Faculty of Military Leadership

ATP-3.12.1

ALLIED TACTICAL DOCTRINE FOR MILITARY ENGINEERING

Edition A Version 1

FEBRUARY 2016

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED TACTICAL PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

3 February 2016

1. The enclosed Allied Tactical Publication ATP-3.12.1, EDITION A, VERSION 1, ALLIED TACTICAL DOCTRINE FOR MILITARY ENGINEERING, which has been approved by the nations in the MCLSB, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2394.

2. ATP-3.12.1, Edition A, Version 1, is effective upon receipt.

3. No part of this publication may be reproduced, stored in a retrieval system, used commercially, adapted, or transmitted in any form or by any means, electronic, mechanical, photo-copying, recording or otherwise, without the prior permission of the publisher. With the exception of commercial sales, this does not apply to member or partner nations, or NATO commands and bodies.

4. This publication shall be handled in accordance with C-M(2002)60.

Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
CAN	i. There are critical flaws in the description of the basic tenets military engineering focussing on affecting "the living conditions of the populace, improving mobility, support removing explosive threats or developing and restoring critical urban infrastructure." This goes against Canada's doctrinal employment of Engineers (Engrs) to provide mobility, counter-mobility, survivability, and general engineer support to the formation it is supporting. It is only during true humanitarian operations that a military force will engage in the provision of assistance to a population. On sustained operations it is more likely that a formation with its supporting Engrs will provide the security envelope required for non-governmental organisations to conduct their relief efforts; ii. There are several instances of the use of national level descriptors for tactical activities that are simply mentioned without a full description or definition. Two of these many things issues are as follows: 1. Under counter-mobility it mentions "the commander will express his intent in terms of Combined Arms Obstacle Integration (CAOI) and will seek to maintain his own freedom of manoeuvre ...", and subsequently describes it as the "effects-based approach to counter-mobility." Without a proper definition these sections are meaningless as Canada does not have this lexicon within our doctrine at all; 2. The introduction of the FLOCARK. mnemonic without properly describing how it is used is confusing and undermines the validity of it and the Canadian doctrine it was borrowed from; iii. The definition used for route clearance is not the NATO accepted definition, and throughout it is described as an enabling activity rather than the mobility task that the CA maintains it is; iv. The acronym and abbreviation section of the publication although sizeable, is lacking as it does not capture everything that is used in the publication; v. This ATP is written poorly throughout. The document is riddled with literal translations, which may be technically correct as word-by-word substitutions; however they do not work with the sentence structure that they are written in.

ESP	To whole section 8, chapter 5, for contravening promulgated Allied doctrine ratified by Spain (land and Maritime) ATP-08 (Volumes I and II).
ITA	In accordance to national law, Italy will not use any device which may be classified as antipersonnel mine according to the following definition "An antipersonnel mine is defined as a device which may be placed above, under, inside or next to any surface and adjusted or adapted with specific measures in order to explode, cause an explosion or release incapacitating substances as the result of the presence, the proximity or contact by a person". Moreover, considering military activities in a multinational scenario, cooperation of the Italian Armed Forces also with no signatory Nations of the OTTAWA Convention is permitted, with the proviso that activities by Italian servicemen be compatible to the OTTAWA regulations.
LVA	LVA MILENG is not responsible and not planning to develop Geomatics, Firefighting, Support to CBRN, Environmental protection, Real estate management, water production and purification, sewage recycling tasks. For those tasks are responsible other entities and units (J-2, CBRN Coy, State Centre for Defence Military Site and Procurement).
ROU	- Environmental protection (EP) is not a domain of responsibility for military engineers in Romanian Armed Forces, but only some aspects like terrain works (para 02117); - Geospatial engineering and other geospatial products such as maps and geospatial data are not provided by military engineering in Roman Armed Forces, but only some specific issues like terrain analysis, gathering and providing MILENG data and information relevant for planning and conducting operations (para 0249-02556,0511.h); - Railways and rail port construction/repair and maintenance are not missions of military engineers in Romanian Armed Forces (0511.g); - Management of real property as infrastructure resource is not a functional area for military engineers in Romanian Armed Forces. They only participate in restoring of the terrain during the redeployment stage of operations (para 02112-02113, 0515.d); - Underwater/Diving Engineering capabilities in Romanian Armed Forces are only EOD and they cannot perform any other underwater military engineering tasks (para 02125-02129, 0511.a).

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

PREFACE

The successful execution of military engineering at the tactical level requires a clearly understood, harmonized and practical doctrine, particularly when conducted by allied or coalition forces. Although Allied Tactical Publication (ATP)-3.12.1 - Allied Tactical Doctrine for Military Engineering - is intended primarily for use by NATO forces, it will be equally useful to coalitions of NATO with partners, non-NATO nations and other organizations.

AJP-3.12 (B) describes the fundamental aspects of military engineering and provides guidance for the planning and conduct of these in support of joint operations. ATP-3.12.1 is intended for use primarily by engineer commanders and staff from Component Command to Brigade Level and defines the MILENG deliverables to operations; it does not attempt to describe how tasks should be executed in detail as this will be for commanders at a lower level to determine.

ATP-3.12.1 replaces the previous document called ATP-52 (B).

TABLE OF CONTENTS

CHAPTER 5 - MILITARY ENGINEER SUPPORT TO JOINT FORCES

ANNEXES

LEXICON

CHAPTER 1 – CONCEPT AND PRINCIPLES OF TACTICAL MILITARY ENGINEERING

SECTION 1 - Introduction

ATP-3.12.1 "Allied Tactical Doctrine for Military Engineering" describes the fundamental principles and provides guidance on the preparation and execution of military engineering (MILENG) support at the tactical level. This publication must be read in conjunction with AJP 3.12 and when appropriate, in conjunction with other NATO publications that refers directly to specific types of operations and processes (e.g. ATP-3.2.1 Allied Land Tactics).

SECTION 2 – Comprehensive approach

AJP-3.12 addresses the importance of the comprehensive approach as a vehicle to Alliance unity of effort at the operational and strategic levels. The same principles, especially proactive **engagement, shared understanding, outcome-based thinking and collaborative working** are also applicable at this level. [1]

Above all, a comprehensive approach requires those dealing with execution of tasks to be predisposed to cooperation and structured to develop a shared understanding of a situation and its dynamics from ATP-3.2.1: "*Tactical level commanders must appreciate their role in conjunction with other elements of power in the pervasive application of a comprehensive approach*"[2].

SECTION 3 – Key Engineer Definitions

Key Engineer Definitions in accordance with AAP-6 and AJP-3.12:

1. **Joint Force Engineer (JFEngr)** is the principal engineer advisor to the Joint Force Commander on all military engineer issues. Although he will not act as a commander, he will, on behalf of the JF Commander, have the coordinating and technical authority over the employment of engineer assets throughout the Joint Force, in order to ensure capabilities and resources are used most effectively.

2. **Military Engineering** (MILENG) shapes the physical operating environment regardless of component or service. Yet tactical MILENG assets are used for the accomplishment of military tasks, they are in increasing demand by civil

[1] For a more complete discussion of the Comprehensive Approach, see AJP 3.12 Allied Joint Doctrine for Military Engineering

[2] ATP-3.2.1, Chap I, Sect I – Employment of forces at the tactical level.

authorities. The balance of effort between the two varies with the type and phase of operation and also the different levels of operation, Strategic, Operational and Tactical. Engineer forces invariably have utility in both areas.

SECTION 4 – Scope of tactical military engineering

Tactical level.

The effects of tactical activities must support the operational objectives from which they are originated, leading to an enduring end-state rather than individual tactical successes. AJP-3.12 (B) discusses the “predominant campaign themes” as such combat, security, stabilization, counter insurgency, peace support and peacetime military engagement can be executed throughout all types of military activities. This applies whether it is offensive, defensive or during enabling activities, each can be conducted simultaneously. The various types of military activities are shown and discussed from an engineer perspective in Chapter 5.

Tenents of tactical military engineering.

Regardless of component or service, military engineering remains focused on shaping the physical operating environment. While shaping the operating environment, engineers also affect the living conditions of the populace, improving mobility, support removing explosive threats or developing and restoring critical urban infrastructure. While tactical engineering assets should primarily be used for the accomplishment of military tasks, they are in increasing demand by civil authorities. So Military success increasingly depends on civil support and an ability to balance between military focus and enabling operations.

MILENG spectrum of tasks

Independent of national caveats or service particularities, military engineering comprises a wide spectrum of tasks, varying from combat to construction. The balance between Force support tasks and Combat support operations will depend on the campaign theme, the nature and the phase of the operation. More information can be found as to the nature of tactical operations in ATP-3.2.1. In any case, at the tactical level, there are rarely sufficient engineer resources to meet all demands. Therefore, prioritisation and engineer commander advice is critical to the optimal use of these assets. Very often, tactical tasks exceed organic engineer capabilities and a centralized engineer effort is required, often complemented by civil agencies and an increasing proportion of contracted services. Co-ordinating the available assets in support of the main effort will be a key role for the JFEngr supported by engineer commanders at other levels.

SECTION 5– Military Engineer Roles, Tasks and Functions

Introduction

The introduction of the joint functions in AJP 3.12 provides that the engineer roles and tasks, although essentially remain extant the Joint Functions, further define the engineer effects within a coalition force that transcends traditional land based operations.

Scope of Tactical Military Engineering. AJP-3.12 describes MILENG and its subsets. Tactical engineer activity is particular in that its impacts are rarely limited to a mission. Constructions works and utilities are executed at the tactical level but are almost always utilized by a whole joint force and often by the local populace. In the framework of military tactical operations conducted by NATO, relations between Alliance MILENG forces and civilian authorities, populations, organizations and agencies are complex. This is due to the nature of military operations, often taking place in underdeveloped or failed states, where civil engineering capabilities are dysfunctional or ineffective. Because of this complexity of relations and operating environment, military success increasingly depends on civil support and an ability to balance between military focus and enabling operations.

The full range of MILENG skills covers field engineering, construction, environmental protection, geomatics, protective works, military search, support removing and management of the explosive threat (including but not limited to countering improvised explosive devices (C-IED) and explosive ordnance disposal (EOD[1])). Independent of national caveats or service particularities, MILENG comprises a wide spectrum of tasks, varying from combat to construction and specialist support. The proportion of engineer effort will largely depend on the commander's intent and concept of operations as well as changes in the operating environment. More information can be found as to the nature of tactical operations in ATP-3.2.1, since land tactical doctrine is applicable to most tactical manoeuvres.

Framework of MILENG Roles and Tasks as the transition from the conventional tasks and roles to Joint functions and tasks continues the understanding of the correlation between the two is illustrated in the following paras and figures.

Tactical Tasks and Combat Functions.

AJP-3.12 provides the framework for MILENG at the different levels. Traditional Roles of Military Engineers in terms of **mobility**, **counter mobility, survivability** and **general engineer support which categorize engineer activities,** remains valid. Since Joint doctrine establishes that "although tactical-level MILENG is

[1] The split of responsibilities between Engineers and EOD personnel during operations is a matter for national decision and is not the subject of this STANAG.

most intimately concerned with shaping the terrain, the benefits do not accrue solely to the land component", Joint Functions can also be used as a frame of reference. The next paragraphs attempt to use traditional description of MILENG activities and situate them with Joint functions. All tasks, capabilities and techniques described in this publication play either a leading or a supporting role to one of the functions. The figure below expands in more detail on the MILENG Task Framework. It is important to note that this framework is used solely to support conceptual understanding and is by no means restrictive. As the nature of military operations evolve, it is common to consider tasks traditionally nested in a specific combat function for a completely different one. A rigid application of the categorization proposed here could defeat the purpose of explaining the versatility and reach of engineer tasks. For example, managing explosive threats could be perceived as both under force protection or manoeuver, depending on the purpose of the task. What is important to understand is what these tasks are and how they relate to Joint Functions by shaping the terrain. As depicted in the framework below, engineer tasks support all Joint Functions but generally emphasize more on three functions; **Manoeuver and Fires**, **Force Protection** and **Sustainability**. This is due to the nature of MILENG, applied to shape the physical aspects of the battlefield, which affects more directly these three functions. Figure 1.1 illustrates the Joint Functions below. A more comprehensive description of these joint functions is provided in Chapter 2.

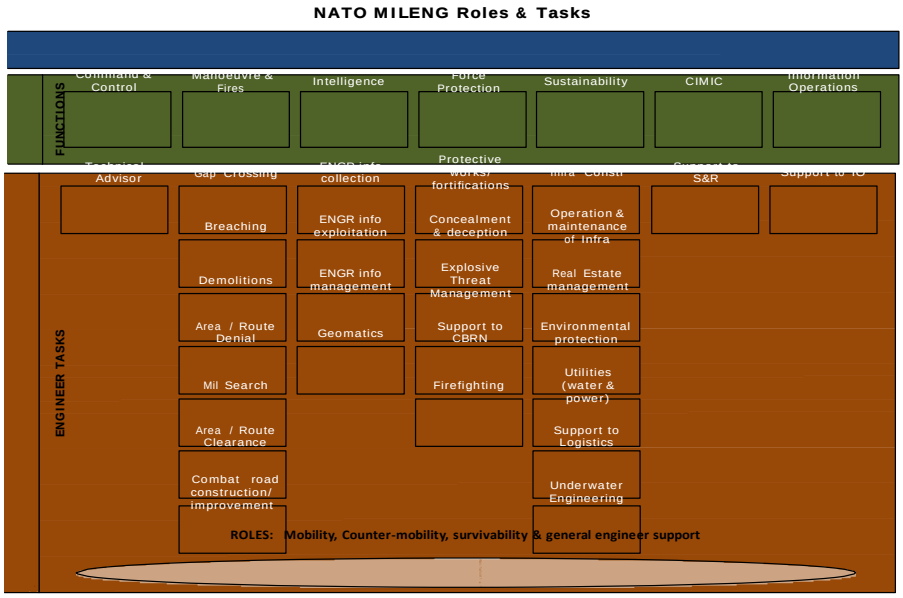


Figure 1.1 - Framework of MILENG Roles and Tasks

Engineer Roles. As mentioned above, the traditional roles of the military engineer have focused upon the advice and provision of:

a) Mobility Support.

b) Counter-mobility Support.

c) Survivability Support.

d) General Engineer Support.

This paradigm of MILENG capabilities is still valid to this day as the physics of military operations remain. However, the implications of each element of engineer these capabilities were based on Combat operations, and less so for security, peace support and PME, as these functions have significantly changed the functions of MILENG within the old role of General Engineer support needed to be redefined to be more inclusive of existing campaign themes such as Force support and Combat support functions as such it becomes very difficult at times to categorize MILENG tasks. What was easily identifiable as a mobility or a survivability task in the past can now fit in others as well. An example of the management of explosive threat, MILENG support to as the clearance and disposal of explosive ordnance (both manufactured and improvised). These tasks can be accomplished as a mobility task if it involves Freedom Of Movement (FOM), as a survivability task if confined to friendly forces' lodgments, or general engineer support if it concerns DDR[3] tasks or support to logistics storage of ammunition. This reality also affects the military structure of different nations in the Alliance where classification of roles and capabilities may differ according to specialties and components. Despite the complexity of MLENG tasks in the contemporary operational environment, using this paradigm of capabilities remains useful as a central point of reference and in understanding and developing MILENG concepts, capabilities and doctrine. Therefore, the descriptions of each roles and associated tasks below should not be considered restrictive and exclusive.

This description of broad engineer activities remains enduring and will now be considered in greater detail. The priority previously accorded to intimate organic engineer support to fighting echelons (Close Support) has been reassessed by many NATO nations, taking into account the changed operating environment already described, resulting in an enhanced General Engineer Support capability for some. It is an area which may involve a greater degree of cross-component support and the engineer tasks will usually be more enduring, relying more on purpose designed and built solutions. It is likely to fulfill a longer-term, operational requirement which encapsulates the diversity and scope of tasks undertaken in support of all three services, not just the Land component.

Mobility

a) Military forces require the ability to move rapidly and freely in the area of operations in order to fulfill their primary mission. Mobility is necessary to achieve concentration of effort and to deploy rapidly to engage or to disengage from the adversant. Superior mobility may compensate for numerical inferiority and is affected by terrain, weather and adversant activity.

[3] DDR is not part of AAP-06, it is from UN terminology; Disarmament Demobilization and Reintegration

b) **The Threat**. In the context of the changed operational environment already described in section 1, adversant counter-mobility operations of whatever type, are likely to focus on stopping or slowing NATO forces so as to fix them in some form of target area or they may simply attempt to prevent our freedom of manoeuvre. The means employed to accomplish these aims, may include use of air delivered assets as well as the use of land mines (including scatterable mines) and IEDs. Natural obstacles and damaged infrastructure will also be enhanced in order to create effective obstacles and thereby seek to limit NATO mobility options.

c) Increased use of the urban environment will present a range of new threats and opportunities for a determined adversant and will require the development of engineer capabilities to deal effectively with this challenging potential threat to own force mobility.

d) **The Concept.** All arms/branches will attempt to bypass or overcome obstacles and maintain mobility by use of their own integral resources and efforts. In manoeuvre warfare when obstacles are encountered, the following actions will be attempted in the order shown so as to retain tempo and initiative:

(1) Bypass.

(2) Overcome the obstacles using integral support.

(3) Deploy specialist obstacle crossing resources.

e) The maintenance of tempo and mobility in the face of an effective obstacle, whether laid by the adversant or not, will depend on the following:

(1) An early assessment of the likelihood of obstacles to be crossed.

(2) Deployment of the force in an appropriate manner, in order to overcome likely obstacles speedily as they are encountered.

(3) Early detection and reconnaissance of obstacles.

(4) Effective drills and procedures.

f) **Main Tasks.** In supporting the mobility of all arms/branches, the main engineer tasks are:

(1) **Gap Crossing.** Including wet and dry gaps.

(2) **Countermine Operations.** The detection, reconnaissance, marking, bypassing, breaching and clearance of mined areas.

(3) **Counter Obstacle Operations.** The breaching, bypassing or reduction of obstacles other than gaps or mined or booby trapped areas.

(4) **Routes.** Developing and improving routes for tactical movement.

(5) **Support to Forward Aviation.** Tasks may include the construction, repair and maintenance of forward airstrips and the preparation of landing areas

(such as Forward Operating Bases (FOBs) and Forward Arming and Refuelling Points (FARPs).

(6) **Explosive threat Management**. Those tasks related to minimizing the risk of explosive ordnance, both manufactured and improvised, to friendly forces. It includes all actions from the provision of advice and engineer intelligence to deliberate actions to dispose of specific explosive threats, such as disposal, search and EOD/IEDD tasks[4]. Note that this task is not exclusively a mobility task. These tasks can be executed as survivability tasks in cases where their execution is not linked to the movement of friendly troops. This task can also be executed by different branch specialist. In fact, for some nations, the functions to mitigate explosive threat can be assigned to non-engineers (logistics or others). Nonetheless, this task is a MILENG responsibility as defined in the Alliance.

(7) **Route Clearance:** Route Clearance is an enabling task that can be conducted in conjunction with and in support to other mobility tasks to achieve and maintain freedom of movement. Route Clearance is defined as: the detection and if found, the confirmation, the identification, marking and neutralization, destruction or removal of explosive ordnance (EO) and non-explosive obstacles threatening a defined route to allow a military operation to continue with reduced risk. Route Clearance is covered in ATP 3.12.1.3 Route Clearance Doctrine.

(8) **Area Clearance**: Area clearance is a mobility task, under the MILENG Support to Joint Functions manoeuvre and fires; of which some components fall under force protection. Area Clearance focuses on vulnerable points and suspicious areas to reduce the risk posed by explosive ordnance (EO) and non-explosive obstacles. In land operations, area clearance is the detection, confirmation, identification, marking, neutralization, destruction, and removal of EO and non-explosive obstacles in a defined area to allow a military operation to continue with reduced risk[5].

(9) **Military Search**: Search is the capability to locate specified targets (may include people, information and material resources employed by an adversary) using intelligence assessments, systematic procedures and appropriate detection techniques and materials.

Counter-mobility

a) Counter-mobility operations affect an adversant's ability to manoeuvre freely and selectively deny him the use of terrain. They may also reduce the effect of an attacker's superiority in numbers, and channel him into areas of our

[4] By suitably qualified personnel iaw STANAG 2143/AEODP-10 conduct all render safe procedures.

[5] Proposed definition

choosing where he can be defeated. Counter-mobility planning must also take account of own-force manoeuvre requirements.

b) There is an enduring requirement for Alliance members to retain a robust counter mobility inventory for the foreseeable future, in spite of the obvious constraints placed upon nations by international and domestic laws. Operational Analysis (OA) has clearly demonstrated the benefits of munitions based capability in particular but there are other ways of achieving this effect including air, direct and indirect fire weapon systems. The planned development of a range of technologically advanced munition-based systems for the future featuring Self Neutralize (SN) and Self Destruct (SD) characteristics, should greatly enhance the ability of NATO forces to create a range of appropriate counter mobility effects (lethal and non-lethal) rapidly across the battlespace, shaping it to our own advantage. Such a capability is also likely to be useful in other situations, particularly the urban environment.

c) **The Threat.** Adversant military doctrine may emphasize mobility in order to achieve superiority of forces at the decisive time and place and to maintain the momentum of combat operations. Adversant equipment may be designed to enable their forces to meet these requirements. Adversant engineers may be organized and equipped to assist in maintaining high rates of movement by clearing and maintaining routes for the advance of all arms/branches units, including breaching minefields and other obstacles, and crossing gaps.

d) **The Concept.** Counter-mobility operations must be correctly balanced so as to disrupt the adversant's mobility while limiting the restriction on our own ability to manoeuvre freely. Barriers may be terrain, target or situation oriented. The increasing likelihood of operating in the urban/close terrain environment has already been noted and the requirement for a coherent counter-mobility capability can be demonstrated here as well as in more open terrain, with the common intent of shaping adversant movement into areas of our choosing.

e) In order to achieve the precise effects on adversant manoeuvre that are required by the commander, obstacle planning will take place following Intelligence Preparation of the Battlefield (IPB) and the estimate process, in which the commander will express his intent in terms of Combined Arms Obstacle Integration (CAOI) and will seek to maintain his own freedom of manoeuvre whilst constraining that of his adversary by ***disrupting, turning, fixing*** **or** ***blocking***[6].

f) **Main Tasks.** The main counter-mobility tasks are:

(1) **Emplacing Obstacles.** This includes a wide range of options such as the use of mines, explosives, digging etc, to achieve the desired effect depending on the situation.

[6] As defined in ATP-3.2.1, Chap 3, Sect 3, Tactical Tasks

(2) **Reinforcing Man Made Obstacles.** The strengthening of civilian structures and military obstacles.

(3) **Enhancing Natural Obstacles.** The enhancement of natural obstacles, to include gaps and trees.

(4) **Increasing Combined Arms/Branch Synchronization.** The value of obstacles can be greatly increased by overlaying them with effective fires.

Survivability

a) Survivability includes all aspects of physically protecting personnel, weapons, and materiel from the effects of adversant weapon and detection systems. It may also include deception measures.

b) **The Threat.** An adversant may use massive firepower for suppression or destruction and to enhance the shock action of its attacking forces. They may also deploy an extensive array of surveillance and target acquisition systems. On the other hand, an asymmetric foe may also seek to inflict disproportionate levels of damage on Alliance forces by unconventional means such as human or vehicle borne explosive devices including suicide attacks.

c) **The Concept.** All arms/branches are responsible for their own immediate survivability requirements. Engineers will augment and enhance unit survivability measures within the limits of available resources and the priorities of the commander. Engineer effort will be concentrated on tasks requiring specialist skills or equipment. Survivability measures begin with the use of all available concealment and cover, followed by digging and constructing fighting and protection positions.

d) During military operations other than war or combat, the design, resourcing and construction of appropriate force protection facilities including camps and other facilities, will usually become an engineer responsibility. This key task will demand a range of specialist skills and equipment to protect the force and enable it to conduct operations effectively in a cross-spectrum environment.

e) **Main Tasks.** The main engineer survivability tasks are:

(1) **Assistance in the preparation and construction of field fortifications**.

(2) **Assistance in the hardening and construction of protective infrastructure works.** This includes collective protection against the CBRN threat.

(3) **Assistance with camouflage, concealment and deception**.

(4) **Assistance in the clearance of fields of fire**.

(5) **Explosive threat Management**. Those are tasks related to minimizing the threat posed by all kinds of explosive devices, both manufactured and

improvised, to friendly forces. This includes all actions from providing advice and engineer intelligence to deliberate actions such as disposal, search and support to EOD/IEDD/C-IED tasks. Note that this task is not exclusively executed as a survivability task, it is often conducted as a mobility task when the explosive threat hinders FOM of friendly forces

General Engineer Support

a) General Engineer support involves the provision of engineer advice, technical expertise, resources and work other than the intimate engineering support provided directly to combat operations.

b) **Main Tasks.** The main tasks within the broad title of General Engineer Support, would include:

(1) **Water supply**.

(2) **Construction of air landing facilities**.

(3) **Airfield damage repair (ADR)**.

(4) **Construction and maintenance of utilities and structures**. This also includes deployed force infrastructure as well as HNS in conjunction with the CA given the new force models.

(5) **Explosive ordnance disposal (EOD)**. Note that EOD is not exclusively an engineer task. Some nations select EOD operators from a different arm and operations to counter EO hazards may well require EOD trained personnel to be augmented by ammunition technical personnel or divers, for example.

(6) **Railways and ports**.

(7) **CBRN decontamination**.

(8) **Support to Reconstruction and CIMIC tasks**.

SECTION 6 – Implications for Military Engineering Operators

Effective MILENG: Engineer resources are rarely sufficient for all tactical requirements. For that reason, MILENG elements will execute tasks within the parameters of JFEngr's plan to support the campaign.

SECTION 7 - Summary

While standing military forces and their MILENG components have been reduced in size, the demand continues to grow and now involves supporting civilian authorities. The comprehensive approach demands thorough understanding of the operational objectives and intimate knowledge of the key actors and engineer resources at the tactical level. Centralized planning and de-centralized execution is the method utilized to coordinate engineer effort (this will be covered in more

detail in chapter 3). An effective engineer technical network and unity of effort is essential in order to ensure that tactical tasks do not consume precious engineer assets which could achieve more important results elsewhere.

The effort of Military Engineering largely depends on the mission and the tactical commander, technical advice is also very important. The JFEngr or Chief Engr will assist the tactical commander in his operational planning and advice on the priority of MILENG support. Coordinating and task-organizing available engineer assets in support of the main effort is an essential role for the Engineer advisor. Additionally, the theatre Engr advisor requires monitoring and inventorying all external engineer capabilities via his contacts on the ground. From friendly forces to industry and GO/NGOs, to specialized equipment and raw building materials, theatre engineers require to exploit resources relevant to their specialty and leverage their utility to the higher levels as applicable.

CHAPTER 2 - MILITARY ENGINEER SUPPORT TO JOINT FUNCTIONS

SECTION 1 – Introduction

Independent of component or service, tactical units often conduct their missions and tasks in a land-based environment. As such, this chapter adapts a large portion of the content of AJP-3.2 Allied Joint Doctrine for the Conduct of Operations, and its subset; ATP-3.2.1 Allied Land Tactics, in an attempt to harmonize with the parameters set in AJP-3.12. Due to the nature of MILENG - often remaining "joint" in scope even at the tactical level – tactical operations are addressed here with the aim of being as general and inclusive as possible and as detailed as necessary. The purpose therefore is to describe in general terms the tasks assigned to the Military engineers within the Joint functions. It is not intended to be prescriptive or detailed but rather act as a guide to help correlate the traditional roles with the now established joint tasks. Nor are the tasks listed under the respective functions intended to be a hierarchal list as with all engineer tasks they are conducted across the entire spectrum of operations and functions dependent upon the environment and tactical plan.

SECTION 2 – Command and Control

Introduction

Effective C2 is key to the success of MILENG components in support of operations. Although invariably in support of combined arms operations, specialty imperatives demand a certain degree of technical authority. This reality does not suggest that the Engr technical network is in fact another command authority; there is only one chain of command. However, the credibility and capability of Engrs rests largely on their expertise in often highly specialized fields. Sometimes, technical requirements will impact on the Commander's plan and Engr advisors have to develop the art of balancing specialty expertise with the higher commander's intent. The nature of MILENG makes them more effective when their effort can be prioritized, their command and planning centralized and their execution de-centralized.

[7] AAP-6

[8] AJP-3.12, Chap 2, Sect I

[9] ATP-3.2.2, Annex E

CHAPTER 2 - MILITARY ENGINEER

SUPPORT TO JOINT FUNCTIONS

SECTION 1 – Introduction

Independent of component or service, tactical units often conduct their missions and tasks in a land-based environment. As such, this chapter adapts a large portion of the content of AJP-3.2 Allied Joint Doctrine for the Conduct of Operations, and its subset; ATP-3.2.1 Allied Land Tactics, in an attempt to harmonize with the parameters set in AJP-3.12. Due to the nature of MILENG - often remaining "joint" in scope even at the tactical level – tactical operations are addressed here with the aim of being as general and inclusive as possible and as detailed as necessary. The purpose therefore is to describe in general terms the tasks assigned to the Military engineers within the Joint functions. It is not intended to be prescriptive or detailed but rather act as a guide to help correlate the traditional roles with the now established joint tasks. Nor are the tasks listed under the respective functions intended to be a hierarchal list as with all engineer tasks they are conducted across the entire spectrum of operations and functions dependent upon the environment and tactical plan.

SECTION 2 – Command and Control

Introduction

Effective C2 is key to the success of MILENG components in support of operations. Although invariably in support of combined arms operations, specialty imperatives demand a certain degree of technical authority. This reality does not suggest that the Engr technical network is in fact another command authority; there is only one chain of command. However, the credibility and capability of Engrs rests largely on their expertise in often highly specialized fields. Sometimes, technical requirements will impact on the Commander's plan and Engr advisors have to develop the art of balancing specialty expertise with the higher commander's intent. The nature of MILENG makes them more effective when their effort can be prioritized, their command and planning centralized and their execution de-centralized.

[7] AAP-6

[8] AJP-3.12, Chap 2, Sect I

[9] ATP-3.2.2, Annex E

data. Liaison with the appropriate staff concerning the provision of geospatial information from a host nation is also essential.

Database management .Geomatic/Geospatial elements provide field support to users of map background displays both in hard and soft copies. It is necessary to ensure that geospatial information is readily available, up-to-date and distributed throughout the theatre. There is a requirement for close liaison with EOD and Engineer Intelligence staff as the maintenance of mines, UXO and general engineer information related databases may also be done by the geospatial staff.

