LOCs) and sustainment operations that support operational requirements throughout the area of operations (AO).

FM 3-34.400 is designed primarily to assist Army engineers at all echelons in planning and coordinating GE operations at the strategic, operational, and tactical levels. It is also a resource applicable to Department of Defense (DOD), joint, and other Army organizations and agencies that have a role in supporting, establishing, and/or maintaining the infrastructure required to conduct and sustain military operations. It is the primary manual to define the engineer function of GE.

FM 3-34.400 is applicable across full spectrum operations. This includes the four types of Army operations (offense, defense, stability, and/or civil support) across the spectrum of conflict (peace, crisis, and war). This FM recognizes the need for joint interdependence and the reality that operations will frequently be performed in a joint, interagency, and multinational environment. This FM describes in detail how to apply the principles of GE when planning and executing GE functions, and is broken down into the following three major parts:

- Part One defines GE in the OE. It provides the staff engineer with the basic concepts and principals necessary to be successful in planning GE missions in support of joint, interagency, and multinational operations.
- Part Two defines the roles and functions associated with gaining and maintaining LOC in support of mobility. It details the responsibilities, planning, and construction/repair actions necessary to assist the force commander in deploying, maneuvering, and redeploying the force.
- Part Three provides information on missions that empower engineers to support sustainment of the force. It includes discussions on procurement of materials, protection support, facilities of various types, base camps, power generation and distribution, well-drilling, and real estate operations.

Although it may be helpful for units conducting construction projects on post, it is not intended to specifically address or focus on the myriad of challenges associated with normal base operations in the continental United States (CONUS) or permanent overseas locations.

The primary audience for FM 3-34.400 is the engineer planner at all echelons. This manual will assist the planner in coordinating, integrating, and synchronizing GE tasks into military operations. GE tasks are part of most military operations. The degree of Army engineer involvement in accomplishing these tasks will vary based on the mission, situation, availability of engineer resources (all Services, host nations [HNs], and contractors), and the commander's intent.

While a dual designated publication, it is intended to inform all Service components of the types of GE tasks, planning considerations, the variety of units available to perform them, and the capabilities of Army engineers to accomplish them. FM 3-34.400 is built directly on the doctrine articulated in—

- FM 3-0.
- FM 3-34.
- JP 3-34.

Planners must recognize that joint and Army transformation is rapidly changing the way we resource and conduct operations, and the application of GE is no exception. The Army has always tailored engineer elements and capabilities to support the force. The provisions of the future engineer force have provided additional modularity into Army engineer organizations to facilitate the commitment of only the required engineer assets into the theater of operations (TO). Enhancing the capabilities of those assets are the reachback capabilities that minimize the footprint of engineers while optimizing the performance of those deployed elements. Planners must apply these improvements and ensure that the GE effort is seamlessly woven into the commander's plan in a proactive fashion and accomplishes the commander's intent.

Terms that have joint or Army definitions are identified in both the glossary and the text. Glossary references: The glossary lists most terms used in FM 3-34.400 that have joint or Army definitions. Terms for which FM 3-34.400 is the proponent FM (the authority) are indicated with an asterisk in the glossary. Text references: Definitions for which FM 3-34.400 is the proponent FM are printed in boldface in the text. These terms and their definitions will be incorporated into the next revision of FM 1-02. For other definitions in the text, the term is italicized, and the number of the proponent FM follows the definition.

Appendix A complies with current Army directives which state that the metric system will be incorporated into all new publications.

This publication applies to the Active Army, the Army National Guard (ARNG)/Army National Guard of the United States (ARNGUS), and the United States Army Reserve (USAR) unless otherwise stated.