Production. Geospatial elements have a limited capability for the provision of graphic support to staff and production of geomatic products, including mapping. However high speed, high volume reproduction capabilities may not be available in the field, in which case they must be provided by national base-plant resources.

Geographic information dissemination. Geospatial elements are tasked to establish formation map supply points tied into higher formation, theatre or national networks. Responsibilities include shipping, receiving, inventory control and sourcing of geomatic data in both hard and soft copy. It does not include delivery to field units which remains a service support function.

Terrain analysis. The process undertaken to address specific concerns of the commander about the terrain and how it will affect the implementation of the plan. Terrain analysis consists of applying classic workflows and initiative to produce terrain analysis products using terrain databases in conjunction with other sources. It does not include information collection. The terrain analysis information provided is used by all staffs in planning operations.

Field survey. Geospatial elements provide theatre level survey support to various weapon systems. They also carry out global positioning system (GPS) or terrestrial survey as required and can collect data for production of mission specific mapping either from the ground or from imagery. Other tasks can include natural obstacle locating and advice on navigation.

Geographic imagery provision. Although the majority of imagery is supplied from and for G2, Geospatial staffs also have access to imagery that can be used for production of image maps and graphics for the G3 element. This requires close liaison with G2 to ensure the correct prioritization/classification, as the imagery sources will often be the same.

Crossing Operations. Crossing operations may be carried out in three overlapping phases:

a) Assault, to gain a lodgement on the far side of the obstacle. This phase is not required for an unopposed crossing.

b) Build-up, to extend the lodgement into a bridgehead.

c) Consolidation, to establish a firm base within the bridgehead from which to break out and continue the overall operation.

Short Gap Crossing. Preparation for the crossing of short gaps must be preceded by map and terrain analysis as well as air and ground reconnaissance to determine gap locations, widths and the grouping of engineer resources to support manoeuvre units. Short gaps are normally crossed from the march by combat units employing organic engineer support or using expedient means. Armored engineers employing fascines, vehicle-launched bridges and armored engineer vehicles will be the likely means of crossing short gaps. Vehicle-launched bridges will normally remain in place to be crossed by follow-on elements and some logistics, and eventually be replaced by support bridging. In addition to the preparation of crossing sites, engineers will also mark the immediate approaches and exits in accordance with STANAG 2036.

Deliberate Water Crossing Procedures. Water crossing operations will be conducted in accordance with STANAG 2395. In short, when a water obstacle cannot be crossed from the march, using existing bridges, fording, swimming or on-hand bridging resources, and the assaulting force is in contact with the adversant, a deliberate crossing operation will have to be carried out. The crossing may be conducted in three overlapping phases: assault, buildup and consolidation. Two main forces may be involved: a bridgehead force and a break-out force. The critical functions of a water crossing are: security, movement control, terrain control and crossing support.

BREACHING

Breaching. Breaching may be conducted as a hasty or deliberate operation, by hand, mechanical or explosive means, or using a combination of means. Once lanes are established they are marked in accordance with STANAG 2036.

a) **Hasty Breach.** An attacking force will attempt to breach from the march using breaching resources within the force. Very little reorganisation of the assault echelon is required and SOPs may be developed for breaching to commence with little or no additional orders being given. Engineer support will come from resources on hand. The scope of engineer support can include reconnaissance, provision of advice, and the breaching, proving, marking and maintenance of lanes.

b) **Deliberate Breach.** If a breach cannot be conducted from the march or if the obstacle is too complex to be crossed using the resources on hand, deliberate breaching will be attempted. The resultant loss of momentum has to be accepted, as more time is required for reconnaissance, planning and the build-up of necessary resources. Engineer support to the deliberate breach is extensive. Timely and accurate intelligence is required to determine the extent and composition of the Explosive threat , and hence the structure of the breaching force. This force normally consists of infantry, armour, engineers, indirect fire support and close air support (CAS). Engineer support to a deliberate breach is likely to include the following:

(1) Detailed reconnaissance of the minefield to determine locations of mine rows and types of mines.

(2) Provision of engineer advice to commanders.

(3) Provision of special engineer equipment and personnel to assist in the conduct of the breach.

(4) Proving, marking and maintenance of lanes.

Minefield Breaching. Minefield breaching will invariably be part of a combined arms/branches operation. In many instances, the minefield will be merely one of a series of obstacles to be breached; the overall obstacle, in this instance, is described as “complex”, thereby posing a considerable challenge to engineers. Increasingly such breaching may take place in an urban setting, reflecting the realities of the contemporary operating environment.

a) **Reconnaissance.** The task of determining the boundaries of a minefield is an all arms/branches responsibility. The physical reconnaissance within a minefield is an engineer responsibility.

b) **Locating Minefields.** Modern reconnaissance and surveillance techniques as well as information obtained from maps, terrain analysis and/or other sources enable a commander to determine likely mined areas. The use of all arms/branches reconnaissance, supplemented by engineer reconnaissance well forward, will provide timely advice on minefield locations thus allowing a commander to adjust the deployment of his force and position breaching equipment so that it can be used quickly. It is essential that planning and preparations commence before the obstacle is reached.

c) **Minefield Composition.** It may not always be necessary to determine the exact composition of a minefield, particularly if a combination of explosive breaching and other methods is used. However, if a deliberate operation is to be conducted, it is advantageous to determine the composition of a minefield prior to breaching. As a minimum, the width, depth and details of adversant weapons covering the minefield are essential.

DEMOLITIONS

General. Demolition is defined as the destruction of structures, facilities, or materiel by the use of fire, water, explosives, mechanical or other destructive means. Explosive demolitions are used for both destructive and constructive purposes, including:

a) clearing obstacles or obstructions and destroying fortifications;

b) impeding the opposing force movement by destroying bridges, cratering roads and airfields,

c) and creating other obstacles such as blowdown in defiles or rubbling of structures in built-up areas

d) Battle field munitions and UXO disposal/clearance;

e) denying areas, facilities, equipment and supplies to the opposing force;

f) preparing sites for general construction work; and

g) quarry operations.

Control of Demolitions. It is the responsibility of the all arms/branches commander to control what is to be fired and when for preliminary or tactical targets. However for operational or strategic targets the JF Commander retains control. For this purpose, a system for the control of demolitions is essential; this is set out in STANAG 2017. For obstacles of particular importance, the tactical commander/JF Comd may impose the requirement for guards e.g. for reserved demolitions or other obstacles, or impose restrictions concerning the firing of demolitions and the employment of scatterable mines

Responsibilities. Simple demolition tasks are those that all arms soldiers (understanding that not all NATO forces are the same) in general shall be capable of completing are;

a) using the Bangalore torpedo;

b) using explosives to assist digging in;

c) destroying vehicles and equipment; and

d) destroying user blinds and misfired ammunition.

Engineers are responsible for executing the more technical demolition tasks requiring special skills, training and equipment; these tasks are usually authorized (preliminary) and controlled (reserve) at the formation level and support the formation. Preliminary demolition tasks are part of the counter mobility plan. Whereas Reserve Demolition tasks are part of the counter attack plan and although both are prepared and executed by engineers these types of demolition tasks are controlled at the highest levels[11].

AREA / ROUTE DENIAL

Introduction. As NATO has a requirement to continue to denying adversary personnel and vehicles access to areas and routes this task remains valid. With the introduction of the Ottawa Treaty in 1997[12], denying area and route access through the use of anti-personnel mines is no longer viable. Many countries have also reduced the use of anti-tank mines to impose control and or use through denial methods, which further exacerbates into a current capability gap. A controllable, mine-free barrier system that fully meets NATO's capability and legacy requirements is still in development, however in the interim a means to satisfy the capability gap still exists. While it is still necessary to develop an Area and route denial system that delivers lethal and non-lethal effects to personnel and vehicles (including armoured vehicles), the use of sensors, effectors, human-in-the-loop command and control weapon systems along with non lethal obstacle and denial systems satisfy the requirement. These systems and measures[13] will be employed by engineers throughout the full spectrum of operations to provide; Force Protection Support, Counter-Mobility support for both Area and Route Denial operations.

Three main engineer responsibilities for denial operations (Block,Fix,Turn and/or disrupt) are:

a) Force Protection Support: employment of systems to protect a fixed location (base camp, key infrastructure, entry control point).

b) Area Denial: employment of systems to support the scheme of manoeuvre by shaping or hampering the movement of the adversant and enhance the effectiveness of direct and indirect fires (area, point).

c) Route Denial: employment of systems to support local security, and prevent adversant obstacle emplacement and their use of linear avenues of approach (border, tunnel, route).

---

11 STANAG 2017 provides the details of this level of control.

12 The Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (a.k.a the Ottawa Treaty) 1997

13 STANAGs 2237 and 2430 provide the details on control measures in place for obs numbering and reporting.

MILITARY SEARCH

Introduction. Military Search operations[14] are imperative to uncovering and neutralising concealed adversaries. Friendly forces seize the initiative through offensive Military Search operations locating people, information, and material resources employed by the adversant and then acting to interdict the adversant's ability to conduct operations. Friendly forces protect themselves and friendly populations against attack, in part, through defensive Military Search operations.

Principles of military search. As a means of both carrying the fight to the adversant and of defending friendly forces, effective Military Search operations are vital to coalition success. Therefore, the planning, coordination, and execution of effective Military Search operations are of the utmost importance to all multinational force partners. There are three levels of search which are;

a) **Basic Search**. All military personnel should be prepared to conduct Basic Search incidental to performing their assigned missions and duties on a continuing basis. Basic Search does not involve a pre-planned search operation and no specific adversary threats or environmental hazards have been identified. Basic Search is inherent to force protection. All military personnel should be able and ready to conduct Basic Search.

b) **Intermediate Search**. Intermediate Search is appropriate for deliberate, pre-planned offensive Military Search operations when there is no specific intelligence indicating the presence of functioning explosive / hazardous devices, there is no indication of environmental hazards and a high assurance level is not required. Intermediate Search is the first level at which units form teams to conduct Military Search operations.

c) **Advanced Search**. Advanced Search is appropriate for deliberate, pre-planned Military Search operations when there is specific intelligence indicating the presence of a functioning explosive / hazardous devices, there are indications of environmental hazards or a high assurance level is required.

Military Engineer participation in a specific Search operation will be dependent on the level of Search as well as the Risk Assessment and the resources available. In particular, Military Engineers will be involved in Advanced Search operations when specific explosive or environmental hazards are likely. Military Engineer assets may also be held on standby when lower level Search operations are ongoing.

AREA CLEARANCE

Introduction. This section defines a common methodology for area clearance and discusses the practical application of area clearance capabilities

[14] STANAG 2283/ATP-3.12.1.1 Military Search provides details on Mil Search

and activities. It provides area clearance principles and some standards at the tactical level.

Applicability. Area clearance is a mobility task, under the MILENG Support to Joint Functions manoeuvre and fires; of which some components fall under force protection. In land operations, area clearance is the detection, confirmation, identification, marking, neutralization, destruction, and removal of EO[15] and non-explosive obstacles[16] in a defined area to allow a military operation to continue with reduced risk[17].

Area clearance is not normally conducted under fire or in adverse weather and is normally conducted during hours of daylight. Leaders and planners must strive to limit the areas requiring clearance to only those areas necessary to support military operations. When possible, areas not required for military operations and not an immediate threat to friendly forces are permanently marked and avoided. It is also not normally oriented to counter risks posed by natural disaster, such as clearance after an earthquake. Some situations where area clearance could be required, in support of operations, include;

a) Airfield clearance.
b) Equipment retrieval operations.
c) Runway construction.
d) Logistics facility construction.
e) Air and seaport recovery.
f) Forward air refuelling point (FARP) operations.
g) Support and relief operations.

Area clearance normally focuses on EO and non-explosive obstacles clearance in a defined area to ensure the safe usage of the area by/for military units. To ensure continuity of effort, a controlling headquarters for the area clearance effort is designated and responsible for;

a) Specifying the area to be cleared and the depth of clearance in tasking orders.
b) Specifying the standards and guidelines for the clearance mission[18].
c) Accrediting a unit ability to conduct clearance operations.
d) Maintaining a database of cleared and uncleared areas and showing the clearance status for each area.

---

[15] Explosive ordnance is defined in AAP-6

[16] Non-explosive obstacles are covered in STANAG 2430 Land Forces Combat Engineer Messages, Reports and Returns.

[17] Proposed definition.

[18] Area clearance utilizes similar procedures as Route Clearance and Military Search. Refer to STANAG 2625 ATP-3.12.1.3 Route Clearance and STANAG 2283 ATP-3.12.1.1 Military Search.

e) Establishing and maintaining a system to monitor current clearance activities and posting clearance inspections of cleared areas.

Planning. Planning includes the requirement for the support by other military units including medical, logistics and maneuever forces for security, as well as, coordinating the support of host nation agencies, local security forces, etc. Planning for area clearance involves the risk management process and effectively guide commanders, staff and military engineers to select the preferred methods of clearance. The degree of risk influences the methods and thus the clearance rate[19] at which areas may be cleared, with every task having its own set of complications and nuances.

Area clearance operations consist of the following three phases:

a) Technical survey, including;
   (1) Information gathering (detailed technical and topographical information of known or suspected hazardous areas).
   (2) Reconnaissance (visual or aerial, including the use of imagery).
   (3) Survey (defines the area in terms of size, described through measurements and azimuths).
b) Clearing, including;
   (1) Planning
   (2) Site layout.
   (3) Detection.
   (4) Clearance.
   (5) Proofing.
   (6) Final marking.
c) Report and Handover[20] .

In the clearance phase, all obstacles and hazards from a specified area to a specified depth are removed or destroyed. However, clearance operations have residual risk[21] after the implemented procedures. This requires management systems and clearance procedures that are appropriate, effective, efficient, and safe. These procedures need to have an internal audit mechanism to ensure that the end product is safe.

Site layout. A safe clearing operation includes the proper design and layout of a clearance worksite by fencing and marking hazardous areas, controlling the movement of personnel, enforcing safety distances, and providing effective medical support.

---

[19] Rate of clearance is referred to in the levels of clearance in STANAG 2625 ATP-3.12.1.3 Route Clearance
[20] STANAG 2430 Land Forces Combat Engineer Messages, Reports and Returns.
[21] STANAG 2625 ATP-3.12.1.3 Route Clearance

Methods. The clearance phase is the direct application of an asset to remove a specific threat. Based on the recognition of threat locations, leaders match the best clearance method and equipment available to counter the threat. The safe execution, highest possible effectiveness, and impacts on future operations need to be considered. Clearance procedures vary depending on the type of clearance equipment available.

Area Clearance Elements. Area clearance is typically a combined-arms operation executed by security and support element, command and control (C2) element, clearance element, and reinstatement elements.

a) Security and Support Element: The mission of the security and support force is to provide security and protection of all elements and to facilitate area clearance.
b) Command and Control Element: The C2 element integrates the activities of all the elements. It maintains communications with higher headquarters as well as reporting.
c) Clearance Element: The clearance element has detection, identification and neutralization capabilities.
d) Reinstatement Element: Improves the area upon completion of clearance operations in order to facilitate the use of the cleared area.

General Considerations and Limitations

a) Area clearance utilizes similar procedures as Route Clearance and Military Search.
b) Risk management measures should be continuously reviewed by the military engineer troop commander with the involvement of the tactical commander. There is always residual risk following a clearance operation; there is no 100% guarantee.
c) The nature of the task site (terrain, vegetation, metallic debris) and the operating environment (threat/hazard level) influence progress.
d) Handover-takeover should be supported by documentation recording all the details of the clearance and reinstatement.

ROUTE CLEARANCE[22]

RC is an enabling task that can be conducted in conjunction with and in support to other mobility tasks to achieve and maintain freedom of movement. Unlike breaching, RC is not normally conducted under threat of direct or indirect fire. However, planning must take into account the threat of possible adversary surveillance and / or adversary attack. Units should conduct and coordinate RC to ensure that friendly forces retain the ability to move as the Commander

[22] Route Clearance is covered in ATP 3.12.1.3 Route Clearance Doctrine.

dictates. Timely and accurate reporting of the effect achieved by RC operations is fundamental.

Route Clearance is defined as: the detection and if found, the confirmation, the identification, marking and neutralization, destruction or removal of explosive ordnance (EO) and non-explosive obstacles[23] threatening a defined route to allow a military operation to continue with reduced risk[24].

ROAD CONSTRUCTION / IMPROVEMENT

Introduction. Road construction and improvement is conducted as required in support of mobility operations (Manouvre) to enhance existing routes and roads or to allow access by military units to areas not serviced by the existing road network. This is conducted normally as a support activity however in operations that are humanitarian in nature, it can also be a force support task as well the engineers can augment civil agencies with the use of equipment or resources to assist those activities.

Routes for Tactical Movement. Despite the improved mobility of modern combat and logistic vehicles, engineer support will still be required to construct, repair, open and maintain multiple routes for tactical movement. While keeping routes clear of obstacles, is a particularly important task for land forces engineers to ensure tactical mobility and sustainment of the force therefore the need for route construction and maintenance teams will be required. Routes can be subsequently upgraded if they are to be used more extensively. As such routes and lanes must also be properly marked for friendly forces in accordance with STANAG 2036.The following are basic consideration in determining route and construction requirements;

a) **Route Reconnaissance.** Reconnaissance is required to determine the availability and trafficability of routes. Existing route networks must be checked and limitations or shortfalls identified. The reconnaissance must then determine what additional routes must be provided, taking account of the resources available.

b) **Routes for Combat Vehicles.** Routes primarily for use by combat vehicles are normally designed and constructed to carry limited traffic for relatively short periods. Requirements for construction will vary based on local conditions.

c) **Routes for Logistic and Other Wheeled Traffic.** Routes for wheeled traffic in the forward areas are usually built to support a moderate volume of traffic. The construction effort is likely to be more extensive than for tracked combat vehicles but similar techniques will be used.

---

[23] Non-explosive obstacles are covered in STANAG 2430 Land Forces Combat Engineer Messages, Reports and Returns.

[24] Proposed definition.

SECTION 4 – Intelligence

MILENG intelligence within NATO and national elements are activities that historically focused primarily on actual or potential adversaries within a specific country or region. However, the ability for NATO to act effectively with a comprehensive approach requires information and knowledge regarding the capabilities, interaction and influences of all key actors across a broad operational environment. As a result a KD approach which utilizes subject matter experts to analyze the different actors and systems in all the relevant (PMESII) domains, as well as the specific aspects of the region and operational environment, now develops a much broader and more comprehensive understanding of the engagement space. With regards to engineer specific information (intelligence gathering) the focus remains terrain based due to the nature of MILENG. The aim of this is to provide guidance on the process, from a MILENG perspective, while remaining as general as possible. For detailed information on the process, refer to the JFCBS directive, as necessary.[25]

ENGINEERS AND KNOWLEDGE DEVELOPMENT

Knowledge Development. Today's adversary is a dynamic, adaptive foe who operates within a complex, interconnected operational environment[26]. Knowledge Development (KD), as outlined in the BI- SC concept, is a process where information is collected, fused and analyzed to create ''actionable" knowledge which is then made accessible across the staff, coalition, Alliance, as required[27]. KD is a continuous, adaptive and networked activity carried out at strategic, operational and tactical levels of command. It provides commanders and their staff with a comprehensive understanding of complex environments, including the relationships and interactions between systems and actors within the engagement space[28]. These systems may include but are not limited to politics, military, economy, society, infrastructure and information, the PMESII[29] domains. This approach enables the Commander and staff to better understand possible effects of military, political, economic and civil actions on different Infrastructures, systems and actors within the engagement space. KD primarily supports decision making throughout the different phases of NATO's Crisis Management and planning Processes.

Relationship between Intelligence and Knowledge Development. NATO and national intelligence assets are critical to the KD process and will continue to collect information regarding potential risks and threats to the Alliance. This

---

25 Find a STANAG ref outlining the INT process

26 Bi-SC, Knowledge Development, Pre-Doctrinal Handbook, Final Draft 22 SEP 2009

27 Bi-SC, Knowledge Development, Pre-Doctrinal Handbook, Final Draft 22 SEP 2009

28 see 'Glossary of Terms and Abbreviations'

29 ACO COPD, Chap 3, para 3-6 – Develop a Systems Perspective of the Area of Interest, p. 3-11

includes the possible intentions and capabilities of potential adversaries, on the basis of the different NATO Intelligence Disciplines.

While there are many similarities between military intelligence process efforts and KD, there are two significant differences[30]:

a) Intelligence activities historically focused on actual or potential adversaries within a specific country or region. However, the ability for NATO to act effectively with a comprehensive approach requires information and knowledge regarding the capabilities, interaction and influences of all key actors across a broad operational environment.

b) A KD approach utilizes subject matter experts to analyze the different actors and systems in all the relevant (PMESII) domains, as well as the specific aspects of the region and operational environment, in order to develop a much broader and more comprehensive understanding of the engagement space. This process is the deliberate use of non-military sources to provide information beyond the scope of military intelligence activities, including the acquisition of information and knowledge from International Organizations (IOs), Non-Governmental Organizations (NGOs), private and commercial organizations, as well as the full range of governmental organizations (GOs) and agencies. An essential aspect of KD is therefore the fusion of intelligence with information from other sources in order to produce a comprehensive picture of the operational environment.

ENGINEER INFO COLLECTION

Engineer Information. Engineer information is unprocessed data, which may be used in the production of intelligence and knowledge. It may come from many sources including maps, satellite imagery, reconnaissance, POWs as well as military and civilian sources. The MILENG advisor must identify information requirements to the HQ staff for inclusion in the intelligence collection plan.

Types of Engineer Information. Examples of the type of information engineers should be interested in:

a) Commander's plan (CCIRs);
b) Terrain features;
c) Organic engineer assets and resources;
d) Adversary engineer capabilities and techniques;
   Other engineer assets available;
e) Civilian engineer assets available;

[30] ACO Comprehensive Operations Planning Directive (COPD), Chapter 2 – KD, Oct 2013

f) Critical infrastructure requirements;
g) Local population infrastructure requirements;
h) Local contracting capabilities;
i) Local engineer resources.

ENGINEER INFO EXPLOITATION.

Engineer intelligence was previously defined as the product resulting from the processing of information concerning adversant engineer operations and resources, environmental conditions, military geographic information and terrain required by a commander in the planning of combat operations.

In the current Operating Environment, Engineer Information supports both the traditional Intelligence process and the wider Knowledge Development process. It has a fundamental role in the successful planning of military operations. Engineer information may be collected and reported by all arms/branches, by intelligence gathering services as well as by dedicated engineer reconnaissance. Once reported, engineer information is collated and managed by engineer staff elements. Many items of engineer information are of interest to other arms/branches, intelligence services and agencies and the ability to exchange information within, and between, headquarters is required. Reporting should be in accordance with STANAG 2430, where appropriate.

A structured sequence or process is needed to identify the information and intelligence requirements, gather the relevant information, process them into a product and disseminate them to those who need it. This need for a structured approach is satisfied by a four-stage-sequence consisting of Direction, Collection, Processing and Dissemination. The so called ”Intelligence- Cycle” is the foundation for all intelligence activity. These phases are discrete operations and they culminate in the dissemination of the required intelligence product. The integration of engineer staffs and information into this Intelligence Cycle is critical.

ENGINEER INFO MANAGEMENT.

Engineer info management supports Knowledge Development and is very wide-ranging in its scope. It may encompass the operational capabilities of friendly and adversant forces, the terrain, the weather, geographic information as well as information on infrastructure, utilities and resources needed to conduct operations. It can be considered as both a product and a process that supports the following functions:

a) Force Generation. Engineer support to Knowledge Development informs the force generation process by allowing the engineer commander to advise on and plan the optimal engineer force structures for particular operations paying regard to terrain, tasks and adversant.

b) Intelligence Preparation of the Battlefield (IPB). The purpose of IPB is to help commanders to refine their intelligence requirements, identify decision points and to inform the Operational Planning Process. Within this process the engineer focuses on the terrain aspects of Battlefield Area Evaluation (BAE). One of the products of this analysis classifies the terrain as “GO”, “NO GO” or “SLOW GO” manoeuvre areas by assessing trafficability. Movement template times may also be developed.

c) Situational Understanding. Engineer information adds to the overall situational understanding with particular emphasis on terrain and the capability of adversant engineers. Modern technology offers considerable benefits in ensuring engineer situational understanding information is rapidly and accurately reflected in a complete all arms/branches or joint picture.

d) Joint Targeting Process. Engineers can contribute to the joint targeting process by input to the selection of targets, aiming points, and Battle Damage Assessment (BDA). Destroying infrastructure targets may limit the military options for an adversant or faction in the short term, but may create significant limitations for NATO in the longer term. Consequently, engineers may assist in achieving a desired effect based by denying rather than destroying targets. Engineers may also help to identify alternative targets and aiming points that create similar effects without the consequent damage and other limitations such as cost.

e) Force Protection. Engineers can add considerably to force protection planning and implementation by examining how the adversant could exploit the terrain and what actions our own forces could take to reduce or negate potential adversant action.

GEOMATICS

General. Geospatial is the term used to describe those scientific and engineering activities involved in the capture, storage, analysis, processing, presentation, dissemination and management of geospatial information. Geomatics is the physical products produced as a result of those activities.

Geomatic/Geospatial support is essential to the conduct of modern military operations. Every weapon system, combat unit, aircraft and ship requires some form of geospatial support to deploy, navigate, manoeuvre and fight. Geospatial support includes a responsibility for updating, revising and maintaining geospatial databases, including paper maps, providing limited production capabilities, distributing geographic data including mapping and softcopy data, and other geospatial products conducting terrain analyses, providing terrain analysis teams to formations and conducting field surveys. Co-operation with the intelligence staff, engineer and reconnaissance units is necessary to both obtain and confirm

data. Liaison with the appropriate staff concerning the provision of geospatial information from a host nation is also essential.

Database management .Geomatic/Geospatial elements provide field support to users of map background displays both in hard and soft copies. It is necessary to ensure that geospatial information is readily available, up-to-date and distributed throughout the theatre. There is a requirement for close liaison with EOD and Engineer Intelligence staff as the maintenance of mines, UXO and general engineer information related databases may also be done by the geospatial staff.

Production. Geospatial elements have a limited capability for the provision of graphic support to staff and production of geomatic products, including mapping. However high speed, high volume reproduction capabilities may not be available in the field, in which case they must be provided by national base-plant resources.

Geographic information dissemination. Geospatial elements are tasked to establish formation map supply points tied into higher formation, theatre or national networks. Responsibilities include shipping, receiving, inventory control and sourcing of geomatic data in both hard and soft copy. It does not include delivery to field units which remains a service support function.

Terrain analysis. The process undertaken to address specific concerns of the commander about the terrain and how it will affect the implementation of the plan. Terrain analysis consists of applying classic workflows and initiative to produce terrain analysis products using terrain databases in conjunction with other sources. It does not include information collection. The terrain analysis information provided is used by all staffs in planning operations.

Field survey. Geospatial elements provide theatre level survey support to various weapon systems. They also carry out global positioning system (GPS) or terrestrial survey as required and can collect data for production of mission specific mapping either from the ground or from imagery. Other tasks can include natural obstacle locating and advice on navigation.

Geographic imagery provision. Although the majority of imagery is supplied from and for G2, Geospatial staffs also have access to imagery that can be used for production of image maps and graphics for the G3 element. This requires close liaison with G2 to ensure the correct prioritization/classification, as the imagery sources will often be the same.

SECTION 5 – Force Protection

Introduction. Force Protection. Measures and means to minimize the vulnerability of personnel, facilities, equipment, materiel, operations and activities from threats and hazards in order to preserve freedom of action and operational effectiveness thereby contributing to mission success."

Force Protection Capabilities. FP comprises a number of inter-related capabilities and elements, measures and disciplines, which may contribute to the overall FP function to achieve the desired objective. The contribution of these capabilities will be determined by the operational environment and the level of threat, scale of the operation, climate, civil environment, composition of the NATO led forces, availability of HN Support and the presence of International Organizations.

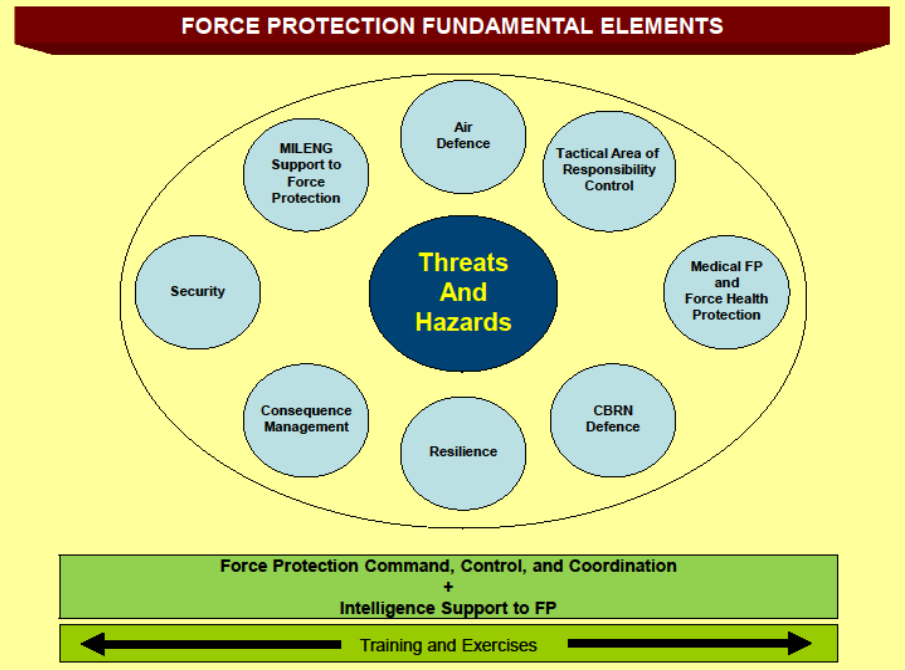


Figure 2-1 - NATO Force Protection Figure[31].

FP is a combination of activities of a large number of specialist areas, each with their own plan and priorities that requires an integrated and synchronized plan. MILENG Support to FP is one of these eight fundamental elements with Military Engineers that support proactively all other capabilities. MILENG has to coordinate and support various engineer efforts in order to integrate these capabilities in to a cohesive and effective set of activities and performances to FP. (in AJP 3.14 MILENG Support to FP is divided into 7 sub categories:

[31] As for AJP 3.14

Protective Infrastructure, Fire Protection, Support to EOD, Support to C-IED activities, Camouflage, Concealment and Deception, Military Search, Route and Area Clearance).

Effective protection does not rely on a single technique or action but comes from a balanced combination of active and passive measures into a coherent, flexible system. This systematic approach to integrated survivability seeks first to prevent an attack. Should an attack take place, its effect should be reduced if not, nullified. If an effect is felt, the protected asset should have the robustness to maintain operational capability. Moreover flexible plans are to set up in advanced in order provide rapidly restoration of destroyed capabilities and ensure the survivability of the attacked base. It is essential that this systematic approach is applied from outside the asset and works towards it.

For the scope of this Publication, land centric, tasks described below reflect main Joint tasks accomplished by Military Engineering in support to Force Protection that require high qualifications and technical skills.

PROTECTIVE WORKS AND (FIELD) FORTIFICATIONS / FORCE PROTECTION ENGINEERING[32]

General. Generally called Protective infrastructure in the joint environment, this includes all the infrastructure, materiel, tasks and activities that contribute to FP. It encompasses professional and technical expertise for planning, designing, coordination, construction and maintenance of appropriate infrastructure, hardening facilities, perimeter security systems, bases' surveillance system, determining stand-off distances and field fortifications that in the land environment are carried out by Engineer Branch/Task Force Engineers under **FP Engineering**[33]. On this regards, national FP caveats may certainly have to be taken into consideration while designing protective works and fortifications. NATO strives to standardize expeditionary infrastructure, however it is understood that national directives may prescribe different standards.

Flexibility. Within any particular Operation or deployment, the level of threat faced will most probably fluctuate throughout the progress of the Operation. The protective measures employed may therefore vary considerably across the battle space as a whole and will most likely change with time. However, the

32 **STANAG 2280** is the reference document that provides Guidance on the methods, materials, and test procedure for protective infrastructures (protective works and fortifications), including protective level of structures, standard weapons categories and severity of effects. **Allied Directive 80-25** provides the FP MMR for common funded infrastructure and link the bounds threat/severity of effects to a defined level of MILENG measures/FP Engineering.

33 A definition of Force Protection Engineering (FPE) is to be found in Nr. 0269. It is the engineering effort conducted in support of the wider aim of delivering protection, a key component of capability.

construction of physical protective measures may take some time and can be costly. Therefore, they must offer flexibility and allow for subsequent changes in threat by either built-in redundancy or the ability to upgrade simply. The threat picture upon which they are based will always remain fluid and subject to a rapid change.

Presentational factors. The physical protective measures employed by a Force must also take into account the political and presentational impact they may have. The loss of a military capability or critical infrastructure may often have more significance impact to the overall mission in this context, than if measured purely in terms of physical value to the force.

a. Force Posture. The protective measures adopted by a Force give a clear indication of how vulnerable it feels itself to be. Any Force Protection work must be in harmony with the Force posture the commander wishes to present. Indeed, it is likely that the Commander may wish to use the physical protective measures adopted by the Force, as a principal means by which its posture is expressed. It is therefore important to plan for both the removal and not just the installation of those measures.
b. Duration factors. Any such construction work also gives a visible indication as to how long the Force believes it may take to create a stable and secure environment.
c. Morale. Operational experience has repeatedly shown that Force Protection preserves both the physical and moral components of fighting power. Our Forces must have confidence in the structures and systems provided for their own protection.

Force Protection Engineering (FPE). FPE is defined as "the aggregate of those engineering activities whose intended effect is the minimisation of the risks to a force's assets posed by operational threats, occupational and environmental hazards that require technical and engineering skills"[34]. The Military Engineers, as technical experts, develop and maintain FP Engineering SOP and best practices, enabling pre-incident vulnerability analysis, post incident response and restoration capabilities.

The FPE Spectrum. FPE manifests as a series of engineering measures undertaken in all 3 environments present in the Continuum of Operations. The engineering structures and systems themselves may be primarily intended for one specific part of the spectrum but may be of wider use.

The FPE Model. The FPE model is a logical process carried out and managed by Chief Engineer through the FP Engineering Cell/Officer (FPEO) in the Engineer Branch to identify, design and realize the necessary and more

[34] In the land environment it covers Protective works and Field Fortifications.

appropriate protective measures and related infrastructures. In relation to FP model[35] responsibilities and inputs from MILENG are related to:

a. Hazard & threat identification to minimize the vulnerabilities defined/identified;
b. Risk assessment and FP task analysis to tailor the FPE intervention to the tasks identified.

Force Protection Engineering Phases. The Force Protection Engineering Model comprises the following phases with actions as explained in the figure 2.2:

a. FP Guidelines and Requirements;
b. Initial FPE planning;
c. FPE Planning approval;
d. Recces and technical evaluation;
e. Preparation of the FPE intervention;
f. Execution of the FPE intervention.

[35] The FP model provides FP planners and commanders with a logical process aimed at identifying and applying controls and measures, effectively responding to incident should occur, and a review process to successfully manage FP at the lowest practical level, as reported in AJP 3.14.

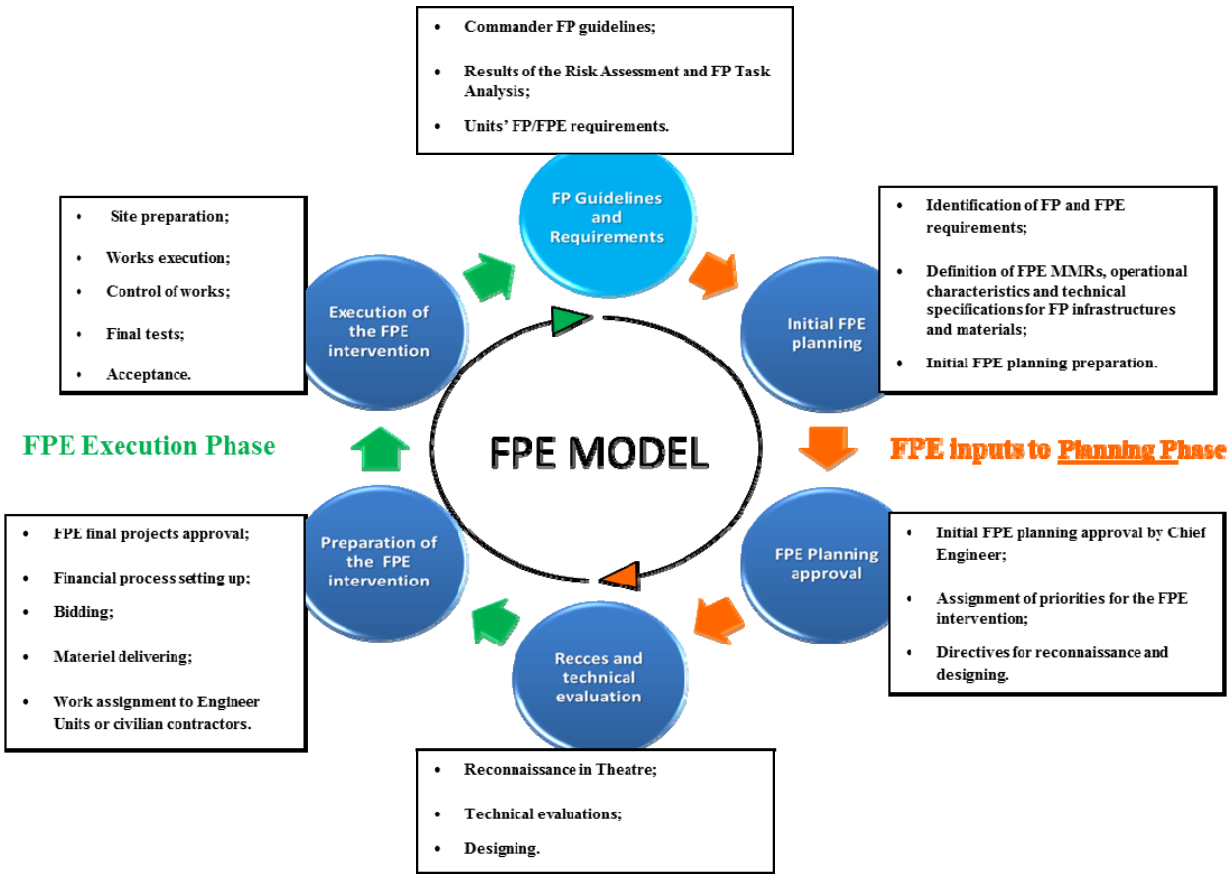


Figure 2-2 - Force Protection Engineering Model Figure.

Protective works. Engineers may augment existing structures or facilities with enhancements or protective materials to increase the protective properties or resistance to damage or attack. Although not as extensive as in the field fortifications in the defense, protective emplacements are used primarily for personnel infrastructure, unit locations and logistic concentrations. Commanders may require hardening of key command and control facilities, especially those with a detectable electronic signature. Engineers provide protective works mainly in the form of constructed barriers and screens such as:

a. Chicanes or route access control points;
b. Fences, screens, or bunkers surrounding a facility or vehicle, equipment or troop concentration;
c. Preparation of sites for tactical air and aviation units;
d. Advice/assistance with the construction of protective barriers;
e. Perimeter protection systems;
f. Support to CBRN Collective Protection (COLPRO).

Field Fortifications. The preparation of (field) fortifications is an all arms/branches responsibility. When time is short or the nature of the terrain requires special techniques, such as the use of earthmoving equipment or explosives, engineers may provide support in accordance with the commander's priorities. Possible engineer tasks include:

a. SME's advice on the construction of field fortifications;
b. Construction of command posts;
c. Construction of artillery gun positions, tank scrapes and weapon pits;
d. Preparation of alternate positions;
e. Preparation of sites for tactical air and aviation units;
f. Strengthening field fortifications and building reinforcement.

Critical Infrastructure Protection. Critical infrastructure should be protected against spectrum of threats. The types of protection built will depend upon the terrain and soil type as well as on the availability of existing buildings and natural cover and Host nation Support. Engineer advises the commander on the selection of the most suitable measures to protect both military and host nation critical infrastructure.

CONCEALMENT AND DECEPTION (AND CAMOUFLAGE)

Introduction. Although camouflage and concealment is and all arms task one of the main engineer survivability tasks associated with force protection is "Assistance with camouflage, concealment and deception." This includes the MILENG Expertise in planning, designing, construction and maintenance of concealment and deception in support to tactical Commanders Measures taken by engineers might include the construction of fighting positions, the installation of dummy equipment and the emplacement of phoney minefields to support formation and unit deception plans.

Camouflage[36] **and Concealment**[37]. In general, all units are responsible for their own concealment and local camouflage. Major positions, facilities, and operational sites, may, however, require special camouflage stores and measures. The tactical commander may then require engineers to undertake such tasks, as advised by his engineer commander. Efforts must be made to mitigate the distinctive signatures that engineer work in preparing battle positions can create. Apart from the use of camouflage nets and natural camouflage material, special camouflage measures often require the employment of engineer

[36] Camouflage is defined in TMS as "*The use of natural or artificial material on personnel, objects or tactical positions with the aim of confusing, misleading or evading the enemy.*"
[37] Concealment is defined in NTMS as "*The protection from observation or surveillance.*"

equipment and devices. This is especially true for large scale camouflage requirements.

Deception[38]**.** Deception is designed deliberately to give the adversant a false and misleading picture of the true tactical and operational situation thus conferring potential benefit to own forces. Deception measures often include camouflage, although construction work should expend as little time and materiel as possible. It is an engineer responsibility to provide advice on deception to the all arms/branches commander.

a) Deception must always be coordinated at the highest practical level and with all the units involved.
b) Special engineer deception measures can include construction of dummy positions, phoney obstacles, including minefields, decoys and the simulated employment of construction equipment. For the construction of dummy positions and decoys, camouflage and deception material will be used and engineer equipment may be employed to excavate soil. Damaged or captured materiel can also be used to create deception. Dummy positions and decoys must be carefully planned and coordinated within the framework of the tactical plan and genuine positions.

EXPLOSIVE THREAT MANAGEMENT

Introduction: Explosive Threat Management is the MILENG task dealing with Explosive Threats. It manages the three MILENG tasks involved in and supporting countering explosive threats: Military Search, Explosive Ordnance Disposal and Support to Intelligence[39]. Explosive Threat Management is a force protection task that is not exclusively for Engineers. Not only because some countries consider EOD not as an engineering task, but also because it involves other branches like Technical Exploitation or C-IED.

Explosive Threat:[40]**.** There are the following types of Explosive Threats: Improvised Explosive Devices (IEDs), Unexploded Explosive Ordnance (UXOs, including mines) , Abandoned Explosive Devices (AXOs) and CBRN Explosive Ordnance (CBRN EO, including Toxic Industrial Materials (TIM) and Petrol/Oil/Lubricants (POL)).

a) IEDs are devices placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed

[38] Deception is defined in NTMS as "*Those measures designed to mislead the enemy by manipulation, distortion, or falsification of evidence to induce him to react in a manner prejudicial to his interests."*
[39] Support to Intelligence is a new proposed MILENG task, in which Direction, Collection, Processing and Dissemination of MILENG information is merged.
[40] AEODP-10(B)/ STANAG 2143 ed. 6 refers

to destroy, incapacitate, harass or distract. IEDs may incorporate military stores, but are normally devised from non-military components.

b) UXOs are all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents.

   Mines are explosive munitions designed to be placed under, on or near the ground or other surface area and to be actuated by the presence, proximity or contact of a person, land vehicle, aircraft or boat, including landing craft. Mines are considered military stores and come in two types: anti-vehicle and anti-personnel. Although anti-personnel mines are prohibited by the OTTAWA treaty which is signed by many countries, they still are a common threat all over the world.

c) AXOs are abandoned ammunitions, ammunition that has not seen a weapon system and is abandoned in the terrain or in a storage.

d) CBRN EO is an explosive device containing a CBRN element. Although a CBRN element is normally not explosive by itself, it can be so due to an external threat, such as fire or a detonation, and then even may cause a disaster.

Military Engineers are responsible for the provision of awareness training to all personnel on mines and other explosive Threats.

Explosive Threat Manager: This is normally the role for the principal EOD Staff Officer of the Joint Force. The Explosive Threat Manager is the Subject Matter Expert and coordinates all tasks related to the Explosive Threat. He operates the Multi National EOD Coordination Cell (MNEODCC). He reports directly to the Joint Force Engineer and to the (MN/CJ)EODC(C) of the higher command.

The JF Engineer is the principal MILENG advisor of the JF Commander and has the coordinating and technical authority over the employment of all MILENG assets throughout the Joint Force. As there are rarely sufficient MILENG recourses to meet all demands, coordinating and task-organising available MILENG assets in support of Explosive Threat Management is an essential role for the JF Engineer, in which the Explosive Threat Manager is his principal advisor and SME.

Military Search is executed by military engineers and/or EOD units and is used to find explosive threats when executing Breaching and/or Area/Route Clearance tasks. Military Search is described in more detail in section 3, para 0226[41].

Explosive Ordnance Disposal (EOD) is the final detection, identification, on site evaluation, render safe and final disposal of an Unexploded Explosive Ordnance[42]. EOD teams can be tasked for the following:

[41] ATP 3.12.1. As this text should be implemented in that ATP, the ATP itself is not mentioned.
[42] Definition according to AAP 6. In reality it is not only for Unexploded EOs, but for all Explosive Threats.

a) Explosive Ordnance Reconnaissance (EOR).
   EOR is the investigation, detection, location, marking, initial identification, confirmation and reporting of suspected unexploded explosive ordnance in order to determine further action.
   EOR can also be executed by specially trained Engineers and SOF demspec operators.

b) Explosive Ordnance Clearance (EOC).
   EOC concerns all measures and procedures to be executed to clear an actual Explosive Ordnance. EOC includes assistance to an airplane or helicopter crash or recovery. EOC is divided in three sub-categories:

- Conventional Munitions Disposal (CMD).
  CMD is the approach, identification, securing and disposal of conventional explosive threats. A conventional explosive is a complete device charged with explosives, propellants, pyrotechnics, initiating composition but without chemical, biological, radiological or nuclear material, for use in military operations, including demolitions. Conventional munitions who have failed to explode (UXOs) or obsolete stored munitions (AXOs) pose a major danger potential for the allied forces and public safety, also because they can easily be used in IEDs.
- IED Disposal (IEDD).
  IEDD concerns specific methods, tools and procedures in order to render safe, recover or final disposal of an IED.
- Chemical, Biological, Radiological and Nuclear Explosive Ordnance Disposal (CBRN EOD).
  CBRN EOD is no different from CMD or IEDD, only the involvement of CBRN elements makes it a bigger threat, in which CBRN expertise will be needed in order to mitigate the risks and recover the actual CBRN element after the device is rendered safe. Especially when final disposal is needed, those CBRN expertise is essential to avoid a disaster.

Support to Intelligence builds understanding of all aspects concerning the physical operational environment. Explosive Threats are a fundamental risk for the JF in that physical operating environment. The MILENG Support to Intelligence task directs the information requirements, collects all information, processes it to be used in planning processes and procedures, and disseminates it to all relevant users. Support to Intelligence builds the Explosive Threat database and is operated in the environment cell of the Joint Force. Support to Intelligence is described in more detail in section 4, para 0243.

Explosive Ordnance Disposal

Introduction[43]. Those are tasks related to minimizing the threat posed by all kinds of explosive devices, both manufactured and improvised, to friendly forces. This includes all actions from providing advice and engineer intelligence to deliberate actions such as disposal, search and explosive ordnance clearance. Note that this task is not exclusively executed as a force protection task or a survivability task exclusively; it is often conducted as a mobility task when the explosive ordnance threat hinders FOM of friendly forces.

General: EOD involves the detection, identification, on site evaluation, rendering safe, recovery and final disposal of UXO. It may also include explosives which become hazardous by damage or deterioration. Military Engineers are responsible for the provision of awareness training to all personnel on mines and other explosives hazards. Pending on different organizations within NATO nations, EOD forces/military engineers are responsible to dispose UXO/EO that threaten friendly forces, be able to contribute to protection of personnel and materiel.

A military capability is required to dispose of unexploded ordnance whether aerially or ground delivered or placed by hand. This includes the requirement to clear booby traps and improvised explosive devices (IEDs) and also the capability to deal with Chemical, Biological, Radiological and Nuclear CBRN) threats in a CBRN environment. EOD requirements are laid down in STANAG 2143 and technical procedures are covered in AEODPs. A complete list of EOD related STANAGs is included at Annex A.

It should be noted that EOD is not exclusively the responsibility of engineers and the assignment of responsibilities for dealing with an EO threat will depend on many factors such as: the type of operation; operational imperatives and directives; terrain; EOD or other asset availability; risk and EOD policy/ROE. The forces available to counter any EO threat will consist of specially trained EOD personnel augmented by, amongst others, military engineers, ammunition technical personnel and divers. Former belligerents, host nation agencies, other nations, international organisations and Non- Governmental Organisations (NGO) may also conduct EOD operations within the AO.

The scope of EOD tasks is so broad that nations organize, equip and train their EOD forces in different ways. STANAG 2143 ed.6 establishes basic proficiencies and STANAG 2897 details broad areas of national capability. The following paragraphs describe in broad terms the tasks most often included in EOD.

[43] This task becomes increasingly complex with the emergence of IEDs.

Explosive Ordnance Reconnaissance (EOR) is the focused collection of information on the EO situation in a limited area. Some nations train non-EOD personnel in the EOR role. These personnel can then execute EOR tasks assigned by the Multi National EOD Coordination Center (MNEODCC) as required. Disposal of the EO is not included in EOR.

Explosive Ordnance Clearance serves the purpose of reducing or eliminating the hazard posed by EO, including their disposal.

The execution of EOC missions varies considerably from nation to nation. Some assign the mission exclusively to EOD forces; whereas, others assign the mission to units with varying levels of EO knowledge and expertise. Therefore, nations must clearly state and identify their EOC capability for each specific operational scenario. This includes clear definition of the division of responsibilities between EOD forces and other force elements.

Improvised Explosive Device Disposal (IEDD) includes the location, identification, rendering safe and final disposal of IEDs.

The likelihood of facing a significant and sophisticated IED threat requires that an effective IEDD capability be embedded within the assigned EOD forces provided for each operation. IEDD should be linked to technical intelligence collection organisations.

The disposal of an IED requires specific training and equipment. National policies require compliance with special procedural and safety regulations. The coordination of operations and standby duties is of particular importance for these forces. Principles of IEDD operations can be found in AEODP-3 (STANAG 2370).

Disposal of Chemical, Biological, Radiological and Nuclear EO (CBRN EO) is an EOD task that requires special training according to STANAG 2143. CBRN EO may be conventionally manufactured or improvised. Once the absence of explosives has been determined the CBRN item must be dealt with by appropriately qualified CBRN-trained personnel.

CBRN EO disposal tasks require compliance with special procedural and safety regulations, necessitating coordination with other specialized forces like NBC or decontamination units, in accordance with STANAG 2609. Due to the political sensitivity of this issue, it is unlikely that EOD operators will carry this out in isolation. Support may be required from a number of diverse agencies.

Support Missions

a. **Stockpile Disposal**. At certain stages of an operation, EOD personnel may be required to carry out or assist in the removal of ammunition and explosives

from a stockpile. If the ammunition is to be recovered for future use, stockpile disposal may or may not require the use of render-safe or destruction procedures.

b. **Training of Military and Civilian Personnel**. EOD forces may conduct or support Mine and UXO Awareness Training (MAT), Mine and UXO Risk Education (MRE), and community awareness training regarding EO hazards. The training may address the recognition, marking and reporting of EO, and the correct response in the case of EO detection and bomb threats.

c. **Mortuary Services**. Immediate recovery and clearance of deceased persons is a priority of the Services. EOD forces may be required to assist in the recovery of remains where the presence of EO is suspected. In addition, support may be required for the exhumation of mass graves.

Other Tasks. EOD forces may be required to support other tasks, including:

a) Mechanical mine clearing activities (e.g. “flailing systems”).
b) Protection of VIPs.
c) Security of events.
d) Accident response (Medevac, aircraft crash recovery, mine strikes etc.) that may include removal of EO hazards, investigation and forensic evidence gathering.
e) Technical support during the investigation of EO incidents.
f) Support in Implementing Amnesty Programs: EOD forces assist in the collection and disposal of hazardous munitions and components as part of the CJTF commander’s force protection program, to ensure the continued safety of Military personnel

COUNTERING - IMPROVISED EXPLOSIVE DEVICE:

Introduction: C-IED is defined as: “The collective efforts at all levels to defeat the improvised explosive device system through attack the networks, defeat the device and prepare the force. An IED is defined as “a device placed or fabricated in an improvised manner, incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals, and designed to destroy, incapacitate, harass or distract. It may incorporate military stores, but is normally derived from non-military components”. Note: Networks describe interconnected people or things, and can be identified, isolated and attacked.”

C-IED is a Commander’s responsibility at all levels and requires the coordinated effort of all staff branches. AJP-3.15(A) divides the C-IED approach into 4 pillars and underlying Areas of Activity. These are:

a) Understanding and Intelligence.
   (1) Understand.

b) Attack the Networks.
   (1) Pursue.
   (2) Prevent.

c) Defeat the Device.
   (1) Protect.

d) Prepare the Force.
   (1) Prepare.

SUPPORT TO CBRN

General. Engineers must implement the general rules for defence against the CBRN threat which are common to all arms/branches. National engineers may have specific CBRN responsibilities allocated to them; these vary from nation to nation and are not considered further in this publication. Whatever special responsibilities are allocated to them nationally, engineers are very likely to be involved in the following tasks because of their generic capabilities and organisation:

a) **Assistance with Survivability**. With construction capabilities, engineers are well placed to advise and assist other arms/branches in the provision of field fortifications and other shelters against CBRN attack including improvised collective protection (COLPRO) against chemical attack; these measures are termed “Survive to Operate”.

b) **Mobility Through or Around Areas Affected by CBRN Strikes**. As part of their normal task of route opening and maintenance, engineers are likely to be tasked to clear routes blocked by the effects of CBRN strikes, or to open routes to by-pass.

c) **Decontamination**. Engineers may be called upon to construct traffic circuits and facilities in a decontamination point. In some armies, they may operate the point or provide water for it. Area decontamination may also be an engineer task.

d) **Release Other Than Attack (ROTA) and Toxic Industrial Materials (TIM).** In built up or urban areas, there is considerable potential for engineers to have to deal with the effects of ROTA and TIMH. Industrial areas, power stations and even hospitals offer a range of options for potential enemies to exploit.

FIREFIGHTING

Fire Protection. Fire Protection includes the design and construction of fire prevention and suppression systems within infrastructure. It includes the development, implementation and monitoring of a fire safety program within a

camp, including training, exercises and the evaluation of the Fire protection plans adopted by the military units/bases.

Fire Prevention. Fire Protection Services are a key safety-related component which must be an integral part of every deployment. Within NATO this responsibility falls under different elements within various Troop contributing Nations (TCNs). However regardless of who is responsible the requirement to establish fire protection support needs to be identified within the deployed NATO force. Employment of fire fighters in a theatre of operations is outlined as essential for force protection but can easily be translated into any fire support service from a TCN. Fire can have many causes ranging from poor housekeeping discipline, inadequately designed electrical services, improper handling of fuel or as a result of an attack by adversant forces. Unless fires are quickly contained, controlled and extinguished, the resultant effects can hamper the Commander's ability to project combat power and achieve his mission. It is the FEngr's responsibility to advise the Commander on the proper level of fire protection and prevention services within the theatre of operations. The scope of the advice will include incorporation of fire protection requirements within the Force, selection of camp location, design of the accommodation and facilities, and even mundane TF daily routine to prevent the risk of fires due to poor housekeeping and practices.

SECTION 6 – Sustainability

Introduction. Sustainability is the process of all activities to support or sustain the force, sometimes referred as life services but like Force protection it affects all facets or can involve all MILENG support simultaneously. To describe each facet is not deemed necessary but needs to be recognized in the planning process for sustainment activities.

INFRASTRUCTURE

Infrastructure requirements are normally under the national codes and standards however some important considerations for engineer planners include;

a) Coordinating for a field maintenance team to support each engineer unit to ensure quick turnaround of maintenance problems.

b) Coordinating closely with the logistics staff to assist in management of required construction materials. The engineer staff helps the logistics staff identifies and forecast requirements to ensure a quality control process is in place for receipt of the materials. The management of Class IV supplies for survivability and counter mobility is most efficient when there is a shared interest between the manoeuvre and engineer logisticians.

c) Using expeditionary support packages or pre-prepared stocks of barrier materials.

d) Coordinating closely with the theater support command or sustainment commands (expeditionary) support operations officer, the G-4, the supporting contract support brigade, and the associated LOGCAP planner to ensure that engineer requirements are properly integrated and captured in the contracting support plan and/or specifically addressed in the engineer support plan.

Deployed Force Infrastructure

Deployed Force Infrastructure (DFI) comprises buildings, facilities and installations required to support military forces when deployed. The DFI publication (ATP-3.12.1.4) is intended as guidance for the planning of national, coalition or multinational operations and recognizes the existence of various national standards. It includes recommended scales and standards for accommodation and essential services for expeditionary forces. DFI scales and standards are intended to mitigate the effects of climate and environment in order to preserve the health, welfare and overall operational effectiveness of an expeditionary force. It does not cover the technical specifications for standard infrastructure or designs. However, it facilitates the transfer of DFI between nations by identifying basic common standards to be used when designing and constructing camps. It should be read in concert with references DFI Publication (ATP 3.12.1.4).

Contractor supplied services : There are times when engineering services to deployed operations are more effectively carried out by contractors than by uniformed personnel. If the decision is made to use contractor-supplied engineering services the JFEngr would retain responsibility for the overall engineer effort, though the actual work would be done by contractors. The potential scope of contracted engineering support is large and the organisations that provide the services could include locally hired staff or contractors, NATO agencies such as NATO Support Agency (NSPA), MILENG-based contractors on SOA, or large multi-national engineering firms. The efficiency and effectiveness of the contract options need to be considered early in the planning process and a decision made as to the most cost-effective means of getting the job done. A cost-benefit analysis of different options would have to be done to compare the methods and determine the most effective approach — operationally and economically. This section will discuss some of the options and the procedures to obtain contractor-supplied engineering services.

Scope of Work: There are a number of areas that lend themselves to the use of contractor supplied services on deployed operations. The provision of water, sewage services, and waste collection and disposal as well as power supply and distribution are obvious. Construction and maintenance of the whole gamut of infrastructure including roads and grounds and accommodation in longer-term deployments also makes sense. At the present time there are a host of firms that

would offer “cradle to grave” engineering support to deployed operations. Those services could be bundled with a complete logistics support package.

Civilian Contract Support: Civilian contract support includes all contract support not included as part of HNS agreements. It may be obtained from MILENG sources, other nations or in the theatre of operations. The contract support which will be required may include specialist engineer consulting services, technical translation, material and equipment procurement, and supply of engineer related services.

On deployed operations there will usually be local governments, private companies or qualified individuals available which are able to provide contracted engineering services to the TF. Their capabilities and competency of the organisations, companies or individuals will need to be critically assessed before they are hired, but they usually provide an economic approach to providing support. The contracting process will naturally involve a co-ordinated effort by the JFEngr, J4 Log, J8 Fin and Contracting, J9 CIMIC and Legal staffs. As with any contract the TF Legal Officer must review and approve before signing. There will be a cell in the TFHQ that will co-ordinate all contracts. The JFEngr, as the engineer adviser, will have to ensure that the engineering services being provided meet the needs of the TF and are being done in a competent, professional way.

Equipment support, communications information systems (support), infrastructure facilities management/ professional services and enabler support for NATO HQ (in support of the framework nation) can be provided by contractors at readiness. The best way of achieving a credible, effective contingent contractor capability, whilst minimizing cost, is to use pre-selected/qualified contractor(s), with high readiness capability and well trained. Regional contractors should be prioritized in order to best match with local requirements and needs. In any case HN, contractors and military effects must be synchronized and aligned.

Security concerns will always need to be considered when engaging host nation employees or contractors. The early involvement of the TF security staff and J9 CIMIC to vet the employees and the firms for which they work is necessary.

OPERATION AND MAINTENANCE OF INFRASTRUCTURE

Introduction. Operation and maintenance of infrastructure is normally conducted by the nations emplacing the initial camps and facilities using integral resources. These processes are based on assets available, technical skills and capabilities along with nation standards and regulations. However as the mission continues the magnitude of the support now exceeds the capabilities of the integral force alone. Contracted services provided the means to provide this service.