The proponent for this publication is the United States Army Training and Doctrine Command (TRADOC). Send comments and recommendations on Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commandant, United States Army Engineer School (USAES), ATTN: ATZT-TDD-E, 320 MANSCEN Loop, Suite 220, Fort Leonard Wood, Missouri 64573-8929. Submit an electronic DA Form 2028 or comments and recommendations in the DA Form 2028 format by e-mail to <doctrine.engineer@wood.army.mil>.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

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Introduction

The three engineer functions are combat (mobility, countermobility, and survivability [M/CM/S]), general, and geospatial engineering. Together, the three functions form the foundation of engineer doctrine, providing the framework for the Engineer Regiment's role in supporting the Army and joint, interagency, and multinational operations. In the past, GE functions have been described almost exclusively as stability operations in a sustainment area. In today's complex OE, it is imperative that GE tasks occur throughout the TO. Engineers must be prepared to perform a full array of GE missions while dealing with a wide range of threats and influences. This FM focuses on engineer command and control (C2), planning, establishment of LOC, and sustainment operations as they pertain to GE. It has applications for engineer leaders and planners at all levels and in all types of engineer units (see FM 3-34 for the unit types and descriptions) that may be conducting GE tasks. While selected GE tasks may be performed by combat engineer units, they are typically performed by GE units (to include the United States Army Corps of Engineers [USACE], other Services, HN, and civilian contactors). Combat engineers are limited from performing GE tasks by their need to focus on combat engineering tasks, lack of organic equipment, and specific training limitations for certain GE tasks.

As an engineer function, FM 3-34.400 is linked to several other manuals. In the joint realm, it is specifically linked to JP 3-34. Within the Army, it is primarily linked to FM 3-34. Additionally, numerous other FMs and technical manuals (TMs) subordinate to the engineer keystone manual provide more depth and technical information concerning each of the discussed chapters (and appendixes) for those requiring more details of the subject areas. As the keystone manual for the engineer function of GE, FM 3-34.400 is the primary source manual for all engineer manuals dealing with the subordinate disciplines, missions, and tasks associated with GE.

GE is the most diverse of the three engineer functions. It occurs throughout the AO, must be planned at all levels of war, is executed during every type of military operation, and is performed by elements of the engineer force from all Services. GE tasks—

- May include, but are not limited to, construction or repair of existing logistics-support facilities, supply and LOC routes (including bridges and roads), airfields, ports, water wells, power generation and distribution, water and fuel pipelines, and base camps/force bed-down. Firefighting and engineer dive operations can be critical enablers to these tasks.
- May be performed by engineer elements of all Services or through the use of other organic means, such as the USACE, Naval Facilities Engineering Command (NAVFAC), or the Air Force Civil Engineering Support Agency (AFCESA).
- May be performed by a combination of joint engineer units, civilian contractors, and HN forces.
- Include the acquisition and disposal of real estate and real property.
- Usually require large amounts of construction materials, which must be planned and provided for in a timely manner.
- May include the production of construction materials.
- Require the integration of environmental considerations. The area of environmental considerations is a subtask under GE in the Army Universal Task List (AUTL).
- Are typically performed by general or construction engineers, but selected GE tasks may also be performed by combat engineers and combat engineer units.

FM 3-34.400 is a significant revision from FM 5-104 in that it reflects the considerable changes that have occurred over the 20 years since that manual was released. While many of the GE tasks have not changed, the OE has shifted. The introduction of field force engineering (FFE) significantly enhanced reachback capabilities and resources, the realities of operations often being joint, interagency, and multinational

operations; and the Army's transitional reorganization and restructuring to a modular force has had an impact on doctrine and operations. Changes that directly affect this manual include—

- The advent of the term assured mobility and its relationship to other doctrine. (See FM 3-34.)
- An acknowledgment of the importance of joint interdependence among the Services.
- The introduction of FFE, its relationship to primarily general and geospatial engineering, and the increased integration of the USACE into the integrated support of deployed forces.
- The use of computer-aided planning and management tools.
- The introduction and formalization of a doctrinal process for infrastructure assessment and infrastructure survey as a part of engineer reconnaissance.
- The formalization of a planning tool that supports the engineer staff running estimate known as essential tasks for M/CM/S.
- The likelihood and acknowledgement that most operations conducted will be joint, interagency, and multinational. The primary focus of joint engineer operations is to achieve the commander's intent by coordinating engineer support throughout the joint AO. All branches of Service possess the organic capability to conduct GE. When available, units such as naval mobile construction battalions (NMCBs) (Seabees), Air Force Rapid Engineers Deployable Heavy Operations Repair Squadron, Engineers (RED HORSE), and Prime Base Engineer Emergency Force (Prime BEEF) organizations can greatly increase the GE effort.
- The formalization of support requirements to homeland security. See FM 1, FM 3-07, and JP 3-26.
- The frequency of contractors on the battlefield and their support for many of the GE tasks. (See Army Regulation (AR) 715-9 and FM 3-100.21.)
- The resulting changes in the basic design and organizational structures and equipment of engineer organizations to support the Army's ongoing transformation.
- The acknowledged importance and the requirement to integrate environmental considerations into all operations.

Finally, FM 3-34.400 is written with the acknowledgement that the OE is much more variable than what doctrine was previously written against. Engineers must be prepared to go into any OE and perform its full range of GE tasks while dealing with a wide range of threats and other influences. It builds on the collective knowledge and wisdom gained through recent conduct of operations, numerous exercises, and the deliberate processes of informed reasoning throughout the Army. It is rooted in time-tested principles and fundamentals, while accommodating new technologies and diverse threats to national security.

PART ONE

General Engineering in the Operational Environment

Part one of this manual discusses GE in the OE. It provides guidance for engineers at all levels for integrating and synchronizing GE into the joint theater and maneuver commander's strategic, operational, and tactical plans. Chapter 1 discusses the application of GE as one of the three engineer functions. Chapter 2 provides the fundamentals for the OE in which GE will be applied. Chapters 3 and 4 discuss C2 of engineer operations along with GE planning considerations, to provide a framework to achieve synergy on the battlefield. These are the building blocks for applying GE to the specific GE missions discussed in parts two and three.

Chapter 1

General Engineering as an Engineer Function

Although they were the size of David, engineers did the work of Goliath.

Assistant Division Commander, 101st Airborne Division (Air Assault), Operation Iraqi Freedom After-Action Review

The three engineer functions are combat (M/CM/S), general, and geospatial engineering. As one of three engineer functions, planners integrate the full spectrum of GE to support all warfighter functions at the strategic, operational, and tactical levels. GE encompasses those engineer tasks that establish and maintain the infrastructure required to conduct and sustain military operations. The nature of these tasks requires planners to integrate environmental considerations into the process. Such tasks are conducted in a joint, interagency, and multinational environment and are integrated into the force commander's plan. This force may be led by any one of the Services and GE support may come from any or all Service engineers, contractors, HN capabilities, or the engineers of other nations. This engineer function occurs throughout the AO and across the spectrum of conflict. Past conflicts focused GE on sustainment areas. This may no longer be the case, given the realities of noncontiguous operations against both symmetric and asymmetric threats.

FULL SPECTRUM GENERAL ENGINEERING

1-1. The joint definition says that *GE* is those engineering capabilities and activities, other than combat engineering, that modify, maintain, or protect the physical environment. Examples include construction, repair, maintenance, and operation of infrastructure, facilities, LOCs and bases; terrain modification and repair; and selected explosive hazards (EH) activities. (JP 3-34) This manual serves as the primary

reference for planning and executing GE as an engineer function at the Army level. It is directly linked to FM 3-0 and FM 3-34.

1-2. GE is the most diverse of the three engineer functions and is typically the largest percentage of all engineer support provided to an operation. Besides occurring throughout the AO, at all levels of war, and being executed during every type of military operation, it may employ all 23 military occupational specialties (MOSs) within the Engineer Regiment. GE tasks—