Contractor Augmentation: Various national contractors are developed as a service support capability for deployed operations. The programs are managed by their respective MoDs/HQ/ADM (Mat) and HQs which retains funding and employment authority for those specific contracts who are intended to be employed in a sustaining role in an established theatre. It should be viewed as a "tool in the engineer toolbox"; and can provide contracted engineer services, not merely civilian employees working under military supervision. The decisions to employ these contractors are a national decision of the TCNs and are made at the strategic level, within those nations. However coordination with NSPA can assist providing advice on delivery of engineering functions to avoid duplication of effort and expense.

Normal Contracted Engineering Functions

a) construction engineering — common tasks;
b) fire services;
c) environmental management;
d) roads and grounds;
e) facilities operations and management;
f) waste management;
g) water supply and distribution, and
h) power supply and distribution.

Normal MILENG Functions

a) construction engineering — inspections and quality assurance common tasks;
b) Environmental inspection and reports
c) Maintenance and operations standards – inspections of services.

REAL ESTATE MANAGEMENT[44]

General: Real estate management is a complex business and is fraught with many potential legal problems. It must be treated in a serious manner; the real estate arrangements and contracts related to that are entered into on behalf of NATO or contributing nations and therefore have continuing legal obligations that must be fully understood. Experienced and knowledgeable real estate expertise and advice must be sought. The TF Engr is the TFC's adviser on real estate asset management. To provide guidance for the TF Engr and HQ staffs in property management during deployed operations it must be understood that the property management and leasing of infrastructure/accommodation or services are subject to the laws, forms and protocols of the HN in which the mission is deployed. ALP-4.2, Land Forces Logistics Doctrine, provides a detailed guidance

[44] For a definition of Real Estate see Oxford Advanced Dictionary

On real estate management (functions, NATO and national responsibilities, property conditions, procedures, organisation) in its chapter 10 “MILENG support to Logistics”. The following guidelines are provided to assist in reaching the best possible deal for NATO. The drafting of a lease or contractual agreement must be done in concert with the TFHQ staffs as previously mentioned.

Leasing of Property: The leasing of real estate and contracting of engineer- / utility services on deployed operations is a negotiated, legally binding arrangement between NATO and another legal entity. Negotiation of such agreements is a shared responsibility between the TF Engr, J4 Log, J4 Fin, J9 CIMIC and Legal staffs on behalf of the contributing nations. To meet the operational requirements of the TFC, a co-ordinated effort by these staffs is required to ensure the right services are acquired at the best available price. The TF Legal Officer must review and approve all TF contracts. No other TF representative has the legal right to enter into such a contract agreement; this prohibition extends to the TFC. Consequently, any activity conducted by the TF that would require a property owner’s agreement must be undertaken with the full involvement of the TF Legal officer.

ENVIRONMENTAL PROTECTION

Introduction: Engineers must consider the environmental impacts of their actions. They must weigh the implications of holding out for logistical support against environmental collateral damage that they will cause. They must ensure that a proper environmental risk assessment is done before beginning any action.

Environmental Protection definition: “The prevention or mitigation of adverse environmental impacts”[45]. Essentially, EP is the protection of the environment from the actions of NATO forces. Protecting our forces from natural environment is part of Force Protection and not EP.

General. During operations, in addition to its forces, NATO brings international values which it hopes will benefit all communities. One of these values is respect for the environment and for the people who live in it. Environmental protection (EP) is NATO’s term for the application and integration of all aspects of environmental considerations as they apply to the conduct of military operations. Environmental considerations include the entire spectrum of environmental media, resources, or programs that may affect, or be affected by, the planning and execution of military operations. Factors that NATO takes into account in its planning include HAZMAT Regulations, environmental compliance, pollution prevention, waste management, due diligence, sustainability, conservation, heritage protection (natural and man-made), and protection of flora and fauna.

[45] NTMS agreed, 31 Oct 2013

Environmental damage may be an inevitable consequence of operations, but environmental planning can minimize these effects without compromising either operational or training requirements. With an understanding of applicable environmental legislation and regulations, NATO forces will be able to plan efficiently and act accordingly. By taking proper steps to assess, plan, train and execute the deployment and the mission, NATO can more effectively protect human health and essential environmental resources, reduce the occurrence of environmental accidents and mitigate any damage that may be caused to the environment. This will limit NATO's potential long-term liability.[46]

MILENG tasks and responsibilities. MC 469/1 NATO Military Principles and Policies for Environmental Protection is the key NATO EP policy document. It is applicable to all NATO nations and others involved in NATO-led operations and exercises. It defines the responsibilities of Commanders, NATO units, Non-NATO units from Contributing Nations and Host Nation. The objective of MC 469/1 is to integrate EP into NATO-led military activities, consistent with operational imperatives, in order to minimise the risk, prevent environmental degradation, and restore/remediate any environmental degradation. Although Environmental Protection is a Military Engineer responsibility and the JFENGR provides the EP appx to Annes EE, specific EP tasks are carried out by different personnel / branches within the various NATO nations.

a) Emergency Response. EP incidents will occur and need to be reported and remediated during the operation.

b) Remediation. Nations do not have to leave a clean environment, but they are liable for any incremental damage their troops cause. Prior to closing out camps or its AOO, nations should complete Close out Environmental Baseline Studies and remediate environmental damage not recorded in their Baseline Studies.

c) Documentation. Accurate theatre record keeping and reporting is essential. NATO and SN Theatre Environment Record Keeping should include: Environmental Baseline Studies, ENGSITREPs, Environmental Damage Reports including Remediation, Camp Handover documentation, etc. Nations (including NATO where it's a lead nation) perform Environmental Baseline Studies (EBS) for Camps and AOO as appropriate. See STANAG 6500 (AJEPP-6), Environmental File for Military Compounds in NATO Operations, for more information and templates.

d) Training. NATO and SNs must provide appropriate EP training for their key personnel in order to allow them to act in an EP friendly manner and supervise the execution of their required tasks.

e) Many EP tasks can also be carried out through the use of non-military resources or through Host Nation support. Regardless of the resources used

[46] from AJP-4 final draft May 09

to complete certain tasks, the responsibility always remains with the military engineer / commander.

f) The following table provides a list of specific EP areas of concern, the military engineer tasks within this area as well as possible resources that may be used. It also lists the most likely non-military engineer stakeholders with whom coordination is required. This list is intended to assist military engineer planners consider the range of EP activities. It should not be considered an exhaustive nor restrictive list.

ENVIRONMENTAL PROTECTION TABLE

Ser	Areas of Environmental Concern	Military Engineering Responsibilities	External Stakeholders	Military Engineer Resources	Ref
(a)	(b)	(c)	(d)	(e)	(f)
1	Operational Planning Process	- Support the implementation of environmental policy - Advise on mitigation of EP impacts of ops - Provide EP advice to Comd - Draft EP - Appendices to Engr annexes	- Legal staff - Ops / planning staffs	- Planning staff - Subject matter experts (SMEs)	
2	Environmental Baseline Study/Environmental Closeout Study	- Conduct/coordinate study and implement remedial action as required	- host nation - IOs / NGOs Other SN's	- Specialist personnel - SMEs - Contractors - NSPA	STANAG 6500 (AJEPP-6)

Ser	Areas of Environmental Concern	Military Engineering Responsibilities	External Stakeholders	Military Engineer Resources	Ref
(a)	(b)	(c)	(d)	(e)	(f)
3	Camp operations and closure	- Engineer support to camp operations - Education and training of camp personnel on environmental responsibilities	- host nation	- Planning staff - SMEs - contractors - NSPA	STANAG 6500 (AJEPP-6) STANAG 2582 (AJEPP-2) Camp Closure Handbook (Annex Y to ATP 3.12.1.4) (TBC)
4	Potable Water	- Water distribution systems - Produce potable water - Testing protocols - Water point reconnaissance - Effluent monitoring and testing	- Logistics - host nation and CIMIC when using local sources - IO/NGO's	- Planning staff - SMEs (Med, EP) - Heavy equipment - Contractors - NATO Agencies - Well drilling	
5	Wastewater Treatment Systems	- Assessment/design /monitoring - Collection - Treatment - Disposal Optimization - Education / Training / Awareness	- Supply elements - Host nation - CIMIC	- SMEs - NATO Agencies	STANAG 2582 (AJEPP-2)

Ser	Areas of Environmental Concern	Military Engineering Responsibilities	External Stakeholders	Military Engineer Resources	Ref
(a)	(b)	(c)	(d)	(e)	(f)
6	Management of Hazardous Materials (i.e. Halocarbons, Halon)	- Design / Construction / siting of storage/disposal facilities - Installation of compliant air conditioning, refrigeration and fire extinguishing systems - Response management and remediation - Maintenance of halocarbon and halon containing equipment	- Logistic elements - Environmental staff - Occupational Health and Safety staff	- Planning staff - SMEs - Heavy equipment - CBRN personnel - Firefighters	STANAG 2582 (AJEPP-2)
7	Management of Hazardous Waste	- Design / Construction / siting of storage/disposal facilities - Response management and remediation	- Logistic elements - Environmental staff - Occupational Health and Safety staff	- Planning staff - SMEs - Heavy equipment - Firefighters	STANAG 2582 (AJEPP-2) STANAG 2510 (AJEPP-5)
8	Management of non-hazardous solid waste	- Design and/or management of collection, storage, treatment and disposal systems - Develop recycling/reuse programs	- Logistic elements - Host nation - CIMIC	- SMEs - Heavy equipment - Contractors - NATO Agencies	STANAG 2582 (AJEPP-2) STANAG 2510 (AJEPP-5)

Ser	Areas of Environmental Concern	Military Engineering Responsibilities	External Stakeholders	Military Engineer Resources	Ref
(a)	(b)	(c)	(d)	(e)	(f)
9	Energy Conservation and Management	- Planning - Construction - Maintenance - ensure Contractor Compliance - Alternate Energy design - Education / Training - Energy management	- Logistic elements	- Planning Staff –SMEs - NATO Agencies -IO/NGOs	STANAG 2582 (AJEPP-2)
10	Petroleum, Oils and Lubricants (POL)	- Planning/ specifications - Storage setup - Maintenance - Inspections - Spill Response	- Supply elements - Environmental staff - CBRN - Firefighters	- SMEs - Contractors - NATO Agencies - Heavy equipment	STANAG 2582 (AJEPP-2)
11	Soil Contamination	- Planning - Site Preparation - Remediation	- CBRN - Firefighters - Supply elements - Environmental staff	- Heavy equipment -SMEs - Contractors - NATO Agencies - EOD	STANAG 2582 (AJEPP-2)
12	Firing Range Management	- Design and planning - Testing - Ammo Removal/Clearance Assessment - Remediation	- SMEs - NATO Agencies	- EP SME - EOD - Heavy Equipment	
13	Cultural / Archaeological	- Planning - Location - Monitor compliance - Education and awareness	- Host Nation - Legal staff - IOs / NGOs - CIMIC	- Geomatics - SMEs	STANAG 2582 (AJEPP-2)

Ser	Areas of Environmental Concern	Military Engineering Responsibilities	External Stakeholders	Military Engineer Resources	Ref
(a)	(b)	(c)	(d)	(e)	(f)
14	Air emissions	- Monitoring, assessment (e.g. from incinerators or sewage lagoons), corrective action	- Host Nation - Medical staff - IO/NGO's - Environmental staff	- SMEs (EP)	STANAG 2582 (AJEPP-2)
15	Noise Pollution	- Planning - Mitigation	- Host nation - Medical staff	- Heavy equipment - EP SME -Contractors - NSPA	
16	Protection of Ecosystems	- Planning, monitoring and assessment - Implement mitigation measures	-Host nation - Environmental staff - IOs / NGOs	- SMEs - contractors	STANAG 2582 (AJEPP-2)
17	Sustainability	- Planning and design of infrastructure and environmental systems	- SMEs - IO/NGO's - Host nation	- SMEs - contractors - NSPA	STANAG 2582 (AJEPP-2)

UTILITIES (WATER AND POWER)

Introduction. The provision of water (sewage treatment) and power are all normally conducted in accordance with national standards. However within NATO the means to provide a standardized approach to these resources required that certain guidelines and procedures are followed within the alliance to ensure interoperability.

Water must be sourced, treated, stored, distributed, issued and disposed. Water quality standards must be appropriate for a range of uses including drinking, cooking, washing, laundering, medical, firefighting and water-borne sewerage systems. Water services include bulk storage with distribution being achieved through bulk deliveries, packaging and/or pipelines. A key reference for water quality standards are STANAG 2136, Minimum Standards of Water Potability during Field Operations and STANAG 2885, Emergency Supply of Water in Operation.

Power. The requirements for power differ from mission to mission and the optimum power production solution differs according to the localisation, climatic conditions, local resources, size, function, Force structure, concept of operations, and the phase of the operation. Planners must ensure that appropriate requirements for energy efficiency (power generation and consumption) are met during the infrastructure planning phase. To achieve energy efficiency, three key principles should be taken into account: modularity, interoperability and sustainability[47]. Some factors to consider when determining power generation and its sustainability are:

a) Coordination of power requirements, comprising all levels from individual and tactical combat systems up to power generation for a large NATO camp, should be considered as key elements to contribute to increasing the effectiveness of existing energy systems and reducing liquid fuel demand. method of specifying electrical power supplies: standard types of electrical power STANAG 4133 and field electrical power supply technical aspects for interoperability AEP-25 provide guidance.

b) The use of multi-energy as well as multi-size systems, from the early stages of an operation, to ensure efficient and secure power. However, autonomous power generation and supply must be continuously available for operational functions and critical services in case of failure of a traditional centralized grid.

c) Operational commanders are responsible for the use of resources under their command, including energy. The senior military engineer (in accordance with MC 560/1 the JFENGR at the operational level and the Chief Engineer at the tactical level) advises the commander on operational energy concerns such as prioritizing, energy conservation programs, awareness plans and training objectives.

SUPPORT TO LOGISTICS

General. As defined in MC 0319/3, NATO Principles and Policies for Logistics, "particular areas of expertise in Support to Logistics, which used to be called 'Infrastructure Engineering for Logistics', are MILENG (...). MILENG is a multi-faceted force multiplier and an essential physical enabler, throughout all stages of the operation and particularly when conducting tasks associated with Reception, Staging, Onward Movement and Integration (RSOM(I)) and sustaining the Allied Forces". Support to logistics is a significant MILENG missions in operations, infrastructure in-theatre being critical for both operational and logistic purposes. Once the concept of operations (CONOPS) has been agreed for an operation a concept of support (CONSUP) is then developed to ensure the mission will be resourced. From the CONSUP the requirements for infrastructure for logistics purposes can be derived and compared with the existing infrastructure. This comparison will identify any shortfalls. In some

[47] See C-M(2014)0009, NAC ratified Policy on Power Generation for DFI

scenarios the existing infrastructure will be good and little effort will be required but in other scenarios significant work will be required to bring the infrastructure up to the minimum military requirement. This work may be done by HNS, contractors and/or military engineer support. JFEng staff will implement the planning, maintenance and disposal of the infrastructure works required to support the logistic mission and the Joint Force as a whole. For example, as a part of an analysis of infrastructure requirements, it is critical to take into consideration any munitions safety requirements[48].

Joint Logistic Support Group (JLSG). "The Joint Force Engineer and staff are the focal point for the planning and execution of all aspects of MILENG within the JOA. The Senior Joint Engineers of the subordinated commands (including the JLSG) are responsible for the prioritisation and coordination of the MILENG support within their areas of responsibility" (MC 0319/3). If a multinational JLSG is formed, a military engineering and infrastructure branch[49] (MEIB) will be established in the JLSG to plan and coordinate the provision of MILENG support within the supported JFC's AOR. MEIB specific responsibilities include also supporting the planning and synchronisation of logistic aspects of the OPLAN, developing environmental baseline studies (EBS) for camps and major installations as a basis for environmental protection planning, the identification of the requirement for the development and maintenance of infrastructure, and conducting C2 of JLSG subordinate MILENG units within respective line of expertise and in accordance with delegated authorities.

Infrastructure development and management. MILENG Support to Logistics covers the construction, restoration, acquisition, repair, maintenance and disposal of those infrastructure facilities required to mount, deploy, accommodate, sustain and re-deploy military forces. This also includes construction, restoration and maintenance of lines of communication (LOC), and facilitation of environmental protection[50]. To enable NATO commanders to maximize the effectiveness of their assigned MILENG capabilities and resources, the availability of senior engineer expertise is necessary at all HQ levels. To ensure that consideration of MILENG capabilities and forces is adequately addressed in the NDPP, defence planners and MILENG experts at the SC level must work closely with both NATO HQ staff and senior engineers in national HQ. A detailed planning and a thorough reconnaissance, involving all functional specialists, are essential to identify resources and shortfalls for the construction, maintenance and operation of facilities. Priority is given to facilities to install POD, Staging Areas, Assembly Areas and their connecting routes.

---

[48] Allied Ammunition Standard Technical Publication (AASTP) - 1 *Manual for NATO Safety Principles for the storage of Military Ammunition and Explosives*

[49] See also AJP-4.6 (B) for more details.

[50] See para Environmental protection (section 2114 to 2116 and Appendix) for more information

Contingency planning is vital as the infrastructure picture can change very rapidly. At the operational level the infrastructure function is mostly concerned with the provision, operation and maintenance of the infrastructure needed for the upcoming and/or ongoing operation. In order to prevent the contributing nations from competing for limited facilities and to ensure efficient use of critical resources, co-ordination between Engineers and Logistics is crucial in assigning or scheduling the use of limited facilities and resources. As the primary responsible engineer adviser to the JFC, the JFEngr will have coordinating and technical authority, on behalf of the JFC, over the allocation of engineer resources to Components. Within that framework, the JFC may shift the main effort of MILENG support entirely to logistics, and may allocate capabilities normally seen supporting the manoeuvre to infrastructure development and sustainment, enhancement of freedom of movement or the provision of real life support. At LCC level, the Chief Engineer (CEngr) will be the responsible for the construction and maintenance of Theater infrastructure, environmental protection and supporting MEIB in managing Real Estate that has been designated for LCC.

UNDERWATER ENGINEERING

Introduction. Within NATO Underwater Engineering is the responsibility of not only engineers but other arms as well. The link within the engineers is to act as a facilitator in a comprehensive approach. This enables the military to reach the desired end state by coordinating, synchronizing and de-conflicting military activities across the entire range of functions within joint military operations with the associated underwater (Diving) capabilities of each TCN. The aim of this section is to highlight in general terms the capabilities of Engineer divers in the conduct of operations that would be harmonious across all underwater activities and capabilities that provide the greatest possible tactical advantages.

Military Engineer Diving[51]

General. Military engineer diving is an extension of military engineering into the water. Military engineer divers provide the armed forces with the capability of performing military engineer tasks underwater. Military engineer divers do the majority of their work inland waterways. This can include lakes, river deltas, inshore waterways, harbours, urban environment (e.g. confined spaces, sewage systems, drainage systems) and other areas as tasked. Military engineer divers assist the freedom of manoeuvre and movement by supporting the movement of troops and equipment. Supporting assets range from a small team to multiple larger teams with a diverse range of capabilities. Military engineer diving must be conducted following national diving safety regulations and require a high

[51] For more information see ADivP-1(B) Allied Guide To Diving Operations (STANAG 1372) and ADivP-2(B) Allied Guide To Diving Medicine (STANAG 1432)

degree of planning to achieve the maximum amount of underwater performance with the maximum degree of safety for the diver(s). To meet the operational and safety requirements the following aspects always have to be taken into account.[52]

a) Mission.
b) Location and depth of water.
c) Time scale.
d) Environmental factors.
e) Resources (personnel and equipment).

Characteristics: The characteristics of a military engineer dive teams are:

a) **Flexibility.** Military engineer dive teams can apply a wide range and support nearly all underwater missions on the battlefield. Military engineer diving teams are relatively small, specialized organizations. Each team has specific duties and responsibilities but are flexible enough to support the commander in most situations.

b) **Mobility.** Military engineer dive teams have limited mobility while conducting their tasks. They must enter the water relatively close to the task site and they cannot cross large bodies of water without boats. Based on a field section, the diving team has the same ground mobility like the rest of the engineer unit.

c) **Reliance on Equipment.** Military engineer dive teams rely heavily on their equipment and breathing apparatus. Even surface swim operations will require the use of bulky personal issued equipment.

d) **Vulnerability.** Environmental and operational conditions have a major influence on the selection of divers, diving technique and the equipment to be used. Military engineer dive teams are vulnerable to unique environmental and operational hazards. These include:
   (1) Underwater visibility,
   (2) Water temperature, depth,
   (3) Currents,
   (4) Tides, Sea state, and waves,
   (5) Arctic and tropic conditions,
   (6) Confined spaces,
   (7) Polluted / Contaminated water,
   (8) Underwater Obstacles,

[52] The requirement to ensure available stand by recovery divers and medical resources are available in case of dive accident should be considered.

(9) Electrical Shock,

(10) Explosions.

Principles of Employment: Military engineer diving expertise is required throughout the AO. Since there are only a limited number of divers, military engineer commanders may choose to allocate diving assets only to the most critical mission sites. Early integration of divers into the planning process is critical to successful diving missions. The principles for employing military engineer divers are the same as for other military engineer assets. These include:

a) **Integration with Other Combat Functions.** Combat power is used to find, fix, and strike the enemy. All activities on the battlefield support the integrated combat power. Military engineer divers should conduct tasks in accordance with the commander's plan. When military engineer divers support and conduct joint / combined operations, the diving supervisor coordinates the dive tasks and advises the local commander on dive related issues.

b) **Centralized Coordination.** Military engineer diving assets are a limited resource. They need to be centrally coordinated at the highest practical level.

c) **Decentralized Execution.** Military engineer diving assets, once tasked, are controlled at the lowest level necessary for the execution of the task.

d) **Allocation of Priorities.** All effort on the battlefield must be focused on the commander's priorities. Military engineer divers should not be held in reserve. Therefore dive tasks must be considered with the other priorities.

e) **Continuity.** The military engineer dive team, most familiar with the area of operations and situational awareness, should conduct the task. Once committed to a task, it may be tactically and logistically difficult to change that commitment.

f) **Early Warning and Reconnaissance.** Foresight and anticipation of tasks are important and a reconnaissance is essential. When a new dive task is planned, time is needed to assemble a dive team and their equipment in order to conduct dive site reconnaissance and preparations. For diving medical reasons, divers may also need to rest before starting a new task.

The Role and Tasks of Military Engineer Divers: Military engineer divers conduct tasks as part of the combined / joint force in the full spectrum of operations. If required, they have the ability to execute tasks independently. Table 2-1 provides examples of military engineer diving tasks:

Military Engineering Roles	Tasks	Examples
Mobility **Counter mobility** **Survivability** **General Engineer Support**	**Reconnaissance (including assessment)**	- Critical infrastructure (e.g. bridges, harbour facilities, locks, pipelines, dams, culverts, abutments, pillars) - Bottom survey, hydrographic survey etc.(e.g. wet gap crossing)
	Breaching	- Removal or destruction of underwater and surface obstacles including explosive ordnance
	Military Search	- Underwater search (e.g. resources, personnel) - Underwater EOR
	Obstacle Emplacement	- Emplacement of underwater obstacles, including placement of A/T mines
	Demolitions[53]	- Destruction of piers, docks and underwater installations - Create underwater and surface obstacles - Destruction of underwater infrastructure
	Removal or Mitigation of Battlefield Hazards[54]	- Removal or destruction of underwater obstacles including explosive ordnance
	Construction and Repair	- Reconnaissance / survey and repair of critical infrastructure - Laying and repairing underwater pipelines and communication lines - Construction, maintenance and repair of critical infrastructure (e.g. docks, piers, underwater sewage and water systems)
	Safety, Search and Rescue	- Safety standby - Missing equipment (e.g. boats, vehicle, aircraft) - Missing person

Table 2-1 Military Engineer Diving Tasks

[53] Conducted by appropriately trained personnel in underwater EOD, in accordance with STANAG 2143/ AEODP-10.
[54] Conducted by appropriately trained personnel in underwater EOD, in accordance with STANAG 2143/ AEODP-10.

SECTION 7 - Cimic

Introduction. NATO CIMIC[55] is the link to the civil environment and the military facilitator in a comprehensive approach. This enables the military to reach the desired end state by coordinating, synchronizing and de-conflicting military activities with civil actors, thus linking military operations with the civil sector. The aim of CIMIC is to establish and maintain the full cooperation of the civilian population and entities in order to create conditions that offer the commander the greatest possible moral, material, environmental and tactical advantages. (AJP-01)

Engineer support to CIMIC. Engineer resources may be committed to support CIMIC programs in the framework of the objective assigned to the operation. It could include, among others, the delivery of clean drinking water, assisting construction projects or demining activities. Sufficient engineer resources will be essential to deliver such support. Cooperation, co-ordination and specific arrangements, including funding, need to be established between the different actors to have the best employment of Military Engineer Support to CIMIC programmes and to minimize potential negative impacts like the creation of a dependency culture. Co-ordination and co-operation between engineer's and CIMIC staff regarding such activities is vital. The support of CIMIC activities must be clearly defined in order to support the commander's intent and to avoid the dilution of engineer effort in tasks not essential to the implementation of the mission

SUPPORT TO CIVIL AUTHORITIES

Support to Civil Authorities (SCA): Although SCA is primarily a civilian responsibility, NATO cannot ignore areas where it can contribute to restore essential services. When initiated at the tactical level, SCA tasks can have adverse effects on the campaign if their intended effects are not coordinated with higher Engr and local authorities. Since operators are in direct contact with the population, they can overcommit MILENG assets and resources to SCA tasks. Such situations can be detrimental to the campaign but also inhibit the execution of SCA responsibilities by local civilian agencies, creating unproductive reliance on military.

Disaster Relief: At the tactical level, response to these kinds of emergencies should be set under the parameters of area damage control and civil protection specified by higher operational commanders for specific AOs. Any response exceeding those parameters would normally be prescribed by higher command.

[55] NATO's CIMIC doctrine is detailed in AJP-9.

Military Engineering Support to Civil Authorities. MILENG is a multifaceted activity and a force multiplier across the full range of Alliance operations, but particularly NA5CRO. It uses both military and civil engineering capabilities and typically includes infrastructure repair; reconstruction and development; liaison with national authorities, IOs, and NGOs; and support to displaced persons and refugees. MILENG capabilities are well suited to all HA tasks and engineer units are well equipped to be used in consequence management and disaster relief such as flooding, earth quakes etc.

a) Efficient use of scarce engineer resources is essential to provide effective support to HA. Other contributing factors include early involvement of engineers in the overall planning process, centralised coordination, and decentralised execution.

b) The level of assistance can vary from small, highly specialized teams to complete engineer units. Small teams may be used to conduct damage assessment or estimate engineering repairs, and can assist in specialised support such as power supply and distribution, utilities repair work, well drilling activities, and water purification. In large HA and IDRO, NATO engineer units can provide technical expertise and will usually support the planning and design of infrastructure including facility construction, structural repair, debris clearance, emergency repairs to restore utilities, and camp construction for both deployed forces and IDPs and refugees. Explosive ordnance disposal (EOD) could also be provided.

c) MILENG support to infrastructure includes the construction, restoration, acquisition, repair, maintenance and disposal of infrastructure facilities, including the construction, restoration and maintenance of lines of communication. The Joint Force Engineer (JFEng) and his staff may support and coordinate the project management and execution of all infrastructures, including civilian reconstruction efforts.

d) NATO common funding will only be available for this purpose where it serves the core minimum military requirement in direct support of the NATO mission.

SUPPORT TO INTERNATIONAL ORGANIZATONS.

Introduction. NATO forces might intervene in crises, for example, to strengthen, uphold or restore peace and security, to re-establish governance and authority, or to provide humanitarian assistance. NATO forces will usually be but one contributor; and while different participants' respective goals may be broadly aligned, each is nevertheless shaped by different perspectives, priorities, motivations, mandates, timeframes, cultures and processes. This complex of actors may include, in addition to multinational military forces, the indigenous population, media, diplomats, International Organisations such as the United Nations (UN), Non-Governmental Organisations (NGOs), private military and security companies, multinational companies and opportunists. As such the

engineering aspects and interactions with these Civilian organizations needs to be understood and planned for with a theatre of operations.

SECTION 8 - Information Operations

Introduction. Info Ops is an analysing, planning. integrating and assessing function focused on the information environment rather than a capability in its own right. Whilst the inter-related activity areas can make use of all or any capability or activity that can achieve an influence, affect understanding, or have a counter command effect; the extent is only limited by imagination, availability, policy and legal constraints. However, there are several capabilities, and techniques that form the basis of most Info Ops activity. The capabilities and techniques used in support of Information Effects are varied but have to follow a protracted and directed plan in support of the commanders intent.

I In addition to the tasks of liaison, reconnaissance, provision of an advisory service and coordinating the management of infrastructure projects military Engineers are also involved in direct relief operations which can support the IO plan. The engineers involved in the actual engineering support tasks need to establish relationships with a variety of civilian authorities and agencies and thereby establish a valuable source of information to assist in the planning of information activities. However, due care must be taken to avoid overt use of these activities being perceived as intelligence gathering.

CHAPTER 3 - MILITARY ENGINEER

COMMAND AND CONTROL

SECTION 1 – Introduction

The Alliance must be disposed to engage in military operations in partnership with a number of Troop Contributing Nations (TCN) and/or with combined arms and component contingents. In this context, Command and Control (C2) is a challenge in itself. Although the National Commander retains full command over military forces of the same nation, the NATO command relationships are nevertheless clearly established. C2 of engineer elements is particular in that although there is only one chain of command, their inherent technical authority should also be maintained to the extent possible. The concepts of command and control explained in Joint doctrine still apply at the tactical level with emphasis on one concept: "***Centralized Coordination, Decentralized Execution***"[56]. In that regard, according to the command relationships detailed in ATP-3.2.2 – Command and Control of Allied Forces (Full Command, OPCOM, TACOM, OPCON, TACON, Admin Control)[57], tactical engineer elements must ideally remain OPCOM to Engineer authority throughout the mission.

SECTION 2 - Command and Control Principles

Effective command and control will be a key enabler towards the provision of coherent and optimized engineer support at all levels. Tactical C2 of engineers presents many of the same features and responds to the same principles stated in AJP-3.12 (B). The following principles should be applied:

a) Unity of command meaning a single focus for engineer advice and support as well as the full participation of engineer staffs in planning and operational processes.

b) Centralized planning and coordination coupled with de-centralized execution and control.

c) Timely warning, reconnaissance and deployment by engineers is key to success.

d) Use of the Supporting/Supported Command Concept (via engineer advisors) to employ key engineer assets to where they are most required, if necessary, cross component. Use of HNS engineers, international organizations, etc…, may also be relevant.