- May include construction or repair of existing logistics-support facilities, supply and LOC routes (including bridges and roads), airfields, ports, water wells, power generation and distribution, water and fuel pipelines, and base camps and force bed-down. Firefighting and engineer diving operations are two aspects that may be critical enablers to these tasks.
- May be performed by modified table of organization and equipment (MTOE) units or through the USACE.
- May also be performed by a combination of joint engineer units, civilian contractors, and HN forces, or multinational engineer capabilities.
- Incorporate FFE to leverage all capabilities throughout the Engineer Regiment. This includes the linkages that facilitate engineer reachback (see appendix B).
- May require various types of reconnaissance and assessments to be performed before, or early on in, a particular mission (see FM 3-34.170).
- Include disaster preparedness planning, response, and support to consequence management (CM).
- Include the acquisition and disposal of real estate and real property.
- Include those engineer protection planning and construction tasks that are not considered survivability tasks under combat engineering.
- May include camouflage, concealment, and deception (CCD) tasks (see FM 20-3).
- May include the performance of environmental support engineering missions.
- May include base or area denial missions.
- Usually require large amounts of construction materials, which must be planned and provided for in a timely manner.
- May include the production of construction materials.
- Require the integration of environmental considerations.

1-3. The Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3500.04D contains a hierarchical listing of tasks that are performed by a joint military force. It provides a common language and reference system for joint commanders, staffs, planners, combat developers, and trainers. As applied to joint training, the Universal Joint Task List (UJTL) is a key element of the requirements based mission for task analysis. It contains strategic national and strategic theater tasks, operational tasks, and tactical tasks (theater Army [TA]). Each task also contains measures of performance and criteria that support its definition. At the tactical level, the UJTL links the operational tasks to tactical tasks by requiring Services to produce Service-specific tactical task lists. For the Army this is codified in FM 7-15. Although an analysis of the UJTL is important, most relevant links for GE tasks (since they are typically considered tactical tasks in this hierarchy) are in the AUTL.

Note. The *UJTL* is a menu of capabilities (mission-derived tasks with associated conditions and standards, such as the tools) that may be selected by a joint force commander (JFC) to accomplish the assigned mission. Once identified as essential to mission accomplishment, the tasks are reflected within the command joint mission essential task list. (JP 3-33)

1-4. FM 7-15 outlines GE tasks that units may use as one of the sources to establish their mission-essential task list (METL). Figure1-1 highlights those Army tactical tasks that are subordinated to providing GE support. While there may be examples of GE tasks not listed under Army tactical task (Provide General Engineer Support), the vast majority are included in these subtasks.