---

[56] AJP-3.12, Chap 2, Sect I

[57] ATP-3.2.2, Annex E

e) Centralized technical authority to ensure that standards of construction (for example) are achieved. If there are no Alliance standards the JFEngr is to set them.

f) Reach-back and reach-forward. A **reach-back** function is a pre-planned access form deployed Engr elements to technical authority either in the theatre rear area, higher HQ or national structure. **Reach-forward** not much different from reach-back in that the mechanism is only reversed and expertise is coming from outside the tactical elements. Response in a reach-forward is generally driven top-down as a proactive engagement of lower Engr elements as opposed to a reactive posture.

Centralized Control, Decentralized Execution. The most efficient results are achieved by centralized coordination by the Engr Advisor at the tactical level, whereas the details of the execution of the task should be delegated to the lowest practical level. Taking AJP-3.12 (B) C2-principle[58] even though two or more MILENG assets are assigned under command of manoeuver elements, their employment should always be controlled and coordinated by a higher level HQ. If engineer companies are detached to Infantry Battalions, they must report to the equivalent of an Engineer Battalion[59] HQ.

Allocation of Priorities. Closely linked with engineer task-organization, is the requirement for engineer commanders at all levels to maintain close liaison with their respective tactical commanders and staff to ensure that engineer work is properly and clearly prioritized. This will ensure best use of a scarce resource. Frequent changes in priority resulting in the need for continual redeployment of engineer units and equipment should be avoided as much as possible as this is wasteful. In the likely event that engineers are required at short notice to carry out vital and unexpected tasks, engineers employed on lower priority activities should be earmarked for redeployment as necessary. This may result in other arms/branches having to undertake non critical engineer tasks where feasible.

Command Procedures. Effective command procedures are an essential element of any engineer task. Standing operating procedures (SOPs) will be laid down by the theatre or formation commander; they are used in order to speed up command and deployment activities. It is essential to brief supporting engineers from other nations on SOPs, which are not covered by STANAGs.

Engineer units or sub-units can work with forces of an allied nation under any command relationship and degree of authority stated in ATP-3.2.2[60]. Engineer deployments and organizations should normally comply with tactical

---

58 AJP 3.12 Chap. II, Sect. II, Centralized control, decentralized execution

59 Distinctions between MILENG elements is defined in BI-SC Agreed Capability Codes and Capability Statements, Oct 2011

60 ATP-3.2.2 - Command and Control of Allied Forces

Boundaries[61]. The tactical commander would expect to retain his usual engineer advisor, even when engineers are regrouped. However, if a formation is reinforced by other engineer units, it may be necessary for the tactical commander to decide on the appointment of the engineer commander.

SECTION 3 – Functional Coordination and Liaison

Engineer Communication. A clearly defined channel of communication, to communicate accurate and timely information, is essential to enable an engineer commander to advise his tactical commander and to command and coordinate engineer operations. Reports and returns are to be submitted in accordance with STANAG 2430[62].

In order to enable the engineer commander to command his widely dispersed troops effectively, properly advise the tactical commander and review priorities, he must be able to:

a) Receive early reconnaissance reports and information on tasks.
b) Issue orders quickly and clearly on tasks, priorities, grouping, resource allocation and movement.
c) Have good situational awareness of ongoing missions in order to Monitor locations resources available and the progress of tasks.
d) Be able to communicate with all Engr commanders within a Theatre
e) Have access to the appropriate technical advice as required (often reach-back to Allied and/or national-level specialized capabilities).

Communications are therefore vital to engineers, both within units and to the supported formations. All available means to maintain links must be utilized including liaison officers where appropriate.

Procedures.

a) **Lateral Communications**. Lateral communications are particularly important for engineer operations that cross unit boundaries.
b) **Communications between Superior and Subordinate Engineer Commanders**.

   As far as resources allow, Engineer commanders are responsible for the establishment and maintenance of communications for engineer functional coordination to the headquarters of immediately subordinate units or formations.

---

61 ATP-3.2.1, Chap II, Sect II – Operational Areas

62 Standard reporting defined in the standard of the STANAG; AEngrP-2(B) – Land Forces Combat Engineer Messages, Reports and Returns

Liaison. If an engineer unit does not have a permanent representative at the headquarters of any formation it is supporting, it must make arrangements to ensure effective liaison. It is important that an engineer is represented at all planning meetings, reconnaissance or orders groups. If engineers of more than one nation are involved in a specific operation it is essential that engineer liaison between nations is established.

Principles and procedures for establishing liaison are contained in ATP-3.2.2[63] as well as in STANAG 2101. Liaison requirements should be included in all orders. There are three requirements of importance to engineers:

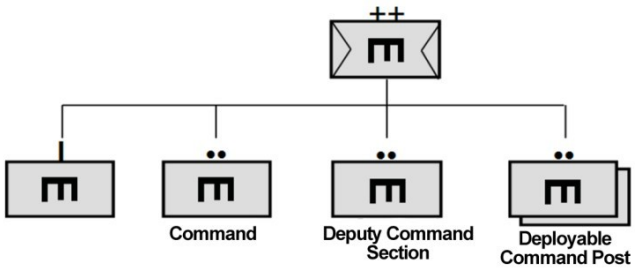
a) Reciprocal liaison when an engineer unit is placed under operational control of a headquarter of a different nationality.
b) Liaison with the host nation authority at the appropriate level through G4/HNS Staff Officer.
c) Specific liaison must be established between adjacent formations in order to ensure the detailed coordination of engineer operations that cross formation boundaries.

With a view to a comprehensive approach, Engrs activities will often impact civil affairs. Given their specialty, Engrs are habilitated to gain technical situational awareness concerning SCA and development initiatives as well as planned projects and intentions of IOs, NGOs and local industry.

Theatre Engr Organization. The staff organization of engineer elements in Joint Force Commands or above is detailed in AJP-3.12 (B). Basically, the construct ideally present at the tactical level, is reflected within a theatre of operations and involves a Senior Engineer element such as a Chief Engr/TFEngr HQ comprising task-organized branches and structures required for the theatre.

The two figures show examples for a theatre Engineer organization. They have to be adapted to the relevant missions.

63 ATP-3.2.2 – C2 of Allied Forces, Annex G; Liaison

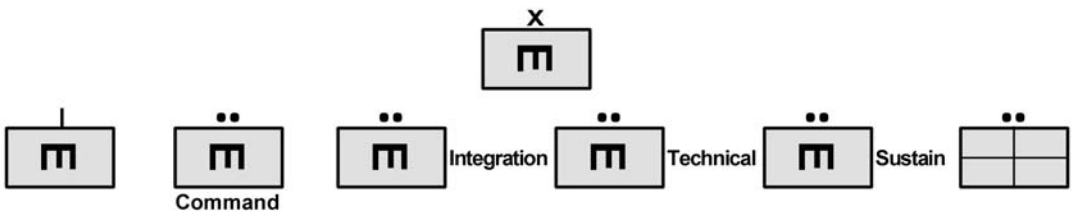


MISSION: To provide a senior engineer headquarters for command and control of engineer operations in a theater of operations.

TYPICAL ALLOCATION: One per major combat operation. Mission-tailored theater engineer command modules as required for contingency operations.

SUPPORTS: Mission-tailored to conduct theater army or corps echelon engineer operations.

Figure 2-1. Example for a Theatre engineer command



MISSION: To provide an engineer headquarters for command and control of engineer operations throughout the area of operations.

TYPICAL ALLOCATION: One engineer brigade headquarters per 2-5 engineer battalions.

SUPPORTS:

- The brigade headquarters provides command and control for engineer operations supporting a division or corps.
- The brigade provides an intermediate headquarters for command and control of assigned engineer operations when task-organized to a theater engineer command.
- The brigade headquarters provides command and control for joint or multinational engineer operations with augmentation.

Figure 2-2. Possible structure for an Engineer brigade command

SECTION 4 – Planning and employment

Employment of Engineers. The employment of engineers is an integral part of the tactical commander's plan at all levels. Engineers must be included in the operational planning process from the outset to ensure that scarce assets are optimized in support of the joint force. The role of the Engr advisor will be central in this regard.

Engineer Responsibilities. Engineer responsibilities can be summarized as follows:

a) Advice to the tactical commander[64]
b) Command of engineer units and command and control of subordinate engineers,
c) Coordination and technical authority over all engineer assets throughout the joint force.

Engineer Functional Coordination. In addition to his responsibilities to the tactical commander, every engineer commander should be linked to an engineer technical authority or "technical network". It is not a chain of command, but is a channel of engineer coordination and technical expertise. It exists to ensure the most economical employment of engineers and engineer resources. It enables the Engr advisor to coordinate engineer support across all components. It is thus essential that engineer units and sub-units supporting joint and combined formations retain the ability to communicate with the appropriate engineer commanders.

Elements of the plan for the employment of engineers will interact with many other aspects of the operational plan. It is essential that the engineer commander ensures that all such aspects are fully coordinated with other arms/branches.

Planning Process. The making of the plan should follow the normal method of an estimate, but certain aspects peculiar to engineers need emphasis. These are:

a) **Engineer Information Collection**. The engineer commander must base his decisions on the best possible information. This will come through engineer channels, from the tactical commander and his staff and from supported units but may take time.
b) **Formulation of the Plan**. The engineer commander may discuss aspects of his plan with his subordinates before he issues his orders. This is particularly important when operating with allied or regrouped engineer forces.
c) **Priorities**. There will always be a demand for more engineer resources than are available. The engineer commander must advise the tactical commander and obtain priorities for engineer work.
d) **Allocation of Resources**. Based on these priorities, the engineer commander allocates resources on the authority of the tactical commander. He will allocate specialists, materials and time to these tasks in accordance with the priorities for work and his subordinate units' capabilities**.** Additional engineer resources may be available with the assistance of the engineer commander or advisor at the higher level (normally TF or JF Engr).

64 For further details see Chapter 3, Section 2

SECTION 5 – The engineer estimate

A solid and comprehensive engineer estimate is the foundation of effective, efficient and decisive engineer support to tactical operations. Ideally, the estimate is conducted at the highest levels of the MILENG structure in theatre, providing subordinate Engr Commanders with guidelines within which to conduct their own. However, the estimate is generally more of a tactical planning tool. The findings of the engineer estimate will lead to the formulation of the Engineer Annex EE[65] to OPLANS and Orders.

Engineer estimate integration. As commanders generally do not get involved in detailed supporting arms planning, engineer advisors conduct their own estimate of the situation, following the commander's planning guidance. The sequence below demonstrates continuous iterative and re-iterative process that should be used as guide:

a) Commander's Mission Analysis. Upon reception of the tasks from the higher commander or upon a change to the initial situation, the commander will initiate his Mission Analysis[66]. At higher levels, he will do so with staff while at lower tactical levels he may do so during his reconnaissance with his arms advisors. At the end of this process, the commander will have issued his planning guidance, either in writing or verbally.

b) Engineer Adviser's Mission Analysis. Engineers (advisers or commanders) conduct their own mission analysis concurrently with the commander's. This analysis will focus specifically on engineer tasks, defining the engineer mission statement and identifying key issues to be addressed with the commander or his staff. All technical limitations or aspect of the engineer mission analysis which can affect the commander's plan will be addressed at the proper level.

c) Preliminary Staff Checks. As the estimate and engineer planning continues, initial staff checks are conducted in order to confirm the operation's feasibility from an engineer's perspective. As key information is discovered, engineers will keep the commander or his staff informed and will also prepare the engineer input to the Information Brief covering engineer-related capabilities, limitations and risks requiring decision from the Commander.

d) Engineer Advisor's Analysis of Relevant Factors. With the commander's planning guidance and his mission analysis, the engineer advisor directs his staff or subordinate commanders to conduct an analysis of key factors. As the most prevalent factor is often ground, the analysis should also cover adversant, friendly forces, resources available as well as time and space.

e) Final Staff Check. This stage corresponds with the courses of action comparison inside the planning process. Engineer advisors will develop an

---

65 Annex EE is mentioned in AJP-3.12 in Chapter 3 and an example is provided at Annex B.

66 Mission Analysis is not defined in AAP-6 but refers to a systematic consideration of assigned and implied tasks. At higher level during JOPGs, this process will also be referred to as **Problem Framing.**

engineer concept of support for each tentative COAs. When considering tasks specific to each COAs, specialized resources and time assessment will be identified as well as regroupings of engineer assets and inherent command relationships proposals.

Considerations. While conducting the estimate, the engineer advisor will analyze key factors relevant to specific aspects of the theatre or expected mission/tasks. Note that many of the information requirements for the engineer estimate are the result of the IPB. When conducting the estimate, engineers are not generating new knowledge but interpreting known information into deductions that will form the basis of a plan. The factors below are discussed as a considerations for developing the estimate:

a) **Situation**
   (1) Adversant. Overall intentions and doctrinal engineer support to the adversant course of action.
   (2) Friendly. Commander's intent and all available MILENG assets.

b) **Ground**. This is a general assessment of the terrain where operations will take place using terrain analysis information from the IPB. Engineers may also conduct their own assessment of the ground using different methods such as the mnemonic FLOCARK[67], meaning;
   (1) F: Features.
   (2) L: Lanes.
   (3) O: Objectives.
   (4) C: Canalizing ground.
   (5) A: Approaches.
   (6) R: Rate of approaches.
   (7) K: Key Terrain.

SECTION 6 – Summary

Effective C2 is key to the success of MILENG components in support of operations. Although invariably in support of combined arms operations, specialty imperatives demand a certain degree of technical authority. This reality does not suggest that the Engr technical network is in fact another command authority; there is only one chain of command. However, the credibility and capability of Engrs rests largely on their expertise in often highly specialized fields, their ability to interpret the terrain and recognize the effects that can result from those factors. Sometimes, technical requirements will impact on the Commander's plan and Engr advisors have to develop the art of balancing specialty expertise with

[67] FLOCARK is only a suggestion of key factors to consider when evaluating the challenges and opportunities presented by the terrain. This mnemonic is well adapted to MILENG key deductions.

the higher commander's intent. The nature of MILENG makes them more effective when their effort can be prioritized, their command and planning centralized and their execution de-centralized.

CHAPTER 4 - MILITARY ENGINEERING

PLANNING OF OPERATIONS

SECTION 1 – Introduction

Engineer tasks are invariably demanding in time, resources and manpower. The early identification of engineer support requirements is therefore critical and demands the involvement of engineers in the planning and reconnaissance process from the outset. Engineer input to the planning process is also required to ensure that engineer factors such as terrain and infrastructure, which may constrain the planning options, are fully considered.

Engineer staffs at all levels will carry out planning that must be integrated not only horizontally across their HQs but also vertically with engineer staffs at superior and subordinate headquarters, and outwards to the HN, IOs, nongovernmental organizations (NGOs) and other relevant actors. Engineers have a significant contribution to make to the Operations Planning Process (OPP) at all levels and must be fully involved in campaign synchronization.

SECTION 2 – Engineers and the NATO Planning Process

Context. The Operational Planning Process (OPP) is an iterative and re-iterative process comprising the same parts independent of the level at which planning is conducted. The planning process is described in AJP-5 – Allied joint Doctrine for Operational Planning It is important to note here that although this publication focuses on the tactical level, it is understood that tactical level NATO MILENG organisations will operate in a Joint or multinational context. It will be attempted here to provide more detailed descriptions to the concepts covered in AJP-3.12.

Engineer Input to the Phases of the Operational Planning Process. The level of engineer input to the OPP will be determined by the operational requirements. HN engineer support may cover, or partially cover, some of these requirements. Available time, funding, resources and manpower will be limiting factors that ought to be taken into full account when planning for engineer tasks. The phases of the Operational Planning Process are described in detail in AJP-5 Allied Joint Doctrine for Operational Planning and the Comprehensive Operations Planning Directive (COPD). Engineer involvement in this process is described in detail in AJP-3.12.

SECTION 3 – Engineer Resources and Materials

Resources development plan

Procurement. The provision of engineer resources, such as earthmoving equipment, bridging and general construction stores, is normally the responsibility of engineers. The requirement for materiel is dictated by the environment and military considerations but may be significant. Engineer resources will generally be obtained from one or more of the following sources:

a) Engineer field and support units.
b) Military logistic organizations.
c) Other government or service agencies.
d) Engineer or civilian workshops.
e) The local civilian economy by requisition or local purchase.
f) By extraction or exploitation of natural resources; examples are stone and timber.

The authority to exploit these resources will be granted by higher levels dealing with the Host Nation.

Funding. Funding arrangements may not be agreed until after the force has been established. Until this occurs NATO forces must be prepared to be self-sufficient. There will be occasions when operational level engineering has to be provided and financed from NATO Common Funds. If the situation requires, the NATO Security Investment Programme (NSIP)[68] will provide the funds for infrastructure and Communications and Information Systems (CIS) to support military forces.

Engineer resources and materials

Engineer Material (Class IV Supplies).
Material and Resources mainly used by engineers, often referred to as "Engineer Resources", will be similar among most military forces. Because engineer resources are vital to engineer operations, it is important for engineer commanders to identify the requirements by type and quantity to the appropriate logistic organization and then monitor their allocation and provision even if they do not control them. At each level of command, when the engineer commander formulates his plan, he should ensure adequate allocation of engineer resources for its implementation.

---

[68] For more information see Bi-SC ALLIED JOINT OPERATIONAL GUIDELINES FOR LOGISTICS (JOG 13/01), edition 15 Feb 2013, Chapter V, Section IV, Para 0509 "Infrastructure and NSIP" and Bi-SC 85/1, Capability Package Directive, Jan 13.

The provision of engineer logistics is normally a national responsibility though agreements may be made to share specific responsibilities. The NATO Support Agency (NSPA) will normally procure and supply materiel for NATO operational infrastructure.

Movement and Holding of Engineer Resources. Engineer materiel supply points will be located as far forward as is tactically possible, provided security can be guaranteed. It is not likely to be rapidly movable. Its aim will be to service the whole of the Area of Operations (AOO). It will be collocated with existing infrastructure services and will bring together host nation and imported engineering agencies; power, roads and railways are desirable features. Engineer planners have to consider the following:

a) Engineers have a limited capability to move engineer stores and equipment, using integral transport, but large quantities of stores will usually have to be moved on other transport. If this movement is not controlled by the engineer commander, it should be monitored to ensure that the stores arrive in the right place at the right time and in the right order.

b) It is very unlikely that all engineer resources are held on transport. Some will always have to be held on the ground. The engineer commander must, therefore, make timely plans to ensure that transport is provided to move resources when these are required.

c) It will often be necessary to dump resources forward, at or near work sites. Dumping is costly in labor, Material Handling Equipment (MHE)[69] and time but makes best use of limited transport. The tactical situation must be carefully assessed in determining locations and stock levels. Dumps must be planned judiciously in conjunction with the operations and logistics staffs.

d) The limited numbers of critical engineer equipment require that, in case of damage or breakdown, their repair is high priority. The engineer commander must request that this support is rendered by maintenance forces as far forward and as early as possible, to reduce down time.

SECTION 4 – Infrastructure Development Plan

Infrastructure is defined in AAP-6 as “all fixed and permanent installations, fabrications or facilities [required] for the support and control of military operations[70].

---

69 See AAP-6

70 AAP – 6 (2004 definition). To be deleted to use ‘Concise Oxford English Dictionary’ (COED) definition: “the basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise.” (final deletion process by NTMS)

The purpose of all infrastructures planning for the NATO Deployed Forces is to provide the user with complete, functional and cost-effective facilities. More details about Deployed Force Infrastructure (DFI) is provided in para 416.

Due to the expeditionary nature of current operations there is an ever increasing demand for infrastructure in the theatre of operations.
Specific requirements depend on the nature and location of the operation and may also change significantly over time.

Proper planning for infrastructure development is important for a number of reasons:

a) **Mission success**: the requirements of a mission can change very rapidly and also change the infrastructure requirements, a proper plan that allows for changes and additions to existing infrastructure can make it much easier to relocate forces within a theatre or bring additional forces into a theatre in a timely manner and facilitate the handover to the HN or closure at the end of the operation.

b) **Cost**: infrastructure is expensive to build and maintain, both in terms of manpower and money. Proper planning, taking into consideration Civilian and International Organizations in the process, can contribute significantly to efficient use of both limited resources. An early planning for stabilization and reconstruction is also essential to save money and avoid duplications.

c) **Impact on local population**: as previously described, in the current operating environment, the impact of our forces on the local population can be a significant factor in mission success. How and where we construct infrastructure, how we maintain this infrastructure, how we handle the waste created by this infrastructure and how we ultimately dispose of this infrastructure can all influence how we are perceived by the local population. Environmental protection and comprehensive approach (IOs, NGOs, CIMIC, HN…) must be applied when planning, using and handing over the infrastructure/facility.

d) **Force protection**: the design and layout of infrastructure contributes to force protection, proper planning ensures that the appropriate FP issues are included from the beginning but also with the End State (redeployment) in mind.

e) **Environmental protection:** While planning for camp construction a site environmental baseline study[71] has to be conducted before any other staffing process is initiated. This study provides the foundation to confirm location suitability and, if selected, for camp life-cycle management.

[71] Details on the format of this study are provided in STANAG 6500, covering AJEPP-6, Environmental File for Military Compounds in NATO Operations

Infrastructure planning will include Forward Mounting Bases (FMB), Intermediate Staging Bases (ISB), Theatre Reception Centres (TRC), Air and Sea Ports of Disembarkation (APOD and SPOD), Forward Operating Bases (FOB), Forward Support Bases (FSB) and storage and repair facilities.

All infrastructure must satisfy the Minimum Capability Requirements (MCRs) necessary to ensure Commanders and their HQs are fully capable to effectively operate across the spectrum of conflict. Issues such as restrictions on health and safety, overcrowded and substandard working conditions have an impact on the daily mission accomplishment. Infrastructure must be simple, solid and safe. The choice between different options available to meet MCRs on AOR will be influenced heavily by local factors, such as:

a) Availability of materials and resources;
b) Capabilities of construction troops and contractors;
c) Availability of existing facilities and real estate;
d) Mission duration, and other operational imperatives;
e) Geography and topography;
f) HN standards, traditions and culture.

Deployed force infrastructure (DFI) should be designed and developed considering the appropriate standard of accommodation (Tier 1 to 4)[72] subject to command guidance, operational duration, climate, HN local knowledge (natural hazards) and logistics capability. The total scope of the required infrastructure will be evaluated on a case by case manner for each base camp, as the sum of numerous increments. The camp design should be a fully integrated system with allowances made for increases in the standard of accommodation as operations mature and with future expansion in mind. DFI is discussed in more detail in ATP-3.12.1.x.

SECTION 5 – Barrier planning

Fire, movement and obstacles are decisive factors in all operations. Obstacles are an essential element of defensive operations and their effects on the physical battlespace contribute to impose our will on the adversant. As such, the Alliance defines tactical obstacles as **Barriers**[73]. Barrier planning considerations are mostly related to defensive postures[74]. Engineers must be directly involved

[72] in accordance with SHAPE Guidance on NATO Security Investment Programme (NSIP) Funded Infrastructure and Communication and Information System (CIS) Projects on Crisis Response Operations (CRO) – Revision 1, 23 Dec 09

[73] AAP-6, Barrier/Systeme d'obstacle, Nov 1991

[74] ATP-3.2.1 – Allied Land Tactics – refers to barriers for defensive operations in Chapter 6 and defines this as an Engineer task under Counter-Mobility

throughout the barrier planning process which is an integral part of operational planning.

All obstacles, laid by any means or arm, must be coordinated, usually into belts and zones, with the barrier plan. Commanders, advised by engineers, must submit their requests for obstacles planned by the engineers. The appropriate commander will then approve these requests, based on engineer advice.

The tactical commander may impose certain conditions on barrier planning and operations such as the designation of Barrier Restricted Area (BRA) to ensure his own freedom of manoeuvre and the main point of engineer effort. Lanes through, and gaps between barriers, must be kept open and then be able to be closed rapidly on order.

For obstacles of particular importance, the tactical commander may impose the requirement for guards e.g. for reserved demolitions or other obstacles, or impose restrictions concerning the firing of demolitions and the employment of scatterable mines.

The maximum effect is obtained from obstacles when they are employed in combination, and when they are covered by fire. They are likely to include natural and manmade obstacles which must be coordinated with host nation advisors, when appropriate, and comply with host nation agreements, ***ROE as well as the Antipersonnel Mine Ban Convention; the Convention on Certain Weapons, amended Protocol II and Protocol V and the Convention on Cluster Munitions***. Anti-tank minefields will often be the most important element of any obstacle plan. Modern mine systems considerably increase the effectiveness of minefields since:

a. Minefields can cause considerable casualties and delay to the adversant as well as disrupting his movement and forcing him to present an attractive target array to Air, aviation and indirect fires.

b. Forces are able to emplace a greater variety and quantity in less time, particularly using scatterable mine systems.

c. The laid life of modern minefields can be pre-selected in accordance with tactical requirements. The effect of laid-life mines on the manoeuvre plan must be considered during engineer planning.

d. Future mine systems will feature self-destruct (SD) and self-neutralize (SN) capabilities or even the ability to be turned on and off at will to suit the commanders plan. This will be particularly well suited to delaying options.

Minelaying procedures are covered in STANAG 2036. Other aspects concerning all obstacle types are discussed below.

Concept of Employment. An effects-based approach to counter mobility is required to meet the current and future operating environment. The commander will express his intent in terms of the effect on the adversant which he wants to achieve such as disrupt, turn, fix or block. This approach to obstacle planning is called Combined Arms Obstacle Integration (CAOI) and ensures the optimum integration of available assets. Barriers must be co-ordinated with the overall obstacle plan and can be employed in three ways:

a. **Terrain-Oriented Barriers**. Planning for these obstacles may be based on a thorough terrain analysis and long term planning, and is related to the tactical commander's initial concept of operations. Individual obstacles may be prepared prior to hostilities (increasingly unlikely), and could be either permanent or field type. They may include minefields, demolitions and constructed obstacles. They form the backbone of the obstacle system because they reinforce or modify the existing terrain to the defender's advantage and should be prepared as far forward[75] and as early as possible. When appropriate, logistic and organizational planning for obstacles is carried out in peacetime.

b. **Situation-Oriented Barriers**. Once adversant deployment for an attack has commenced, additional intelligence will become available which will confirm or revise the assessment of the adversant's intentions. Specifically, his likely axes of advance and selected points of main effort should be identified through the dynamic IPB process and an indication of the force ratio expected should be determined. Additional obstacles may then be implemented in these areas to strengthen the existing defense once an anticipated adversant course of action has been confirmed. They may be planned prior to the start of an operation if this is possible, to allow their rapid execution when required. Scatterable and remotely delivered mines or other rapidly emplaced obstacles are likely to be used because of the speed of reaction required especially for the closure of breached obstacles. Other types of mines, demolition and obstacles may be used if time permits.

c. **Target-Oriented Barriers**. Scatterable mines, delivered by fixed wing aircraft, helicopter, rocket or artillery, offer the ability to attack targets directly, for example manoeuvring or resting units or key choke points such as defiles or bridges. Pre-requisites for the success of target oriented obstacles are real-time reconnaissance, resources availability and short reaction times. The aim of this type of barrier may be to disrupt adversant deployment by causing casualties and thus prevent the quick and unhindered introduction of follow-on echelon forces. It is expected that in the future, improved situational awareness across NATO forces will make this type of barrier highly effective

---

[75] The term "*forward*" is used here in the conventional sense of a contiguous battlefield. In a non-contiguous battlefield the principle applies but has to be adapted to the fact other friendly units may be forward, therefore meaning: ***as close to the threat as possible.***

and will allow fleeting, high value opportunity targets to be engaged decisively by joint fires. The principal targets may be:

(1) Armored forces.

(2) Headquarters and fire support elements.

Anti-tank and Anti-personnel Barriers. Barriers are employed against armored forces but where the terrain forces the adversant to dismount, or an adversant is likely to operate on foot, barriers may be exclusively anti-personnel in nature, such as wire obstacles. Only legally compliant anti-personnel measures will be deployed and their use will be clearly stated in engineer or force ROE[76]. This may include their use within anti-tank minefields so that the adversant will be hindered in negotiating such areas on foot and from clearing anti-tank mines by hand.

Siting of Obstacles. Obstacles should be prepared in such a way that they are co-ordinated with the fire plan so that the adversant cannot by-pass them or can do so only in those places where this is in line with the commanders intent. This objective can be best achieved if they are constructed adjacent to natural obstacles or combined with them to produce a more effective obstacle. Their depth must be great enough to inflict heavy losses of personnel and equipment to the adversant while negotiating them in one bound. In many cases, the stopping power of several closely spaced obstacles, in depth, may be greater than that of a single large barrier because the attacker is forced to deploy and expose his breaching resources on several occasions.

Barriers on the Flanks and in Depth. There is a need for obstacles in depth and on the flanks to contain and restrict adversant penetrations. These must be carefully planned in lose coordination with flanking and counter-attack forces. Obstacle plans and the identification of BRA are to be coordinated across boundaries at all levels.

Balancing Mobility and Counter-mobility. Obstacles and movement are competitive elements in combined arms/branches operations. Balancing the requirement for counter-mobility and mobility is a continuous task for staffs. To ensure that the correct balance is achieved between the effect on the adversant and retaining our own mobility, tactical commanders at all levels must clearly identify:

a. The priorities for engineer effort and other arms/branches in the execution of counter-mobility tasks.

b. The areas and routes and that may be required for the assembly and deployment of reserves.

[76] The article of the Law of Armed Conflict referring to constraints on obstacles is to be insetrted here

c. The areas and routes that are required, at least for a specified period, for counter moves and for re-supply purposes.

Barrier Restricted Areas. BRA may be declared in order to retain the requisite freedom of movement to guarantee the success of a planned counter move. The restriction may involve time, location or type of obstacle. BRA may be declared by a joint force commander, where manoeuvre of friendly forces must not be hindered by barrier operations. Within them, obstacles may not be emplaced, activated or executed without the authority of the commander who controls the area.

Declaration of BRA can create a risk to the defensive plan which must be carefully considered by the tactical commander. The level of risk which can be accepted will be determined by our ability to react quickly to a change in the circumstances in these areas, using appropriate obstacle systems.

If a BRA is ordered for a limited period of time, minefields with a limited laid life and, in future, remotely controlled minefields, will be emplaced.

Control of Demolitions. It is the responsibility of the all arms/branches commander to control what is to be fired and when. For this purpose, a system for the control of demolitions is essential; this is set out in STANAG 2017.

Obstacle Numbering. Obstacle numbering will be carried out in accordance with agreed procedures (STANAG 2237 currently in draft) and will be reported in accordance with STANAG 2430, Land Force Engineer Messages Reports and Returns, which provides a means of identifying, uniquely, all friendly and any identified adversant obstacles.

Marking of Minefields. Minefields will be marked in accordance with STANAG 2036.

SECTION 6 – Engineers and contractors

Contractors will often be employed to provide a range of engineering and logistics services during operations. Contractors in an area of operations can be employed by NATO or directly by a single national contingent. When employed by a national contingent, national contracting regulations will be in effect.

The NATO Support Agency (NSPA) is NATO's principal logistics support management agency and will normally be responsible for the awarding of engineering services contracts during Alliance Operations and Missions (AOM). NSPA is an option for nations in providing contracted services during NATO

operations and in some instances may be the only option for real life support. Further information is to be provided in ALP 3.4, Chapter 10

SECTION 7 – Engineers and Host Nation Support

Introduction. There is a distinction to be made between Host Nation Support (HNS) which is supplied by the host nation authorities, and In Theatre Resources (ITR), which are contracted for by NATO forces or others acting on their behalf. The availability of HNS/ITR and the state of the local infrastructure will clearly have a significant bearing on the requirement for engineers and the range of tasks they will be required to undertake. In more detail, HNS is "civil and military assistance rendered in peace, crisis and in war by a host nation to allied forces and NATO organizations which are located on or in transit through the host nation's territory." The type of HNS which may be provided ranges from services using only civilian resources, to support from military units. HNS may be provided to all arms/branches; however engineers will frequently be major users of HNS because of their roles and reliance on materiel.

HNS Resources. Where available, HNS resources which are likely to be of particular interest to engineers include:

a. **Airfields/Sea Ports.** This includes facilities, maintenance services, work areas, warehousing, storage, security, repair and airfield damage repair (ADR)[77]

b. **Civil Labour.** Skilled and/or unskilled labour may be available.

c. **Construction.** Engineering services, damage repair to facilities including ports and transport infrastructure and bridging may be provided.

d. **Facilities.** Maintenance work, spares and storage facilities may be available.

e. **Supplies and Services.** Rations, water and utilities may be provided.

f. **Transportation and Movement.** Transport, traffic control, materiel and container handling equipment may be available.

Provision of HNS. The efficient provision of HNS requires close liaison between allied forces and the host nation authorities, including the determination of priorities. Whenever possible HNS should be pre-planned in peacetime. There are three options for the provision of HNS:

a. **Generic Planning.** Generic plans are those which are developed for possible operations where some of the planning factors have not been fully identified or cannot be fully assumed.

[77] AAP-6, Aug 1998

b. **Contingency Planning.** These plans are developed for possible operations where planning factors have been identified or can be assumed; they are produced in as much detail as possible.

c. **Ad Hoc Planning.** Ad hoc plans are tailored to meet unforeseen circumstances as they arise or to update generic or contingency plans.

SECTION 8 – Summary

This chapter covered engineer input to the NATO planning process, engineer resources and material planning, barrier planning, relations with contractors and the host nation. It is important to remember that engineers both influence and support the planning efforts and that the value of their contribution rests on their technical expertise. Engineer advisers need to be able to identify when they are required to influence planning efforts and when they should focus on developing support concepts in response to planning guidance. Without organic or externally procured resources, material and capabilities (including but not limited to contractors and infrastructures), engineers can provide only limited support to planning of operations and the options developed will be proportionally limited.

CHAPTER 5 - MILITARY ENGINEERING

SUPPORT TO JOINT FORCE OPERATIONS

SECTION 1 – Introduction

Independent of component or service, tactical units often conduct their missions and tasks in a land-based environment. As such, this chapter adapts a large portion of the content of *AJP-3.2 Allied Joint Doctrine for the Conduct of Operations*, in an attempt to harmonize with the Joint Force support parameters set in AJP-3.12. Due to the nature of MILENG - often remaining "joint" in scope even at the tactical level – tactical operations are addressed here with the aim of being as general and inclusive as possible and as detailed as necessary to illustrate the nature of the Engineer activities in relation to the other supported elements within a joint force.

SECTION 2 – Pre-deployment

Research and Preparation. In engineer terms, efficient use of the pre-deployment period relies heavily on the information and resources available. The timely exchange of information based upon well-defined information exchange requirements and interoperable databases of terrain, infrastructure and resources will have considerable potential to save manpower, equipment and time. Such as databases should be developed and maintained for contingency planning. Links with the civil engineering industry, which is deployed world-wide on construction projects, can be invaluable. Retention of an ability to design, construct or repair accommodation, hospitals, roads, railways, airfields and utilities is essential, as will be the ability to control the work of local labour, understand contracts and ensure on-site quality control. It is highly likely that increasing use will be made of contractor support in future Alliance operations where this is considered appropriate.

Reconnaissance and planning during the pre-deployment period are crucial in determining the engineer effort required and in deploying it in an efficient and timely fashion. Ground reconnaissance may not always be possible in advance, reinforcing the need for detailed up-to-date databases. However, where ground reconnaissance can be carried out, it is essential to include engineers to assess the effect of the factors discussed earlier. The reconnaissance team should have an ability to negotiate and let contracts, including methods of payment. Where local resources are scarce, there may be competition between coalition partners. Agreements on sharing or apportioning should be made beforehand, with one nation providing resources control. Centralized control should have the effect, not only of ensuring equable shares, but also of keeping down costs.

Engineer stores and materiel will often have to be shipped from home bases, in many cases in task tailored sets or in partially prefabricated form. Wherever the origin of these stores and materiel it is likely to be controlled by national organizations until arrival in theatre. Within a NATO force, the mechanism for establishing the state and location of engineer stores, and for their distribution to participating countries, must be clearly established. Where industrial surge capacity is envisaged, or urgent operational procurement procedures are to be used, the production and delivery lead times of engineer stores must be closely matched to the deployment plan.

Reconnaissance. Engineers differ from other arms/branches in that many tasks require stores and equipment that are not permanently held with units. The successful and prompt completion of engineer work depends upon personnel, stores and equipment being available in the right configuration, place and time. Engineer reconnaissance is therefore a key engineer enabling activity in providing the necessary information and warning time. The advent of advanced technology such as Unmanned Aerial Vehicles (UAVs) allows a wide range of information to be gathered remotely but does not remove the need for a manned engineer reconnaissance capability to provide guaranteed 'eyes on' to the commander in all weathers and environments.

The primary role of engineer reconnaissance is to provide combined arms and engineer commanders with timely and accurate engineer information on the natural and manmade environment, and on adversant engineer activity and intentions. Its secondary role is to play an integral part in contributing to combined arms reconnaissance.

It is important that the engineer commander accompanies the tactical commander on any significant reconnaissance tasks in order to ensure that engineer aspects are taken into account at an early stage. The composition of the reconnaissance party required for engineer tasks will depend on the nature of the task. The need for local protection should not be overlooked.

Principles of Engineer Reconnaissance. As stated, engineer operations are resource-intensive and engineer tasks can impose a drag on operational tempo if their sequencing is not planned early. Engineer reconnaissance is therefore essential to ensure that engineer effort is focused where it can best achieve the desired effect and to allow focused concurrent activity.

a) **Principles**. The following principles apply to the provision of effective engineer reconnaissance:

   (1) Engineer reconnaissance should be command-driven, normally through the Commander's Critical Information Requirements (CCIRs), Priority Information Requirements (PIRs) and Requests for Information (RFI).

   (2) Engineer reconnaissance should be centrally coordinated at each level of command in order to maintain tempo. Thus, it may need to be task

organized in order to provide the required level and type of detail on time.

(3) Engineer reconnaissance generally deploys as part of combined arms reconnaissance.

(4) Engineer reconnaissance should have the same vehicle signature (though not necessarily exactly the same vehicle) and the same basic combat sensor suite (though engineer additions may be required) as combined arms reconnaissance. This will stop it being a signature vehicle and allow it to meet its combined arms reconnaissance requirement.

(5) Engineer reconnaissance requires specialist training.

(6) Access to the results of engineer reconnaissance should be available at every level of command.

b) **Tasks**. The tasks that engineer reconnaissance is likely to carry out in all types of operation and at all levels include:

(1) Confirmation of terrain analysis in support of the IPB process.

(2) Route reconnaissance to either confirm terrain information or to gather fresh information.

(3) Obtaining cross-country movement, trafficability and going information.

(4) Reconnaissance of natural, adversant and friendly obstacles in support of manoeuvre.

(5) Identification of the location, strength, grouping, movement and procedures of adversant engineers.

(6) Support for forward aviation.

(7) Identification of local infrastructure, facilities, utilities, resources and transportation.

(8) Identification of significant UXOs.

(9) Obtaining battle damage information.

(10) Liaison and escorting duties.

(11) Minor close support engineer tasks including small scale demolitions.

SECTION 3- Deployment

During the deployment phase, it is essential that engineer equipment and stores are clearly marked, in the correct prioritized order and loaded as complete sets on the same ships or aircraft. An engineer element and their equipment must always be amongst the earliest to arrive in theatre. Experience in all NATO nations has

shown a requirement for a larger number of engineers at the start of an operation (during the “surge” phase) than when a ‘steady state’ has been established.

Deployment of air forces may not coincide with that of ground troops. Whenever it occurs, supporting engineers tailored to the threat and utilities demands, should move in advance of them. Dedicated engineer support may include the provision of bulk fuel handling, aircraft protection, airfield damage repair (ADR), support to Explosive Ordnance Disposal (EOD) and provision of other utilities. If tactical fuel handling equipment will be required, including ship to shore facilities, it will need to be moved early. In some circumstances, it may be necessary to establish a forward mounting base, close to the theatre of operations, in which case an additional engineer force may be required.

Entry Operations. Reception, Staging, Onwards Movement and Integration

Reception, Staging, Onwards Movement and Integration (RSOMI). Selection of Ports of Debarkation (PODs) will depend largely upon the operational plan but will be heavily influenced by the infrastructure, HNS / In Theatre Resources (ITR) and other facilities, for example training areas and logistic storage areas. The requirement for comprehensive databases is reinforced. Reconnaissance of the POD, if necessary by more covert means, must include engineers. Once selected and confirmed, the POD will have to be established, taking into account the provision and maintenance of the facilities and services required to receive the main force. Establishment and sustainment of the POD in a benign environment, with sophisticated infrastructure in place and readily available HNS, would require relatively little engineer support. However, less favorable conditions could demand some or all of the following capabilities:

a) **Ports**. Clearance of underwater obstacles by divers may be required. Design, construction or repair of floating quays or jetties, including container handling and crane facilities must also be considered. Selection of the SPOD should aim to minimize such work in order to save time. Some inshore work may be required to lay moorings for ships or fuel containers. Depending on the situation, facilities for over the-beach offloading may have to be constructed.

b) **Airfields**. Early tasks could include ADR requiring heavy and specialist equipment. Provision of hardened command facilities, blast protection for aircraft, construction of weapon storage areas, dispersal areas and fuel farms may be required. Expedient surface materials such as mats would save on time but increase shipping volume. Aircraft are heavy consumers not only of fuel but also of water, particularly for decontamination. Electrical power may be required for runways, ground servicing and domestic use. If the airfields need additional temporary accommodation, it may have to be built and provided with utilities, including sewage disposal.

c) **Camps**. Some form of staging accommodation will normally be required. The level of work will depend on the theatre infrastructure, but even where

buildings are available, some conversion or supplementary work to provide force protection may be required. In some circumstances, camp construction on virgin sites will be the only or preferred course open. The requirement for tentage, semi-permanent or prefabricated accommodation and its qualitative improvement will depend upon the climate and expected duration of the campaign and are key factors in the establishment of theatre construction standards. Camp stores, including provision of utilities, should be held in standard sets. The adversant threat will affect the force protection measures required.

d) **Logistic Installations**. Where possible, existing hard-standings and storage facilities will be used. They may need protection, both from adversant action and from theft. When facilities do not exist, they must be built, often involving heavy earthmoving plant and the provision of surfacing materials. Bulk fuel farms will usually be required, possibly including ship to shore handling facilities. Ammunition, including air weapons, mines and explosives will need protected facilities in the rear area. Provision of the necessary logistic facilities will be essential before the arrival of the main sea or air lift of stores and equipment.

e) **Hospitals**. As with camps, hospitals may have to be built on virgin sites. Where existing buildings can be converted, work will often be required to widen doorways, provide ramps and install water and (emergency) power supply, waste disposal, air conditioning and heating. Medical products invariably require refrigeration. Helicopter pads will be required. Collective CBRN protection may also be needed.

f) **The Road Network**. The facilities described above may be dispersed and may need the construction and maintenance of connecting roads or tracks. SPODs will have to be connected to the logistic storage areas which, in turn, must connect to lines of communication (LOC). Field and general hospitals must be connected to APODs for casualty evacuation to base hospitals. Circuits within discrete installations must also be maintained. The maintenance requirement will be heavily influenced by the condition, weather and usage, but it will be a continuous task which requires a specific engineering capacity.

g) **Railways**. The repair and maintenance of the railway network may be required. In some circumstances its extension may be necessary.

h) **Geospatial Support**. Engineers may be responsible for geospatial/geomatic support ranging from hard copy maps to digital data. There may also be a requirement for a geo based mission rehearsal facility.

i) **Protection of PODs**. The physical security and protection of the PODs extends beyond measures within discrete installations, such as bund walls round ammunition stocks, to fortification works and minefields. The nature of the work and effort required will be dependent upon local circumstances.

j) **Area and Route Clearance and Explosive Ordnance Disposal (EOD)**. Engineers may be responsible for mine clearance and EOD tasks (though EOD is not exclusively an engineer responsibility) throughout the area of operations. Generally this would only be conducted for the protection of own troops.

Training & Acclimatisation. Some engineer support to training and acclimatization may be required, for example the marking of field firing ranges, targetry manufacture or practice obstacle construction.

Intra-Theatre Deployment. Provision of intra-theatre mobility is an essential engineer task. It must be achieved despite disruption by climate, terrain or adversant action. Engineers will provide routes for use as LOC or for redeployment. Engineers will develop or improve the routes including culverts and bridges, recover assault bridging and replace it with logistic bridging, ferries or floating bridges. Depending on LOC length and condition, some construction or repair work may be required. Transit or holding areas containing refuelling points, utilities and temporary accommodation may be needed. The routes will require regular maintenance. Further enhancements to intra- theatre movement may be needed in the form of helicopter operating bases or airstrips. Alternative routes, bypasses or laterals may also be required, constructed from scratch or by developing existing facilities.

SECTION 4 – Redeployment

Redeployment of a force will require MILENG support to the very last moment to maintain Freedom of Movement (FOM) back to the POD. The reception and staging facilities used to introduce the force, if properly maintained, should require little additional effort to redeploy that same force. A surge of engineer effort may be required to dismantle entry or exit facilities which may require redeployment of engineer assets; some to be returned to the home bases for reuse, some to be disposed of locally[78]. Forward mounting bases may also be used on redeployment.

It is common during redeployment that either logistics and/or engineers take the lead for all operations. Generally, engineers will be involved in:

a) Handing over of construction works[79];
b) Environmental remediation;
c) Real property damage repairs and reinstatement;

---

[78] Actually a “Camp Closure Handbook” is under development. This handbook will provide more details about MILENG responsibilities and tasks during redeployment.

[79] Construction works can be handed over to Host Nation Security Forces or other IOs, GOs and NGOs, involvement from the LEGAD, CIMIC and logistics authorities is critical, especially in the liability for structures after their handover.

d) Engineer services contract termination;
e) Dismantlement of tactical infrastructure.
f) Maintaining FOM on MSRs for redeploying forces, including Route Clearance

SECTION 5 – Military Engineer support to Land Operations

Land Force Activities. Land Forces conduct four types of Tactical Activities; offensive, defensive, stability and enabling activities. The engineer support to each of these four types of activities is discussed in detail below.

This section also discusses engineer support to Airborne, Airmobile and Amphibious operations.

Offensive Activities

Purpose. The main purpose of offensive activities is in most cases to defeat an adversant by imposing will through the threat and the use of violence. Subsidiary purposes are: pre-emption to gain the initiative; disruption of adversant offensive action; deception or diversion from the main effort; seizing ground; and fixing the adversant as an economy of force operation. The attacker seeks to create the conditions for freedom of movement and manoeuvre, shatter the adversant's cohesion, and defeats his forces selectively, thus creating and sustaining momentum.- (AJP 3.2 Para 0226 a.)

Mobility

A range of engineer activities will be required to support the offence. Mobility is vital to achieving success in offensive operations and therefore engineer support will be central in maintaining the speed and momentum of an attack. In this way, the joint force commander can seize the initiative and achieve surprise by his selection of the timing and direction of attack. Counter-mobility tasks, particularly flank protection, the fixing of adversant counter-attacks forces and the closure of adversant withdrawal routes, are also important. Engineers will be required to support attacking forces by any or all of the following actions:

a) Breaching, marking or opening our own, as well as adversant minefields.
b) Providing the means of crossing rivers or other obstacles.
c) Securing the flanks by means of minefields, demolitions and other obstacles. These also help to shape and structure the battlefield and may allow commanders to use economy of force measures for force protection.
d) Preparing and maintaining routes for follow-up echelons.
e) Supporting the consolidation on the objective by digging, laying minefields and creating obstacles.
f) Route Clearance

The achievement of these functions depends on adequate reconnaissance, timely provision of the necessary equipment and stores, and on the proper grouping and control of engineer elements, particularly minefield breaching and gap-crossing armored vehicles.

Movement. Engineer units must follow the general rules for movement laid down for all arms/branches. They may move either as separate movement serials or with elements integrated into a support unit's plan.

Planning Moves. The engineer commander will participate in planning the movement of the supported formation. He will use engineer intelligence to recommend routes, by-passes or necessary reconnaissance to the tactical commander.

Route Reconnaissance. Engineers should be included in route reconnaissance parties. They should ascertain whether the condition and capacity of the routes are adequate; if not, remedial actions, such as diversionary routes, restrictions and the reinforcement of bridges, are to be planned. In addition a route assessmernt should be done.

Engineer Support to Movement. It will normally be the responsibility of the in-place force to maintain routes within its area. Engineer tasks in support of movement will include:

a) Engineer reconnaissance.

b) Establishment of by-passes.

c) Clearance of obstacles and explosive threats**.**

d) Building of bridges.

e) Damage Repair.

f) Road Upgrades.

Engineers in the Moving Formation. In order to maintain the momentum of movement, engineer detachments will usually move as, or with, the first movement elements. Engineers may be required to pre-deploy some engineers into the theatre of operations in order to:

a) Clear EO and non-explosive obstacles.

b) Deal with scatterable mines.

c) Fill craters and repair route damage.

d) Bridge gaps.

If engineer tasks are to be accomplished during the preparation for operations by formations, engineer units will frequently have to move independently. In this case, the commanders of the engineer units will be responsible for movement and for movement security. If necessary, they should request the protection of air defence and other units during the move.

Crossing and breaching obstacles

Any obstacle can be overcome given sufficient resources and time. However, in an attack, the combined arms/branches commander must attempt to force his way to the other side of the obstacle before the adversant can fully organize defensive preparations. Leading elements determine the extent of the obstacle and seek a bypass. If there is no bypass is possible, the tactical commander will attempt a hasty breach/crossing of the obstacle, without loss of momentum, using the resources immediately available to him.

If an obstacle cannot be overcome, a deliberate breaching / crossing operation will have to be carried out which requires new orders, bringing up additional breaching and/or crossing resources, and the employment of specific breaching and/or crossing procedures[80].

Crossing Operations. Crossing operations may be carried out in three overlapping phases:

a. Assault, to gain a lodgement on the far side of the obstacle. This phase is not required for an unopposed crossing.

b. Build-up, to extend the lodgement into a bridgehead.

c. Consolidation, to establish a firm base within the bridgehead from which to break out and continue the overall operation.

Forces and Tasks. Forces employed in a crossing operation may be organised as follows:

a) **Bridgehead Force.** The bridgehead force consists of an assault echelon and a main body. The assault echelon is tasked with gaining the lodgement, normally by seizing intermediate objectives. The main body conducts the build-up phase and participates in the consolidation phase. Within its area of responsibility the force has normal responsibilities for security including the far side of the obstacle.

b) **Break-out Force.** The break-out force is tasked with the continuation of the overall operation. This force will conform to the bridgehead force regarding use of ground in the bridgehead. In some circumstances the break-out may be an additional task for the bridgehead force.

c) **Force in Place.** When an allied or national force is already in place along the obstacle it may be called upon to assist the bridgehead force during the crossing. A passage of lines will occur as the bridgehead force and the break-out force pass through the force in place.

---

[80] STANAGs such as 2395 and 2485 refer

Minefield Breaching. Minefield breaching will invariably be part of a combined arms/branches operation. In many instances the minefield will be merely one of a series of obstacles to be breached; the overall obstacle, in this instance, is described as “complex”, thereby posing a considerable challenge to engineers. Increasingly such breaching may take place in an urban setting, reflecting the realities of the contemporary operating environment.

a) **Reconnaissance.** The task of determining the boundaries of a minefield is an all arms/branches responsibility. The physical reconnaissance within a minefield is an engineer responsibility.

b) **Locating Minefields.** Modern reconnaissance and surveillance techniques as well as information obtained from maps, terrain analysis and/or other sources enable a commander to determine likely mined areas. The use of all arms/branches reconnaissance, supplemented by engineer reconnaissance well forward, will provide timely advice on minefield locations thus allowing a commander to adjust the deployment of his force and position breaching equipment so that it can be used quickly. It is essential that planning and preparations commence before the obstacle is reached.

c) **Minefield Composition.** It may not always be necessary to determine the exact composition of a minefield, particularly if a combination of explosive breaching and other methods is used. However, if a deliberate operation is to be conducted, it is advantageous to determine the composition of a minefield prior to breaching. As a minimum, the width, depth and details of adversant weapons covering the minefield are essential.

d) **Breaching.** Breaching may be conducted as a hasty or deliberate operation, by hand, mechanical or explosive means, or using a combination of means. Once lanes are established they are marked in accordance with STANAG 2036.

e) **Hasty Breach.** An attacking force will attempt to breach from the march using breaching resources within the force. Very little reorganisation of the assault echelon is required and SOPs may be developed for breaching to commence with little or no additional orders being given. Engineer support will come from resources on hand. The scope of engineer support can include reconnaissance, provision of advice, and the breaching, proving, marking and maintenance of lanes.

f) **Deliberate Breach.** If a breach cannot be conducted from the march or if the obstacle is too complex to be crossed using the resources on hand, deliberate breaching will be attempted. The resultant loss of momentum has to be accepted as more time is required for reconnaissance, planning and the build-up of necessary resources. Engineer support to the deliberate breach is extensive. Timely and accurate intelligence is required to determine the extent and composition of the minefield, and hence the structure of the breaching force. This force normally consists of infantry, armour, engineers, indirect fire

support and close air support (CAS). Engineer support to a deliberate breach is likely to include the following:

(1) Detailed reconnaissance of the minefield to determine locations of mine rows and types of mines.

(2) Provision of engineer advice to commanders.

(3) Provision of special engineer equipment and personnel to assist in the conduct of the breach.

(4) Proving, marking and maintenance of lanes.

Short Gap Crossing. Preparation for the crossing of short gaps must be preceded by map and terrain analysis as well as air and ground reconnaissance to determine gap locations, widths and the grouping of engineer resources to support manoeuvre units. Short gaps are normally crossed from the march by combat units employing organic engineer support or using expedient means. Armored engineers employing fascines, vehicle-launched bridges and armored engineer vehicles will be the likely means of crossing short gaps. Vehicle-launched bridges will normally remain in place to be crossed by follow-on elements and some logistics, and eventually be replaced by support bridging. In addition to the preparation of crossing sites, engineers will also mark the immediate approaches and exits in accordance with STANAG 2036.

Opposed Water Crossing Procedures. Water crossing operations will be conducted in accordance with STANAG 2395.

a) **Deliberate Crossings.** When a water obstacle cannot be crossed from the march, using existing bridges, fording, swimming or on-hand bridging resources, and the assaulting force is in contact with the adversant, a deliberate crossing operation will have to be carried out. The crossing may be conducted in three overlapping phases: assault, buildup and consolidation. Two main forces may be involved: a bridgehead force and a break-out force. The critical functions of a water crossing are: security, movement control, terrain control and crossing support.

b) **Movement Control.**

(1) Planning and control of movement across water obstacles is the responsibility of the tactical commander of the crossing operation. He must be aware of the effect that the composition of forces needed on the far side of the obstacle will have on these functions and develop his crossing plan accordingly.

(2) The movement control organisation will be responsible for ensuring a coordinated and effective movement to and from the crossing sites.

(3) Unit Commanders will be responsible for the movement of their own forces subject to the instructions of the movement control organisation and crossing site commanders.

c) **Engineer Advice.** Each level of command in a water crossing operation will normally have an engineer who is responsible for the technical aspects of executing the crossing.

d) **Communications.** The crossing plan must take into consideration the need for key communications nets. These may include nets for tactical command, movement control and engineer command.

e) **Other Support.** Recovery and medical services should be readily available so that delays are minimized.

Routes for Tactical Movement. Despite the improved mobility of modern combat and logistic vehicles, engineer support will be required to open and maintain multiple routes for tactical movement. Keeping routes clear of obstacles and mines is a particularly important task for land forces engineers to ensure tactical mobility and sustainment of the force. Such routes and lanes must also be properly marked for friendly forces in accordance with STANAG 2036.

a) **Route Reconnaissance.** Reconnaissance is required to determine the availability and trafficability of routes. Existing route networks must be checked and limitations or shortfalls identified. The reconnaissance must then determine what additional routes must be provided, taking account of the resources available.

b) **Routes for Combat Vehicles.** Routes primarily for use by combat vehicles are normally designed and constructed to carry limited traffic for relatively short periods. Requirements for construction will vary based on local conditions.

c) **Routes for Logistic and Other Wheeled Traffic.** Routes for wheeled traffic in the forward areas are usually built to support a moderate volume of traffic. The construction effort is likely to be more extensive than for tracked combat vehicles but similar techniques will be used; maintenance teams will be required. Routes can be subsequently upgraded if they are to be used more extensively.

Support to Forward Aviation. The types and sophistication of aviation ground facilities will vary but they may be characterized by limited numbers of aircraft and short periods of use. During the preparation of such facilities, expedient techniques are used and construction is limited in order to reduce the chance of adversant detection. The types of support which may be provided are:

a) Construction of helicopter landing sites (HLS); FOBs and FARPs.

b) Construction of landing strips, including the adapting of roads and other hard surfaces for use by aircraft.

c) Maintenance and repair of existing airfields, landing strips and other facilities.

d) Preparation of drop zones.

Counter-mobility

Terrain, situation and target oriented barriers may be used in offensive operations. To limit the restriction on friendly force manoeuvre, control measures, such as Barrier Restricted Areas (BRA) may be imposed; these are further discussed in Chapter 4.

In offensive operations, counter-mobility tasks may include:

a) Flank protection.
b) Consolidation on an objective with consequent adoption of a defensive posture.
c) Denying adversant withdrawal routes.

Support to flank protection forces is likely to be the most important counter-mobility task for offensive operations with an open flank. Engineer tasks could include:

a. Route denial.
b. The planning and use of rapid scatterable mine systems.
c. Preparing a range of other obstacles depending on time and the terrain.

Consolidation. Engineers must plan for and be ready to execute a rapid transition to defensive operations. When an objective has been taken, engineers may carry out counter- mobility tasks in order to support the attacking force against counter-attacks.

Care must be taken during consolidation that any counter-mobility activities undertaken do not impede our own freedom of manoeuvre, in relation to subsequent offensive operations.

Survivability.

During offensive operations, use of multiple routes, dispersion, highly mobile forces and wise use of terrain are the best ways to ensure survivability. Planned measures must not unduly restrict the force's ability to manoeuvre at will. This will allow the commander to achieve concentration, speed and flexibility. The following engineer measures may be used:

a) Field fortifications.
b) Camouflage.
c) Deception.

Fortifications. Engineers may construct fighting positions for tactical vehicles and weapon systems. Although not as extensive as in the defense, protective emplacements for artillery, air defense units and logistic concentrations are normally considered in the plan. Commanders may require hardening of key

command and control facilities, especially those with a detectable electronic signature. Engineer assistance during offensive operations also may be required to provide field fortifications for:

a) Reserves waiting in hide areas.
b) Assault forces consolidating on an objective.
c) Manoeuvre forces which are required to halt during the advance.
d) Supplementary and alternate positions.

Camouflage. In a fast-moving offensive situation, time may not allow extensive camouflage measures to be taken. Engineers advise on site selection and proper use of terrain to provide the most expedient camouflage.

Defensive Activities

Purpose. The primary purpose of defensive activities is to defeat or deter a threat. They are generally intended to provide the right conditions for offensive action. Defensive activities alone generally do not deliver a decisive conclusion to a campaign, which often requires offensive activities. However, defensive battles have frequently been the decisive activity of a campaign.

Engineer support to defensive operations consists primarily of:

a) Counter-mobility tasks, in conjunction with combat forces and coordinated with direct and indirect fire weapons, to deny the adversant the mobility he requires and to cause casualties to his attacking forces.
b) Survivability tasks to enhance the concealment and protection of our own forces.
c) Mobility tasks to maintain routes and to support counter moves over all types of terrain. In this way, the all arms/branches commander is able to concentrate combat power to achieve favourable force ratios in order to defeat the adversant at a place and time of his choosing.

Survivability. The lethality of modern weapons systems makes the battlefield an increasingly hostile environment. Where there is a threat from adversant offensive air support (OAS), aviation and direct/indirect fires, considerable attention must be paid to survivability. This is likely to become more significant in the future with the advent of a medium weight capability which by definition is likely to lack protection. Survivability may also be threatened by the adversant's satellite, air reconnaissance an interdiction capability. When facing an asymmetric threat, the requirement for effective survivability is not diminished. The need to protect the force from a range of possible threats is enduring and must include threats posed by vehicle borne IED and suicide bombers for example. Responsibility for survivability depends on the levels of protection required. Basic survivability is an all arms/branches responsibility with engineers providing increased levels of

advice and construction support as the complexity of survivability tasks increase. Survivability includes all aspects of protecting personnel, weapons and supplies by employing:

a) Sound tactics
b) Dispersion and frequent unit moves.
c) Camouflage and concealment.
d) Deception.
e) Emission security.
f) Engineer Support to Force Protection.

Major engineer survivability tasks will include assistance to other arms/branches in:

a) Field Fortifications.
b) Protection of combat supplies.
c) Camouflage, concealment and deception.
d) Camp and facility construction where appropriate.