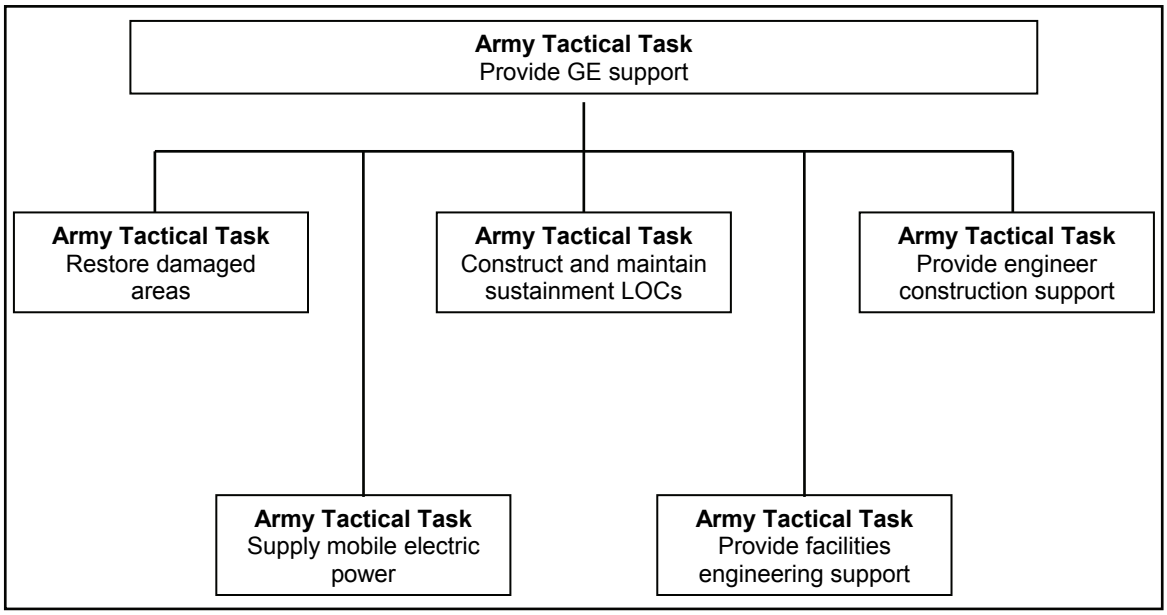

Figure 1-1. GE in the AUTL

1-5. Engineers conduct GE tasks within the full spectrum of GE operations described in FM 3-0. Within the AO, commanders delineate tasks into two all-encompassing categories of operations (decisive and shaping), thus providing a common focus for all actions.

- Decisive operations are those that directly accomplish the task assigned by the higher commander and conclusively determine the outcome of major operations, battles, or engagements.
- Shaping operations create and preserve the conditions for success of decisive operations. Shaping operations enable decisive operations by providing sustainment, sustainment area and base security, movement control, terrain management, and infrastructure development.

1-6. Commanders organize forces according to purpose by determining whether each unit's operation will be decisive or shaping. GE is usually focused as a shaping operation; however, the commander's intent may dictate that it is at the heart of the decisive operation, particularly in stability or civil support operations. An example of this is provided in the perspective on page 1-4. In the perspective an engineer-led operation was a decisive (or shaping) operation in Afghanistan, with operational, and perhaps even strategic, implications. See the following section for more discussion of GE in full spectrum operations. During execution, the commander combines and directs decisive and shaping operations while preserving opportunities. Ideally, decisive operations occur approximately as planned, while shaping operations create and preserve opportunities and freedom of action to maintain momentum and exploit success.

PERSPECTIVE

During Operation Enduring Freedom V and VI, the rugged, mountainous terrain of Afghanistan's Hindu Kush range became home to Army engineers. The mission was to construct a new, two-lane, 123-kilometer road—a highway from Kandahar City (roughly 25 kilometers northwest of Kandahar Airfield) to Tarin Kowt. Working seven days a week for months in the extreme climate and terrain of Afghanistan, the engineers completed the project ahead of schedule. While this mission was led by engineers from the 528th and 864th Engineer Battalions, it involved an unprecedented level of teamwork between the Army, U.S. government, Afghan National Army, the Afghan government, and various international civilian organizations. The completion of the road marked the end of geographical isolation for hundreds of thousands of Afghan people and assisted the country in its transition toward democracy. This action was more than just the building of a road.

Compilation of Articles

1-7. Commanders visualize their concept of operations and describe their intent. The circumstances may lead the commander to describe their AO in spatial terms of unassigned area, close combat, and sustainment area. These terms may be useful when operations are generally contiguous and against a clearly defined symmetric enemy force. The OE will seldom allow the commander the luxury of describing his AO in such terms. The OE will likely consist of noncontiguous operations against an asymmetric adversary. Figure 1-2 graphically describes possible means by which the commander may visualize his AO.

1-8. The combination of contiguous and noncontiguous operations that the commander uses will have a major impact on the planning and execution of GE tasks. In a contiguous AO, GE tasks are typically performed to the rear of division boundaries by engineer units assigned to higher echelon headquarters. As the AO becomes less contiguous, GE tasks are required in forward areas in proximity to combat units. Since GE assets are not organic to the brigade combat team (BCT), the BCT is normally augmented with the necessary engineer assets to perform GE tasks within the BCT AO. The types of GE assets that will augment the BCT are dependent on the types of missions to be accomplished and the availability of engineers. Selected GE tasks may be performed by combat engineers. The impacts of the noncontiguous battlefield on GE tasks are numerous. They include—

- **The need for increased work site security.** Because units will perform GE near forward elements, contact with the enemy is much more likely. Units conducting GE tasks must be proficient in combat operations to provide for their own defense against such threats. Commanders directing the performance of GE missions must treat these missions as they would any combat operation and ensure the protection of their personnel. General engineers focused on combat operations cannot be focused on performing their GE missions and tasks. It is in the interest of the maneuver commander to keep general engineers out of close combat operations and focused on their GE missions and tasks.