Fortifications. The preparation of field fortifications is an all arms/branches responsibility and is a sub-set of the broader issue of Force Protection Engineering (FPE). When time is short or the nature of the terrain requires special techniques, such as the use of earthmoving equipment or explosives, engineers may provide support in accordance with the commander's priorities. Possible engineer tasks include:

a) Advice on the construction of field fortifications.
b) Construction of command posts.
c) Construction of artillery gun positions, tank scrapes and weapon pits.
d) Preparation of alternate positions.
e) Preparation of sites for tactical air and aviation units.
f) Construction of storage facilities for ammunition and other materiel.
g) Advice on, and on occasions, assistance with, the construction of protective barriers.
h) Strengthening field fortifications.

Protection of Combat Supplies. Combat supplies should be protected in particular against blast, shrapnel, incendiaries and CBRN contamination. It is most important to provide protection for ammunition and fuel stores. The types of shelter built will depend upon the terrain and soil type as well as on the availability of existing buildings and natural cover. By giving advice to the logistic commander on the selection of the most suitable storage sites, the requirements for engineer support may be considerably reduced.

Camouflage and Concealment. In general, all units are responsible for their own concealment and local camouflage. Major positions, facilities, and operational sites, may, however, require special camouflage stores and measures. The tactical commander may then require engineers to undertake such tasks, as advised by his engineer commander. Efforts must be made to mitigate the distinctive signatures that engineer work in preparing battle positions can create. Apart from the use of camouflage nets and natural camouflage material, special camouflage measures often require the employment of engineer equipment and devices. This is especially true for large-scale camouflage requirements.

Mobility.

During preparations for defensive operations, engineers will reconnoitre, improve and open routes for use during the battle. These may include lanes through barriers, routes from hides to battle and alternate positions and those for maintenance, re-supply and counter moves.

Routes. When the main defensive battle is joined, the maintenance and improvement of routes will be a major engineer task. Adversant interference by artillery, air forces and scatterable mines, plus the requirement for off-road movement, may require the deployment of counter- mine equipment, assault bridging, trackway and engineer heavy equipment well forward. It is vital that NATO forces be able to manoeuvre freely in the defense so as to be able to concentrate and strike the adversant at the optimum place and time. The same importance is given to maintaining key routes in Other Operations and this will pose particular problems when Lines of Communication (LoC) are extended over long distances and are subject to asymmetric attack.

Minefield Gaps and Lanes. Careful planning and coordination with the combat arms/branches will be essential to ensure that the required lanes or gaps are left in minefields or other obstacles for the redeployment of troops and to facilitate counter moves. These gaps and lanes will need to be closed rapidly on order.

Support to Counter Moves. The adversant's use of obstacles to mine and create tank obstacles for the protection and consolidation of his own offensive operations will require the deployment of combat engineers in support of NATO counter-penetration and counter-attack forces. They must be equipped with assault bridging, armored engineer vehicles and breaching equipment, in order to provide the combat support required.

Stability Activities / Operations

The transition from combat operations to multi-agency stabilization operations (to reestablish security, stability and prosperity (underpinned by the rule of law)) is hugely important. It is likely to be characterized not by the achievement of specific end-states (such as absolute victory) but by incremental conditions-based outcomes (albeit they may reflect political direction to achieve particular goals according to a rough timetable). The mix of actors, and their respective motivations, will be highly dynamic. Conventional opponents, even once defeated, may re-appear or be reinforced by irregular activists; the threat they pose may need to be countered at the same time that legitimate indigenous governance and authority are being reestablished. Pursuing the gradual transition towards stability, NATO commanders also contribute to protecting, strengthening and restoring civil society and the rule of law.

The long-term goal should be to resolve the underlying tensions that led to the inception or resurgence of conflict, and to create the conditions for successful longer-term development. The immediate contribution by NATO military forces, however, is likely to be to reestablish and maintain (sufficient) security for the local populace and civilian agencies to enable the stabilization process to advance. This will involve preventing or containing violence, and protecting people and key institutions. There will then be a need to promote those (largely political) processes which lead to lasting stability, through the development of indigenous capacity, rule of law and a robust civil society. The level of military activity required depends upon the context of the campaign and the ability of the other instruments of power (e.g. IOs and NGOs) to operate with appropriate protection, despite perceived security risks.

In addition to enable extraction, NATO forces are likely to be required to support a broad range of initiatives:

a) **Security Sector Reform**. Security Sector Reform (SSR) involves reforming security institutions so that, under the control of a legitimate authority, they can play an effective and accountable role in providing internal and external security. SSR can apply to any security institution, including police and militias, and may be preceded by Disarmament, Demobilization and Reintegration (DDR). It encompasses: host nation defense ministry reform; training and development; education; and support for the enhancement of judicial and law enforcement institutions. Engineer Tasks include:

   (1) supporting disarmament efforts through weapon ,

   (2) ordnance collection and destruction;

   (3) construction of facilities for security institutions;

   (4) support to training.

b) **Capacity Building**. Capacity building involves the enhancement of national and regional institutions in order to reinforce their credibility among, and authority over, an indigenous population. The aim is to cultivate sufficient authority within local, regional and national institutions that their governance becomes self-sustaining. Engineer tasks include:

(1) construction of facilities for national institutions,

(2) provision of advice to relevant institutions.

c) **Restoration of Essential Services**. In the immediate aftermath of a conflict, when appropriate civil agencies may be unable to act quickly or operate with sufficient safety, the reconstitution of critical infrastructure and the restoration of essential services may fall to the military. The aim is likely to be two-fold: to provide support to those in need, and to cement the support of the civil population. Services deemed essential will depend on the situation and the needs of the people. They may include the protection and/or restoration of medical care, the re-establishment of transportation systems, and the provision of potable water, electrical power and other utilities. As the security situation becomes more benign, non-military organisations (including indigenous ones) should (re-)assume responsibility for reconstruction, drawing upon international funding where appropriate. Alliance Engineers are often the only entity with the technical skills and capabilities to execute these tasks. Exhaustive assessment of the status of essential services in local areas will heavily engage close cooperation between CIMIC and MILENG technical advice. Engineer advisors will also assess local engineer contracting possibilities and, as required, provide over watch and quality assurance in support of local governance or for Alliance-funded projects. Engineer tasks include:

(1) restoration of essential services,

(2) advice or planning supporting,

(3) evaluation / assessment of infrastructure and

(4) services, contractor or labour force supervision

Enabling Activities

As described in chapter 1 (Figure 1.1) enabling activities link to other operations: they include those intended to make or break contact with the adversant, and those conducted out of contact. They are discussed in detail in ATP-3.2.1. The major activities are listed below and some of them are discussed in more detail:

a) **Reconnaissance**. Engineer reconnaissance is covered in chapter 3.

b) **Security**. Security operations provide early and accurate warning of adversant operations.

c) **Advance to Contact**. The advance to contact seeks to regain contact with an adversant under the most favorable conditions.

d) **Meeting Engagement**. A meeting engagement involves action between two moving forces.

e) **Link-Up**. The aim of a link-up operation is to establish contact between two or more friendly units or formations which may have the same or differing missions.

f) **Withdrawal**. A withdrawal occurs when a force disengages from an adversant force in accordance with the will of its commander.

g) **Retirement**. A retirement is different from a withdrawal in that it is a movement away from the adversant by a force out of contact with the adversant.

h) **Relief of Encircled Forces**. The purpose of this operation is to break through adversant positions to reach an encircled force, thus restoring freedom of action.

i) **Relief of Troops in Combat**. Relief of troops occurs when combat activities are taken over by one force from another. There are three types of relief operation: Relief in Place, Forward Passage of Lines, and Rearward Passage of Lines.

j) **Engineer tasks include Crossing and Breaching Obstacles**. Crossing and breaching obstacles normally occurs during offensive operations, but they can occur throughout the battlespace, including the rear area. They often involve a passage of lines.

Advance to Contact. The advance to contact seeks to gain or re-establish contact with the adversant under the most favorable conditions for the main force. Operations will be bold, rapid and often de-centralized in order to surprise the adversant, keep him off balance and exploit success. In order to achieve this, extensive reconnaissance will be required. Adversant protective elements must be destroyed or neutralised without impeding the movement of the main body. Provision must also be made for flank protection.

Engineer Tasks. The major engineer task in an advance to contact is the support to mobility by the opening up and improvement of routes of advance and the maintenance of main supply routes (MSRs) and other important strategic routes. Engineers create obstacles to support flank protection operations. Engineers also have reconnaissance responsibilities, which are intended to facilitate:

a) The selection of routes which require a minimum amount of preparation and maintenance.

b) Preparing for the rapid deployment and regrouping of the engineer units and resources required, including the pre-positioning of heavy engineer equipment.

During an advance to contact, the obstacles encountered may not be dense, for example: scattered anti-tank mines, road-blocks, bomb craters, sometimes a demolished bridge, tunnel or viaduct.

In opening routes, the predominating factor is speed. Engineer tasks may include:

a) The removal of mines, anti-handling devices and obstructions of any kind.
b) The creation of bypass routes.
c) Filling in or bridging craters.
d) Gap crossing.
e) Marking the routes created through obstacles.

Engineers supporting leading units must, therefore, have access to these vehicles and equipment, which should be held as far forward as circumstances and risk of possible destruction dictate.

. Engineers with the flank and rear guard forces are to be prepared to block adversant avenues of approach. To counter adversant mobility, they rapidly emplace obstacles which are then covered by designated anti-tank and indirect fire. They must be well supplied with ground-delivered scatterable mines, cratering munitions and with rapid bridge demolition materials.

Meeting Engagement. The meeting engagement is a combat action that occurs when both sides seek to fulfill their mission by offensive action. A meeting engagement will often occur during an advance to contact and can easily lead to a hasty attack. In offensive or delaying operations, it will often mark a moment of transition in that the outcome may well decide the nature of subsequent operations. This is why the meeting engagement is described as an enabling activity. Even when the main part of a force is defending, attacking or delaying, individual elements may find themselves in situations which have the characteristics of a meeting engagement. A meeting engagement can occur in various circumstances:

a) When a force which is moving, either tactically or in column or route, makes contact with an adversant, about whom the friendly force has little or no information.
b) By chance or when reconnaissance has been ineffective.
c) When both sides are aware of the other and decide to attack without delay in an attempt to obtain positional advantage, gain ground of tactical importance, maintain momentum or assert dominance over the adversant.
d) When one force deploys hastily for defence while the other attempts to prevent it.

Engineer Tasks. The rapid deployment of engineers can be crucial in transitional phases of the battle. Engineer reconnaissance must be well forward. Land forces engineers must be readily available for mobility or counter-mobility tasks. An appropriate and quick employment of engineer equipment can ensure freedom of movement and deny it to the adversant. Engineer planning of scatterable mines, for example, can provide counter-mobility support if the assets are available. Even if land forces engineers are immediately available there is likely to be only a short time in which engineers are able to prepare, deploy and undertake tasks. Time for reconnaissance will need to be reduced to a minimum. Considerable speed of reaction and improvisation will be required. Engineer tasks are likely to be restricted to:

a) Breaching or crossing of obstacles.
b) Opening up routes.
c) Rapid emplacement of obstacles to the front and/or flanks.

Link-Up. A link-up operation is conducted where forces are to join up in adversant- controlled territory. The aim of a link-up operation is to establish contact on the ground between forces which may have the same or differing missions. In a link-up operation it may be necessary to destroy the adversant between those forces before contact can be established. Frequently, one force will be required to link-up with an isolated force.

Engineer Tasks. These operations demand a considerable effort to coordinate engineer activity, not only with the other arms/branches, but also between the engineers of the two forces. Engineer tasks are likely to include the following:

a) Engineers Supporting Link-up Forces
   (1) To support the mobility of these units by opening and maintaining the axes of advance and link-up.
   (2) If necessary, to support the protection of the flanks of the axes of advance and link-up using rapid obstacles.
b) Engineers Supporting Isolated Forces
   (1) To provide mobility support to the link-up forces by opening and maintaining the axes of advance and link-up.
   (2) If necessary, to support the protection of the flanks of the axes of advance and link-up by creating obstacles rapidly.
   (3) To support the reinforcement of the area to be occupied by the isolated force by creating in it obstacles of all types, at the same time taking into account the route(s) envisaged for the link-up proper.
   (4) Where necessary to neutralize or eliminate obstacles at the place(s) envisaged for the link-up, just before it occurs.

Withdrawal. A withdrawal occurs when a force disengages from an adversant force in accordance with the will of its commander. It seeks to break contact with the adversant. This does not necessarily imply that reconnaissance and/or protective elements do not maintain surveillance over the adversant. A retirement is different from a withdrawal in that it is a movement away from the adversant by a force out of contact with the adversant and is administrative in nature. Retirement is not discussed further in this document.

Engineer Tasks. Engineer tasks during a withdrawal are similar to those during delay operations.

a) During a withdrawal engineer support is required to assist the force to break contact and to keep open the withdrawal routes. Obstacles may be used to assist in breaking contact. Gaps in obstacles will need to be closed when the withdrawing forces have moved through them, frequently in the face of the adversant.
b) Prior reconnaissance should be carried out where possible.
c) Grouping of engineer units with the rear elements of the withdrawing forces, as well as good communications and coordination with the tactical commander and the withdrawing forces, will be important.
d) The need for speed and security increases the importance of rapid bridging and ferrying equipment and scatterable mines. Water crossing procedures are covered in STANAG 2395.
e) Denial measures need to be carefully coordinated.

Relief of Troops in Combat[81]. The types of relief operations are defined as:

a) Relief in Place. An operation in which all or part of a force is replaced in a sector by an incoming unit.
b) Forward Passage of Lines. An operation in which an incoming force attacks through a unit which is in contact with the adversant.
c) Rearward Passage of Lines. An operation when a force effecting a movement to the rear passes through the sector of a unit occupying a rearward defensive position.

Whether conducting a forward or rearward passage, the in-place force has the responsibility to provide mobility for the passing unit along cleared routes or corridors through its sectors. Creating lanes through the in-place unit's obstacles requires permission from the force commander who is in command of both the stationary and moving forces.

Engineer tasks Relief in Place. The handover of barriers to the relieving force is likely to be the major MILENG task; this complex procedure becomes more

81 STANAG 2082 - Relief of Combat Troops

difficult when, within an allied formation, a unit from one nation relieves one from another. Barrier materials and obstacle design and emplacement are likely to differ. As a result, MILENG from both forces must be given sufficient notice and time to carry out a detailed handover and must be free to liaise directly. The information to be handed over includes:

a) Barrier plan and related documentation.

b) MILENG information and data.

c) Crossing plans.

d) Field fortification and other plans.

The procedures for the handover of barriers are given in STANAG 2989 - Transfer of Barriers.

Engineer tasks Forward Passage of Lines. The following considerations should be taken into account when planning a forward passage of lines:

a) The timing of the handover of responsibilities is critical.

b) The relieving force engineer commander should:

(1) Establish liaison with the engineer commander of the in-place forces as early as possible.

(2) Obtain details of identified adversant barriers.

(3) Take on responsibility for engineer operations if the attack starts.

c) The engineer commander of the in-place force (or the force being relieved) will continue to control operations in support of his own force. He will also normally be responsible for ensuring:

(1) The maintenance of the routes forward within his sector.

(2) The passage of barriers within his sector. The in-place force must ensure that there are sufficient gaps and lanes through their barriers and that these are properly marked, including the provision of guides where necessary.

d) Both engineer commanders will consider how the engineer forces to be relieved are to continue to provide support until the beginning of the attack.

Engineer tasks Rearward Passage of Lines. The withdrawing force will carry out its own counter-mobility tasks and keep open its own routes until it reaches the tactical area of responsibility of a rearward force. This tactical area of responsibility must be clearly defined. The engineers of the rearward force are responsible for:

a) Providing sufficient well marked gaps and lanes through their barriers, with guides when necessary, to facilitate the movement of withdrawing forces.

b) Keeping open routes for the withdrawing force.

c) Rapid closing of gaps and denying routes, once the withdrawing force has passed, where necessary to complete the barrier plans.

Airmobile and Airborne Operations

Airmobile Operations An airmobile operation is an operation in which combat forces and their equipment manoeuvre about the battlefield in helicopters under the control of a ground force commander in order to engage in ground combat. When airmobile operations are conducted, they are an integral part of the land battle. Air mobility provides an additional dimension to ground force mobility, but technical restrictions and aircraft vulnerability limit the potential. Airmobile operations are likely to lack integral armour protection and to have limited engineer equipment and little, if any, artillery support. MILENG support to airmobile operations contains mainly area/route denial and demolitions tasks, to canalise and delay adversant armour, and substantial survivability support to protect the force against adversant fire and to allow anti-tank weapons to be used to maximum effect. The means to fulfill those tasks are mostly limited due to restricted airmobile capacity, so improvisation is often needed.

Airborne Operations An airborne operation is a joint operation involving the air movement of combat forces onto an objective. The combat forces may be self-contained for short term operations, or the operations may call for the insertion of combat support and service support units. The troops employed may be a combination of parachute and air-landed elements, depending on the mission and the tactical situation. Improvisation and maximum use of local resources are key aspects of airborne engineer operations. These operations represent a genuine rapid intervention capability for many NATO armies whilst recognizing their limitations and inherent lack of mobility and protection. They will continue to be ideally suited to certain “By surprise” type tasks.

Planning The time required for engineer planning and preparation should be taken into account. Engineer equipment and stores are heavy and there will be severe restrictions on the amount that can be moved in an air-lift. The engineer commander must anticipate possible tasks and advise the tactical commander on priorities so that the best use can be made of the limited lift available. Cross-load planning, based on the landing and operational plan, is essential to maximise engineer survivability and to ensure the proper engineer capabilities land at the best locations to meet mission requirements. Once forces are deployed, communications are likely to be difficult, so each engineer sub-unit must have clear orders on its tasks and priorities. Troops will normally only deploy with stores and equipment for one major task. Subsequent tasks will necessitate re-grouping and the collection of further stores from drop or landing zones. The following will be fundamental to the engineer plan:

a) Information on the availability of equipment and resources in the area of responsibility.
b) Provision of engineer task stores, principally mines and explosives, in the committal area, by host nation or formation.

c) The number and types of support helicopters allocated to engineer units by the commander and the point at which they are placed under tactical control.

Tasks. The fundamental characteristics of airmobile and airborne engineer operations are the need for speed and the limited air lift available. Tasks for engineers operating in an airmobile or airborne force should be coordinated with any ground force affected. Tasks will be planned and resources allocated based on information and intelligence, using standard planning data. Adjustments to engineer tasks must be cleared with the local commander and reported up engineer channels; the absence of vehicles and any imposition of radio silence may make this very difficult. These tasks may include:

a) Counter-mobility

(1) Rapid laying of tactical minefields from the ground or helicopters (airmobile/air transportable mining systems). The resources to lay large patterned minefields will seldom be available; engineers will, therefore, rely more on scatterable and off-route mines and area denial weapons.

(2) Demolitions and rapid cratering of routes.

b) Mobility

(1) Limited preparation of areas for helicopters, such as pick-up points (PUP), pick-up zones (PZ), landing sites (LS), forward arming and refuelling points (FARPs), clearance of landing strips, zones or drop sites and limited airfield damage repair (ADR).

(2) Countermine operations: detection, breaching and marking of mined areas.

(3) Neutralisation of prepared adversant obstacles.

(4) Explosive ordnance reconnaissance (EOR) and EOD support.

(5) Bridging, wet and dry, including over-bridging, and ferrying.

(6) Road maintenance; the task will be only to maintain operational routes and will not include major infrastructure damage repair.

c) Survivability. Airmobile and airborne forces may need to dig in rapidly. Priorities for engineers are likely to include support to gun, mortar and anti-tank weapon positions, and command posts. Engineers may also have to assist with camouflage, concealment and deception.

SECTION 6 - Military Engineer support to Air Operations

General. The success of the land battle, and access to the area of a conflict, is often dependent on the air support available. The degree of air support is usually dependent on the timely provision of ground installations of suitable type, number and location. The planning and execution of the acquisition, development or construction of air landing facilities is likely to play an important part in all land

operations. Engineers may be responsible for this work with appropriate technical advice from the joint air staff.

Support to Helicopters. Helicopter landing sites may require engineer preparation. This may include clearing areas and the provision of adequate angles of approach and take off; this may be a major task for engineers depending on the terrain and location.

Airfields and Airstrips. Tactical air landing facilities may be required in the forward combat zone as well as in rear areas. These can range from airstrips, with minimal and temporary "austere" facilities, to major "well found" airfields, from which tactical fighter or transport operations can take place. The air force commander will determine the requirement for air landing facilities, the general area and the required standards. The engineer, in conjunction with the air and land component staff, will complete a detailed reconnaissance and estimate of the situation to determine the site selection and the location of various facilities. Technical standards for airfields will be defined by both the air component (required facilities, dimensions and bearing capacity) and by engineers (construction aspects). Infrastructure construction is an engineer responsibility.

Existing Airfields. It may be possible to reduce the engineer effort required for airfield construction by the rehabilitation of existing, damaged airfields, those captured from the adversant or by using portions of roads; this may still entail considerable engineer effort. Work will include clearance of debris and damage caused by air attack or adversant demolitions and, the removal of mines or unexploded explosive ordnance (UXO).

Airfield Maintenance. Airfield maintenance requirements will include the maintenance of buildings and facilities, the repair of runways, taxi-ways, aprons, drainage systems and utilities, and the removal of dust, water, snow or other foreign objects. This usually requires dedicated in-place resources.

Planning. The following information is likely to be required by engineers undertaking airfield tasks:

a) Type of aircraft to use the airfield.
b) Airfield standards: alignment, dimensions, bearing capacity, services and facilities.
c) Military and civilian resources available: heavy equipment, labour and material.
d) Time available for reconnaissance and construction.
e) Soil and drainage characteristics.
f) Expected life of the airfield.
g) Any improvements likely to be ordered.

Airfield Damage Repair (ADR)[82]. The resumption of aircraft operations as soon as possible after an adversant air attack is essential, in order to maintain air support to the land battle. A requirement exists to repair airfields damaged as a result of adversant attack. This will encompass the following:

a) Damage definition and assessment.
b) Explosive Ordnance Disposal (EOD), iaw STANAG 2391.
c) Repair of aircraft operating surfaces (RAOS).
d) Repair of Essential Services and Facilities (RESF).

Damage Definition and Assessment Reconnaissance may be a joint air and engineer responsibility. The requirement is to conduct both ground and airborne reconnaissance to determine the location and assessment of damage, extent of the UXO task and selection of optional repair areas. Based on damage estimates and engineer recommendations on the length of time and amount of work required to conduct repairs, the air commander selects the minimum operating strip, access and egress routes, and sets priorities for repair of essential services. It may then become an engineer responsibility to effect repairs and conduct EOD tasks as required. Criteria are set out in STANAG 2929.

Repair of Aircraft Operating Surfaces The requirement is for rapid repair to provide temporary or permanent surfaces from which aircraft can safely operate for a specified number of passes. Special equipment and techniques are likely to be required in order to repair runways within specified times and meet surface roughness criteria and standards.

Restoration of Essential Services and Facilities There may be a requirement to restore essential services and facilities such as fuel, electricity, lighting, arrestor gear, shelters, accommodation and roads or provide emergency equipment for these services.

SECTION 7 – Military Engineer support to Maritime Operations

Maritime Support Concept

Types of Shore Support . Multinational Maritime Forces (MNMF) deployed to a theatre of operations will require some form of Shore Support. As detailed in ALP-4.1 - Multinational Maritime Force (MNMF) Logistics and ALP-4.1 supp 1 - Standard Operating Procedure for the Operation of Advanced and Forward Logistic Sites this support is usually provided by an Advanced Logistic Support Site (ALSS) or a Forward Logistic Site (FLS). The ALSS or FLS provides logistic

82 STANAG 2929 - Airfield Damage Repair

support to the MNMF, ensuring that all passengers, mail and cargo received are processed and transferred expeditiously.

An FLS is usually closer to the operating forces than the ALSS and capabilities may range from very minimal to nearly as capable as an ALSS. The FLS is task organised, based on established and anticipated support requirements. FLSs normally include both a seaport and airport, but may be established with only one or the other where appropriate to the support requirement or site availability. FLSs are expeditionary and are established, moved, and disestablished readily in response to movement of the supported forces. An FLS is maintained in operation as long as the supported forces need it.

The differences and detailed requirements of these sites are described ALP-4.1 supp 1 but both should have the following:

a) Have ready access to both a seaport and an airfield.
b) Be at a secure location within the theatre of operations but not in close proximity to main operating areas of conflict.
c) Be capable of handling, receiving, storing, consolidating, and forwarding POL, supplies, ammunition and personnel required to support afloat units operating within the area of operations.
d) Possess the requisite medical capability to accept, treat and hold casualties until they can be returned to duty or evacuated to national evacuation systems.

Host nation support (HNS) agreements can provide many shore logistic support requirements through the use of Host Nation facilities and services.

Engineer Support. Since the ALSS/FLS mission is logistical in nature it does not generally operate in hostile fire zones. However, commanders finding it necessary to locate FLS operations in such areas are responsible for providing the necessary security measures for FLS personnel and equipment.

Site Selection. The selection of ALSS/ FLSs will inevitably be a compromise between being as geographically close to the area of operations as possible, available facilities and infrastructure at potential sites and Host Nation wishes. Formal preparation of a site survey is the most certain way to ensure that the necessary attributes and shortfalls are identified for potential or assigned sites. A site survey entails full consideration of all aspects of manning, equipping, protecting and operating the site. This involves the detailing of physical facilities, competing requirements, host nation assets, other member nation assets, local equipment and labour pools, commercial infrastructure and any other site factor potentially impacting site operations. It should be remembered that whilst ALSSs can normally be expected to remain static, FLSs can be moved as the area of

operations requires. The following general aspects should be taken into consideration when considering a potential ALSS/FLS:

a) Force Operating Areas.
b) Helicopter operating facilities.
c) Heavy lift aircraft operating facilities.
d) Road/rail links.
e) Commercial air links.
f) Harbour facilities.
g) Communications facilities.
h) Accommodation.
i) Medical Facilities
j) Storage.
k) Other service unit locations.
l) Other on site operations.
m) Local infrastructure.

Site activation. Although the location of the planned ALSS/FLS is primarily driven by mission requirements, consideration should be given to site-peculiar engineering requirements. This consideration should include evaluation of existing infrastructure (seaport, airfield, warehouse, transportation, fuel, accommodation and utilities - including power, water, and sewage/waste handling) and the extent of available HNS (infrastructure and engineering support, source of construction materials, labour, real estate etc). Engineering considerations should be incorporated when determining the actual ALSS/FLS layout and activation. Land or buildings must be designated to accommodate containers, unit equipment, personnel, parking for trucks or buses, reception and parking of aircraft, segregation of ammunition and HAZMAT and establish fuel points, feeding areas, troop accommodation, medical facilities and command and control facilities.

In many cases, forces must rely on HNS to provide or supplement the majority of services, supplies, and facilities. HNS can be viewed as an engineering resource multiplier. Infrastructure shortfalls impeding ALSS/FLS establishment or operations can be mitigated by the use of HN engineering support (equipment and materials) if available. In emergency situations, operating area infrastructure may be so badly damaged that HNS is not a viable option. During conflict, battle damage may have destroyed all or part of the infrastructure. A thorough understanding of current host nation capabilities is essential, particularly when operations are conducted outside member nations.

Where circumstances dictate Military Engineers may be required to construct, repair and maintain harbour and port facilities / utilities. This may include clearing

these facilities of mines or booby traps / UXOs. This may include coordinated effort between Navy and Army Engineer divers.

Ongoing Support. Once the mission of the proposed ALSS/FLS is known, the location determined, local assets available for the operation known and details of HNS realized, the next step is the development of an engineering support plan if required. The plan should identify minimum essential facilities and civil engineering capabilities needed to support the commitment of military forces. These requirements will be identified in terms of HN provided and NATO provided assets through leasing or construction.

Site Deactivation. ALSS/FLS deactivation and relocation (when required) will be directed by the Operational Commander. Under normal circumstances it is likely that only FLSs will relocate as ALSSs are usually static for the duration of the Operation / Exercise. However, under certain circumstances an ALSS may also be required to relocate.

The site commander has overall responsibility for co-ordination of the site deactivation and relocation. Site deactivation and departure will normally be directed and coordinated by a Site Redeployment Team that should include a Military Engineer.

The Logistics Operations Officer, Admin Officer and the Engineer Officer will be the lead planners for the redeployment effort. Care must be taken not to degrade any support being offered to the MNMF when preparing for redeployment.

Site deactivation and redeployment may create significant new engineering tasks, including curtailment of ALSS/FLS functions and services, dismantling facilities, site restoration, disposal of wastes and support for the redeployment of personnel, materials and equipment. It may also involve relocation and re-activation of operations in another location. The host nation or assigned engineers will provide engineering and public works related support until the last piece of equipment, material and troop support leaves the theatre. They will ensure sites have adequately planned for deactivation operations. A schedule to complete engineering tasks must be developed and should consider the following:

a) **Public Works.** Provision for continued or modified services required during deactivation and redeployment. This may involve facility maintenance before retrograde or final disposition, utility operations, transportation, scheduling and operation of material handling equipment (MHE) and cleaning of equipment and material containers.
b) **Site Restoration.** All facilities and land must be left in the same or better condition than when the ALSS/FLS was activated. This may include dismantling of temporary facilities, environmental cleanup and hazardous

materials/waste disposal. Compliance with HN, international and national regulations and laws will be required.

c) **Construction Contracting.** Tasks may include modification, termination or cancellation of leases and service, construction and utilities contracts.

d) **Retrograde of Engineering Support.** Civil engineering support will normally be one of the last activities at the deactivated site. If other than host nation, their timely redeployment to other sites where their services are needed, or back to their home station, must be carefully coordinated with the ALSS/FLS site commander, providing nations and the multinational logistics force.

SECTION 8 – Military Engineer support to Amphibious Operations

Amphibious Operations[83]

Amphibious operations against undefended or defended coastlines present particular problems for military engineer support to the landing force. They should be considered during the shaping (including pre-assault and pre-landing operations and tasks) as well as during the action phase (initial landings and subsequent operations); military engineer support is essential in both phases. The requirement to be able to create a rapid build up ashore accounts for the organisational and technical differences between amphibious and land warfare. Amphibious operations are focused on mobility, characterised by extensive reconnaissance and massed engineer effort to assist in breakout operations. The key differences between amphibious and land warfare are the following:

a) The requirement to rapidly build up the Landing Force ashore in order for it to progress from a combat state of zero to a level permitting manoeuvre and engagement on suitable terms,

b) The need for the Landing Force to rapidly move inland from undeveloped expedient terminal sites and develop those expedient terminals and communication routes to support itself afterwards.