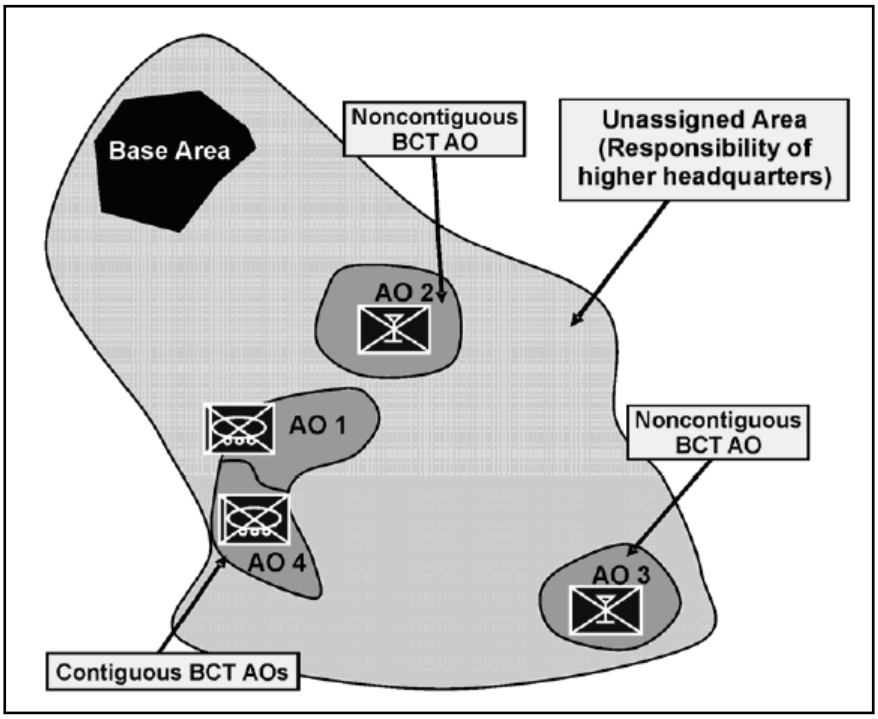

Figure 1-2. Contiguous, noncontiguous, and unassigned areas

- **The need to provide for general and local security.** During contiguous operations, it is often assumed that units receive general security from forward combat units and that only local security is at issue. On the noncontiguous battlefield, units must assume that they will face the same level of threat as maneuver units operating in the AO.
- **The increased number and length of LOCs and main supply routes (MSRs).** With construction and maintenance of these assets critical to sustainment operations, the noncontiguous battlefield greatly expands the GE effort required. Engineer planners can expect smaller-sized units to be spread over greater distances than during contiguous operations. Security of personnel along those routes is an increased concern, and focused convoy security measures will need to be implemented.
- **The need to increase facility construction effort.** Because units will operate with more autonomy within their own AO, they will each require facilities for deployment, supply, maintenance, and other sustainment activities.
- **The increased possibility that combat engineer units may conduct additional GE tasks.** Maneuver commanders at the BCT and higher levels must be able to task their organic combat engineer elements to conduct selected GE tasks. Some tasks can be performed without augmentation. However, a conscious trade-off of potential combat engineering tasks that they could be performing must be made in order to have them perform these tasks. Selected additional GE tasks may be performed when combat engineer units are provided with additional specialized equipment and expertise. Combat engineers will never be able to perform all GE tasks.
- **The likelihood that GE assets will often be task-organized to a much lower level.** Because of the distances involved in a noncontiguous AO, engineer commanders may not be able to effectively C2 the GE effort in a manner that is as responsive to the needs of the maneuver commander without decentralization of authority. These assets may need to be placed in direct support (DS) or attached to BCTs to provide timely and responsive GE support.

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