Planning. An amphibious operation will normally be commanded by the commander amphibious task force (CATF), until the landing force is ashore when command and the responsibility will be vested in the commander landing force (CLF)[84] . Initial planning will be done before embarkation of the landing force, but

---

83 For further information ATP-08, Vol. I (STANAG 1149) & Vol. II (STANAG 1465)

84 The commander amphibious task force (CATF) commands the entire force, including the landing force (LF), until such time as the LF is "established ashore" (in accordance with certain criteria previously agreed to between CATF and commander landing force [CLF], or specified in the initiating directive), at which time command and the responsibility of the LF is passed to CLF. However, this is not a statement of division of labour that necessarily confines military engineer or naval clearance divers to those zones. During the planning process (and especially during the estimates), the forces and methods required to clear both zones will be considered, and both CATF and CLF staffs will discuss these and propose a task organisation.

subsequent detailed planning may be done at sea. It is possible that when plans for the amphibious operations are confirmed, embarked engineer assets will not be suitably located for the amphibious offload. Movement of assets between ships, or "cross-decking"[85] , may be required before the landing. Military engineer equipment may be incorporated into any part of the landing operation. Certain capabilities and equipment are required in the initial assault while other equipment, plant and supplies will be landed only after the landing beach and helicopter landing zones (HLZ) have been secured, tracks and parks improved, and manoeuvre elements have moved inland.

Tasks. The range of tasks likely to confront the military engineer commander in an amphibious operation is extensive and is likely to encompass:

a) During the Shaping Phase (Including Pre-Assault and Pre-Landing Operations and Tasks). There is scope for limited military engineer participation in the shaping activities, particularly with respect to assessment (e.g., related to the nature of the landing beach, obstructions and obstacles, including mines).

b) During the Action Phase (Initial Landings). Combat engineer effort to clear beach obstacles, defences and mines. The most important engineer focus is to enable rapid mobility across the beach and through beach exits into the hinterland for the force.

c) During the Action Phase (Subsequent Operations). The full range of military engineer tasks is likely to arise. Immediate combat engineer effort is vital to improve tracks, beach exits, parks and dump areas. There could be requirements for support to helicopters or aircraft if it is decided to move them ashore, as well as the provision of tactical fuel handling equipment (TFHE) facilities and water supply. Military engineers are essential in facilitating the break-out from the beach (in an opposed landing) and enhancing mobility from beaching points to beach exits into the hinterland (in all landings). The construction of expedient port facilities or repair of existing installations to support subsequent over-the-shore operations may also be required. In this case support from units which are not part of the Landing Force (LF) will be required. Salvage of vehicles and construction of defensive positions and protective facilities might also be required. Military engineer units must be prepared to transition to conventional land operations inland with minimum notice.

---

[85] To re-stow means to re-arrange vehicles and cargo within or between ships to suit changes in the plan. Cross- decking means the transfer of personnel and/or materiel between ships regardless of the reason for it. Both are critical ideas for an embarked military engineer element. If re-stowage involves the movement of personnel or assets between ships, this could be accomplished by an intermediate landing (possibly in a rehearsal or at an intermediate staging point), during which assets are landed and re-directed to different ships on their return, or cross-decking, which is the direct movement of personnel or material between ships.

SECTION 9 - Engineer support to Special Operations

Special operations forces characteristically operate independently and possess organic specialists to ensure intimate support. However, it may be possible for major operations or for specific missions and tasks that engineers are required to support special operations. Most of the time, MILENG assets will not be allocated to special forces under a special command relationship but would rather liaise for the specific tasks under DIRLAUTH for the duration. Possible MILENG tasks include but are not limited to:

a) Construction of facilities (camps, FOBs, airfields, etc…);
b) Support to training for specific tasks and/or on specialized equipment;
c) Support to demolition tasks;
d) Provision of engineer intelligence;
e) Support to obstacle breaching or major gap crossing operations.

The nature of engineer support to SOF will differ only in scale and location. These operations and considerations are covered in AJP-3.5 – Allied Joint Doctrine for Special Operations. It is not expected that engineer elements operate as integral parts to special operations but will instead conduct their conventional roles in a higher threat environment and with little options for lateral support.

SECTION 10 – Summary

This chapter aimed at providing more details on how engineers support the Joint functions as described in figure 1.1. The engineer tasks do not neatly align under a specific Joint function, but shows where the tasks described primarily would support that primary Joint function. For example, the area/route clearance tasks may also support the Force Protection Joint function during Stability Operations but primarily supports the Manoeuvres and Fires Joint function during Combat Operations. The main consideration is that not all engineer activities in all phases can be illustrated as they are interactive and interdependent as the campaign or operation evolves.

ANNEX A

MILENG RELATED STANAGS

NATO nations have concluded a number of agreements on a wide range of engineer matters, which are regularly reviewed with more subject areas under negotiation. This Annex is a non-exhaustive list of STANAGs of relevance to engineers; the complete list is to be found in the NATO Standardization Documents Database (NSDD).

RESPONSIBILITY

Responsibility for these STANAGs is vested in the Military Engineering Working Group (MILENG WG) of the NATO Standardization Office (NSO), whilst this same body also takes an active interest in the work of other working parties engaged on developing related STANAGs. This list classifies these STANAGs separately and further subdivides the key STANAGs for engineer operations into the categories according to their function.

LIST OF STANAGs FOR ENGINEERS

The list of STANAGs of relevance to engineers, for which the MILENG WG has either responsibility or interest in their content, is shown below:

a. **STANAGs Sponsored by MILENG WG.** Military Committee Land Standardization Board promulgated engineer STANAGs are listed below with the custodian nation shown in brackets:

(1) STANAG 2010 - Military Load Classification Markings (FRA).

(2) STANAG 2017 - Orders to the Demolition Guard Commander and Demolition Firing Party Commander (Non-nuclear) (GBR).

(3) STANAG 2036 - Land Mine Laying, Marking, Recording and Reporting Procedures (USA).

(4) STANAG 2238 – Joint Engineering (AJP-3.12) (MILENG CoE).

(5) STANAG 2280 – Test Procedures and Classification of the effects of Weapons on Structures (NOR).

(6) STANAG 2394 - Military Engineering (ATP-3.12.1) (MILENG CoE).

(7) STANAG 2395 – Deliberate Water Crossing Procedures (CAN).

(8) STANAG 2430 – Land Forces Combat Engineer Messages, Reports and Returns (R2) (AEngrP-2) (GBR)

(9) STANAG 2485 – Countermine Operations in Land Warfare (USA)

(10) STANAG 2885 - Emergency Supply of Water in War (DEU).

(11) STANAG 2989 - Transfer of Barriers (ESP).

(12) STANAG 2991 - NATO Combat Engineer Glossary (AAP-19) (CAN).

(13) STANAG 4133 - Electrical Power Supplies: Standard Types and Rotating Generating Sets[86] (ESP).

(14) AEP-28 – Standard agreement on electrical power supply in the field: Technical aspects for interoperability (ESP).

b. **Other STANAGs of Interest to Engineers**. Other STANAGs of interest to engineers, showing the responsible agency in brackets, are listed below. Further details can be obtained from the NATO Standardization Documents Database (NSDD).

(1) STANAG 1149 – Doctrine for Amphibious Operations (ATP-08, Vol. I) (MCMSB – AMPHIB WG)

(2) STANAG 1372 - Allied Guide To Diving Operations (ADivP-1) (MCMSB – UDWG)

(3) STANAG 1432 - Allied Guide To Diving Medicine (ADivP-2) (MCMSB UDWG)

(4) STANAG 1465 – Tactics, Techniques and Procedures for Amphibious Operations (ATP-08, Vol. II) (MCMSB – AMPHIB WG)

(5) STANAG 2002 - Warning Signs for the Marking of Nuclear, Biological and Chemical Contaminations (MCJSB - CBRNWG).

(6) STANAG 2082 - Relief of Combat Troops (MCLSB - LOWG).

(7) STANAG 2101 - Establishing Liaison (MCLSB - LOWG).

(8) STANAG 2136 - Minimum Standards of Water Potability During Field Operations (AmedP-18) (MCJSB-FHTVS).

(9) STANAG 2143 - Explosive Ordnance Disposal and Minimum Standards of Proficiency (MCLSB - EODWG).

(10) STANAG 2221 – Explosive Ordnance Disposal Reports and Messages (AEODP-06) (MCLSB – EODWG).

(11) STANAG 2230 – Allied Joint Doctrine for the Joint Logistic Support Group (AJP-4.6(B)). (MCLSB – CSS WG)

(12) STANAG 2259 – MGD - Terrain (MCJSB - IGEOWG).

(13) STANAG 2269 - MGD - Engineer Resources (MCJSB - IGEOWG).

---

[86] Edition 4, merged, replacing former STANAGs 4133, 4134, 4135.

(14) STANAG 2282 – Interservice EOD Operations on Multinational Deployments (ATP-72) (MCLSB - EODWG).

(15) STANAG 2369 – Identification and Disposal of Surface and Air Munitions (AEODP-02) (MCLSB - EODWG).

(16) STANAG 2370 – Principles of Improvised Explosive Device Disposal (AEODP-03) (MCLSB - EODWG).

(17) STANAG 2377 – EOD Roles, Responsibilities, Capabilities and Incident Procedures when Operating with Non-EOD Trained Agencies and Personnel (MCLSB - EODWG).

(18) STANAG 2391 – Explosive Ordnance Disposal Recovery Operations on Fixed Installations (AEODP-05) (MCLSB - EODWG).

(19) STANAG 2406 – Land Forces Logistic Doctrine (ALP-4.2). (MCLSB – CSS WG)

(20) STANAG 2437 - Allied Joint Doctrine (AJP-01) (MCJSB - AJODWG).

(21) STANAG 2510 EP – Joint NATO Waste Management Requirements during NATO-led Military Activities (AJEPP-5). (MCJSB – EP WG)

(22) STANAG 2582 – Environmental Protection Best Practices and Standards for Military Camps in NATO-Led Military Activities (AJEPP-2).

(23) STANAG 2583 – Environmental Management System in NATO Operations
(AJEPP-3). (MCJSB – EP WG)

(24) STANAG 2818 - Demolition Materiel: Design, Testing and Assessments (CNAD - AC/326 – SG3).

(25) STANAG 2834 – The Operation of the Explosive Ordnance Disposal Technical Information Centre (MCLSB - EODWG).

(26) STANAG 2884 – Underwater Munition Disposal Procedures (AEODP-01) (MCLSB - EODWG).

(27) STANAG 2897 – EOD Equipment Requirements and Equipment (AEODP-07) (MCLSB – EODWG).

(28) STANAG 2929 - Airfield Damage Repair (MCASB - AOSpWG).

(29) STANAG 3680 - NATO Glossary of Terms and Definitions (English & French) (AAP-06) (NCS – NCSTP).

(30) STANAG 5621 - Standards for the Interoperability of NATO Land Combat and Combined Operations Systems (NHQC3S- ISSC - AC/322 – SC/5).

(31) STANAG 6500 – NATO Compound Environmental File during NATO-Led Operations (AJEPP-6). (MCJSB – EP WG)

(32) STANAG 7141 – Joint NATO Doctrine for Environmental Protection during NATO-led Military Activities (AJEPP-4). (MCJSB – EP WG)

(33) STANAG 2609 – Chemical, Biological, Radiological, and Nuclear Explosive Ordnance Disposal (CBRN EOD) Operations on Multinational Deployments.

c. **Other Allied Directives Publication of Interest to Engineers**. Other documents and publication of interest to engineers, Further details can be obtained from the NATO Standardization Documents Database (NSDD).

(34) Allied Directive 80-25

(35) AEODP 10(ed.6).

ANNEX B

ENGINEER ANNEX (From STANAG 2014 TBD)

FORMAT FOR ENGINEER ANNEX TO THE OPORD

GENERAL

1. This annex provides the Engineer Commander with orders and informs supported troops of the engineer support they will receive. It will also, where necessary, explain what, if any, work is required by the supported troops. If necessary, it will provide coordinating instructions for work to be done by engineer troops and supported troops.
2. This annex is not a specialist Engineer Order.
3. In succeeding paragraphs the engineer support should be described.
4. Paragraphs should be in a logical order as applicable to the operations.
5. All detail provided as an example only. Headings appropriate to the operation should be used.
6. Engineer Task Organization: This information may be given in paragraph 3 "EXECUTION" or in an Annex, which may be in text or graphic form. Under this heading, as appropriate, give the sub-division of the force, including attached units, together with the names and ranks of the commanders when necessary.

The following Stanag 2014 -Reports and Returns template with an example of an Engineer Annex, however it is not an all inclusive or prescriptive example but rather follows the guidelines found in the STANAG

SECURITY CLASSIFICATION
Place the required classification at the top and bottom of every page.
(Change from oral orders, if any)
Copy No. ___ of ____ copies
Issuing Headquarters
Place of Issue (may be in code)
Date-time Group of Signature
Message Reference No.

ANNEX (ENGINEER) TO OPERATION ORDER NO.
References: Maps, charts and relevant documents (see Part I, Paragraph 10 of this STANAG)
Time zone used throughout the Order:

1. SITUATION. Any items of information which affect engineer work and where were not covered in Paragraph 1 of the Operation Order or which need to be amplified should be given here.
2. MISSION. Engineer unit/formation mission statement.
3. EXECUTION.
   a. Scheme of Engineer Operations.
   (1) Concept of Operations Supporting the Manoeuvre Plan (including the Manoeuvre/Engineer Commander's intent).
   (2) Engineer Main Effort (organized by mission, unit and phase of the
   (3) operation).
   (4) Engineer Support to Close Battle.
   (5) Division level missions in support of the Brigade.
      (a) Obstacles.
         1. Countermobilitry effort
         2. Obstacle belts supporting the Brigade deep, close, and rear battle. Identify/assign belt responsibilities, priorities and restrictions.
         3. Reserve targets. Identify, prioritize and assign responsibility for Division and Brigade reserve targets. Provide criteria for reserve targets.
      (b) Situational Targets.
         1. Concept for employment, focusing on how they support the Brigade manoeuvre plan.
         2. Brigade planned and executed obstacle plan which clearly identifies location, intent and execution criteria.
         3. Criteria for each type of obstacle, clearly stating the HQ maintaining the authority to use scatterable mines and any restrictions on duration (by belt).
   b. Engineer Tasks to Subordinate Units.
      (1) Engineer level tasks to be accomplished by engineers supporting manoeuvre elements (only as necessary to ensure unity of effort).

(2) Brigade level tasks assigned to engineer organizations (used to inform subordinate unit commanders of tasks under brigade control being done by brigade level forces).

c. Coordinating Instructions:

(1) General.

(2) Coordination of Obstacle/Barrier Plans (including effective time of obstacle belts and details of obstacle handover).

(3) Defense Works.

(4) Route Maintenance.

(5) Engineer supply points.

(6) Denial Measures.

(7) Host Nation Coordination.

(a) Type and location of NG engineer facilities, assets or support.

(b) Procedures for requesting and acquiring HN engineer support (including HN engineer support (including limitations of employment/use of HN assets.

4. ADMINISTRATION/LOGISTICS. Allocation of critical engineer assets, mines, explosives, and defense stores.

5. COMMAND AND SIGNAL.

ACKNOWLEDGE:
NAME (Commander's last name)
RANK
OFFICIAL: (Authentication)
APPENDIXES:
DISTRIBUTION:
NOTES:

SECURITY CLASSIFICATION

The following is an example of an Annex EE

ANNEX EE TO
4-52 BCT OPORD 13-10 2013
REVISION 2
DATED SEP 13

ANNEX EE MILITARY ENGINEERING SUPPORT.

REFERENCES:

A. MC 0560 – MC Policy for Military Engineering dated 1 April 2008

B. STANAG 2238 AJP 3.12 (A) Allied Doctrine for Engineer Support to Joint Operations.

C. STANAG 2394 ATP 3.12.1 Military Engineering.

D. STANAG AJP 3.15 Allied Doctrine for Countering Improvised Explosive Devices (dated 21 March 2011).

1. SITUATION.

The general situation as described within the OPORD main body and Annex B, Intelligence. This Annex provides guidance concerning Military Engineering (Mil Eng) support, assigns tasks, responsibilities, and the engineers employment within the various phases of the Operation.

a. GENERAL

(1) The Engineer will support the operation by providing the following: The initial emphasis will be on infrastructure support Engineering to establish and maintain the infrastructure required at designated APODs, FOBs and along essential theatre lines of communication. The early engineer effort will also focus on establishing the infrastructure and essential utilities required by the deployed headquarters and contributing forces including guidance for environmental protection. Thereafter, the main effort will be focused on Freedom of Movement (FoM), along with Route Clearance Operations and if required EO disposal (EOD)[87]; and search capabilities.

(2) HN engineer support will be very limited. There is a shortage of construction materials and therefore NATO should be prepared to deploy and supply the majority of these materials and seek reliable National and International companies able to carry out construction tasks. Maintenance of Lines of Communication and transportation infrastructure will require intensive engineer effort. This will also require coordination with IO's, GO's, and the Government of Afghanistan (GIRoA) authorities and agencies.

(3) The condition of the main road system is Amber. Roads within city centers and named MSRs and ASR's are mainly improved, GIRoA has no more capacities for further maintenance of transport systems. Further, due to lack of funding caused by the crisis GIRoA has stopped any work on infrastructure. Mil Eng Forces, have minimal mobility, counter mobility and survivability capabilities. They do not possess any bridging equipment. The Afghan military within the province has two qualified EOD teams. Regular engineer soldiers are used to disarm an explosive threat or destroy it in place. The ANSF cannot support with any construction equipment.

b. Scope.

The existing infrastructure in Paktia cannot sustain long-term use by heavy equipment and traffic, and will be subject to serious degradation as a result of military use and lack of maintenance. Airfields and Main Supply Routes (MSRs)

---

87 IAW STANAG 2282 specific operations such as IEDD, EOR,EOC, CMD, CBRN EOD are all included with in EOD, generally not required to list each activity as EOD covers under the one definition.

will require continual maintenance to ensure they remain open. A Mil Eng capability will be established to provide a wide range of engineer support and maintenance. Critical Infrastructure shortfalls may be developed into NATO Security Investment Program (NSIP/CUR) projects in compliance with NATO procedures.

c. Threat.

The following must be read in conjunction with OPORD Annex B. Specific Mil Eng related threats include:

(1) Threats to FoM and force protection from insurgents and IEDs.

(2) Threats to FoM from degraded and scarce transportation infrastructure and physical disasters.

(3) Threats to force protection (FP) from environmental hazards including contaminated water supplies.

(4) Security threats to civilian contractors supporting national and military civil works.

d. Friendly Forces.

Relevant friendly engineer forces and other agencies that may require Mil Eng coordination for support or de-confliction include:

(1) 7TH ENG BN Forces IAW OPORD 12-10

(2) Paktia civilian infrastructure authorities.

(3) Civil contractors employed by the UN, Government of Afghanistan, NGOs and IOs via CIMIC.

e. Assumptions.

The following engineer planning assumptions have been made:

(1) Authority and procedures to expend NATO funds will be in place prior to G-Day.

(2) Mil Eng tasking will meet the Minimum Military Requirements (MMR) according to Appendix 2 – Infrastructure Engineering and BI-SC-85-1, BI-SC-85-5.

(3) Critical Infrastructure outside the perimeter: Civilian agreed norms of GIRoA should meet at least the MMR.

(3) The Force deployment will rely on the support of NATO logistics elements and the use of the APOD at Gardiz Airport.

f. Principal Engineer Tasks.

(1) Mobility Support. Mil Eng forces maintain FoM through monitoring and coordination of maintenance of Land Lines of Communication (LoC) infrastructure (APODs, MSRs, and ASRs) and the provision of RC Assets (Engr Resource Park) and EOD capability essential to operational movement and sustainment. Mil Eng resources will be prioritised to repair and maintain LoC infrastructure over and above HN capabilities.

(2) Survivability Support. Mil Eng support to enhance survivability and FP covering the whole spectrum of engineering capabilities. Units' camps are a national responsibility, however the BDE Engr should advise on the survivability measures to reach the minimum agreed standard (MMR) for the AOR.

(3) Military Search Operations, Route Clearance / EOD. See Appendix 4.

(4) Training. Mil Eng specialists may contribute to multinational training of Joint Force units and should be prepared to train ANSF forces. Mil Eng units will be prepared to conduct this training across the spectrum of engineer operations.

(5) Infrastructure. Infrastructure Engineers will assist in the identification and fulfilment of operational infrastructure requirements.

(6) Environmental Protection. The impact of operations on the environment must be monitored during the operation and mitigation plans put in place to limit the effect. .

(7) Counter-IED. Mil Eng forces will support the C-IED plan by providing C-IED WG input as well as RC, EOD and Military Search capability. See Appendix 4

g. Engineer Task Organisation.

See Annex A.

2. MISSION.

See the OPORD 12-10 Main Body.

3. EXECUTION.

a. Engineer Intent.

The intent of Mil Eng operations is to ensure mission success in the areas of military operations, by maximizing FoM, survivability and sustainment of forces. In particular, Mil Eng forces will provide:

(1) Military Engineering during phases 1 and 3 of the operation; will focus on joint issues such as; construction and development, repair, and maintenance and reinforcement of infrastructure, to include Force Protection of Coalition facilities, and entry / exit points (APODs) and MSRs. As this mission is currently approved

for 12 months, Tier 2 (temporary) infrastructure will be the likely Minimum Military Requirement (MMR).

(2) During phase 2, general support to maintain critical HN infrastructure, which is required for the accomplishment of the mission. NATO common funding may be requested for repairs to the MSRs up to the MMR, intensive coordination required with non NATO partners.

(3) Military Engineering with a focus on mobility support (Route Clearance Operations), limited counter-mobility and survivability in support of FoM, the support of FP measures, and the operation of APODs.

(4) Through the Joint Force Engineer, centralised coordination and decentralised execution of the engineer effort, providing flexibility to support to the mission. Engineers could assist the ANSF forces, within means and capabilities, if required.

b. Concept of Operations.

The phases and general prioritized engineer contributions to each phase are outlined below:

(1) Phase I: Deployment.

(a) Mil Eng infrastructure support to designated APOD and FOB sites.

(b) Mil Eng support to FoM in the AOR.

(c) Mil Eng support to FP.

(d) Mil Eng support to Route Clearance operations and explosive ordnance clearance to enable mission essential activities.

(e) Mil Eng support to Environmental Protection (EP) activities (including site surveys).

(f) As requested, advise/assist HN , GO, IO and NGO authorities on engineer and infrastructure issues.

(2) Phase II: Execution.

(a) Mil Eng support to FoM in the BDE AOR.

(b) Mil Eng support to FP.

(c) Mil Eng support to Route Clearance operations and explosive ordnance clearance to enable mission essential activities.

(d) Mil Eng infrastructure support to designated APOD and FOB sites.

(e) Mil Eng support to EP activities.

(f) As requested, advise/assist HN , GO, IO and NGO authorities on engineer and infrastructure issues.

(g) participate in the UN WASH cluster

(3) Phase III: Transition and Redeployment.

(a) Mil Eng support to FoM in the BDE AOR.

(b) Mil Eng support to FP.

(c) Mil Eng infrastructure support to designated APOD, and FOB sites.

(d) As requested, advise/assist HN , GO, IO and NGO authorities on engineer and infrastructure issues.

(e) Mil Eng support to EP activities.

(f) Mil Eng support to Route Clearance operations and explosive ordnance clearance to enable mission essential activities.

(g) MIL eng support to hoto

(h) MIL Eng support to train ANSF engineers , Dates and participate in NTMA (NATO TRAINING MISSION AFGHANISTAN)

4. CO-ORDINATING INSTRUCTIONS.

a. The BDE Engr will have coordinating and technical authority over all Mil Eng assets in theatre, in order to ensure unity of effort. He will do this by assessing the overall engineer situation and by advising the COM on changes to the allocation of available engineer resources as necessary. The effectiveness of the Mil Eng staff will depend on close co-operation and coordination between Mil Eng staffs at all levels and across all components, following the established command chain.

b. Supported Commanders will determine Mil Eng forces required in order to conduct the tasks, within their area of responsibility of the AOR and have Co-ordinating Authority. Based on requests, COM prioritises the available forces and will make additional Mil Eng assets available under TACON if feasible.

c. Specific dedicated Mil Eng forces will conduct Route Clearance operations and EOD activities as required.

d. The MMR for infrastructure projects will be co-ordinated by the BDE ENG Branch. In addition, there is also a process in place to screen and approve resource requests from BGs via the ENG Branch to JFEng and up to SHAPE (via JFC HQ Brunssum). Common funding for NSIP projects is limited to those multi-national projects that support the mission and are considered critical operational infrastructure in accordance with Chapter 11 of Ref B (CRO capability package).

TCNs will fund projects associated with national support requirements which are not eligible to NATO funding.

e. The BDE ENG Branch will, in close co-ordination with Logistic Resources Branch, HN and international actors, direct, coordinate, and prioritise the repair, upgrade, and monitoring of the MSRs within the AOR that are defined as Theatre Critical Routes (TCRs). Also, with support from reach-back capabilities, Mil Eng staffs will direct, coordinate, and prioritise the repair, upgrade and monitoring of designated APODs.

f. NATO and the TCNs have a collective responsibility for the protection of the environment. However, each nation bears ultimate responsibility for the actions of its forces. National standards may be used if they are more stringent than the GoT's standards (ZERO FOOTPRINT CONCEPT).

g. The BDE ENG Branch will be the central collection and development point for engineer intelligence. The ENG Branch intelligence staff will routinely obtain Priority Intelligence Requirements (PIRs) from the knowledge database, before then integrating them with essential elements of engineer intelligence collected from subordinate Mil Eng units and disseminate information as required. Engineer units will be responsible for engineering reconnaissance and intelligence collection for their respective AORs. Essential elements of information (as opposed to detailed engineering data) will be passed to the next higher and lower echelon Mil Eng staff.

h. The following items are to be considered Mil Eng PIRs:

(a) APOD requirements to support RSOM(I).

(b) Routes / MSRs conditions, to include bridges.

(c) Obstacle Information, to include IEDs, mines, and UXOs.

(d) Engineer Material.

(e) Sources of water supply.

(f) Technical Support to Force Protection.

(g) Common funded infrastructure requirements.

(h) Local infrastructure facilities / organizations available to support engineer contracting.

i. Bed-down of all forces is a national responsibility.

j. The BDE ENG C-IED working group inputs and outputs are as follows:

1. Analysis/recommendations on IED threat, adversant trends for commanding officer

2. Analysis/determination of —hot spots

3. ISR recommendations.

4. RC Resource allocation.

5. Route clearance analysis, RC routes recommendations

6. Targeting nominations—named area of interest (NAI), TAIs, and VPs.

k. Route Clearance responsibilities. Route clearance priorities come out during the C-IED WG. BDE ENG will produce Route Clearance Sync Matrix (RSM) and Route Clearance Schedule (RCS). Units will conduct Route Clearance Operations (RCO) IAW Unit SOPS.

l. Delineation of Engineer Responsibilities:

(a) ENG Branch: provides guidance, co-ordinates all engineer matters within the assigned areas and recommends priorities of work to COM, in order to support the full range of military operations. They must also coordinate infrastructure support with the JLSG and coordinate appropriate Mil Eng support for Logistics operations.

(b) HQ ENG: co-ordinate all Mil Eng matters in the AOR, and are responsible for assessing engineer requirements, priorities, and scope of work.

(c) Mil Eng Forces: deployed as organic assets of national formations, will support their units as assigned.

(d) All Engineering Staff: at all levels and during each phase of the operation, are responsible for providing Mil Eng intelligence gathering and collation, particularly related to obstacles, infrastructure and engineer resources.

(10) Environmental Protection (EP): It is imperative that forces are aware of the key sensitive issues within the AOR. Specifically; clean freshwater is an extremely precious resource in Paktia. Units should exercise maximal conservation efforts as well as pollution prevention measures to preserve the greatest amount of water for use by the indigenous population. It is also imperative that deploying units conduct an initial entry Environmental Baseline Study upon establishing base camps in theatre.

5. SERVICE SUPPORT.

a. Logistics.

(1) The Mil Eng units identified in Annex A shall be equipped with the required engineer specific vehicles, equipment and stores. Re-supply will be through national or multi-national channels as regulated.

(2) Civilian Engineer Agencies are to be employed where possible in order to allow Mil Eng assets to focus on tasks that cannot be contracted. This is co-ordinated by the ENG Branch in coordination with JLSG and it should be in line with the COA to enhance the economical local conditions. (3D approach).

b. HN Support.

(1) Indigenous Labour. HN local government agencies will be utilised for dealing with local nationals to the furthest extent possible.

(2) Use of locally procured construction material, supplies, and equipment will be maximized, however most of the required materials might not be available within the HN and need to be imported and stored.

(3) Third Country Labour Force. Third country labour will be used only after all sources of indigenous HN labour have been exhausted.

(4) Local Contractor. Local contractor capabilities will be used to the maximum extent possible in accordance with Annex FF.

(5) Local Facilities. Local (HN) facilities will be utilized to the maximum extent possible. The following priorities will be followed to satisfy facility requirements, consistent with operational necessities:

(a) NATO owned, occupied, or leased facilities.

(b) NATO owned facility substitutes proposed in theatre.

(c) HN support in accordance with HN / Coalition agreements.

(d) NATO owned facility substitutes located outside of the AOR.

(e) Facilities from commercial sources.

(f) Constructed facilities utilizing contractor capabilities.

(g) Constructed facilities utilizing NATO Mil Eng construction units.

c. NAMSA Support.

(1) NAMSA has been appointed by SHAPE as contract integrator for 4-52. For that purpose NAMSA has established pre-arrangements with industry, but also provides further support arrangements.

(2) Capability Packages: NAMSA is Host Nation for the SHAPE owned Capability Packages.

(3) NAMSA has in place a stand-by arrangement for Architecture and engineering support. That arrangement allows NAMSA to quickly develop A&E solutions for NIMFOR engineering and infrastructural requirements.

6. COMMAND AND SIGNAL

See main body.

a. Engineer Responsibilities.

(1) ENG Branch co-ordinates all operational level engineer matters for the operation.

(2) Mil Eng staff within the BDE HQ and KMD directorates have a pivotal role to play in ensuring that timely and accurate Mil Eng input is provided to the intelligence, assessment, planning, synchronization and targeting processes.

(3) Mil Eng staff in the HQ Forward Element (FE) have a key role in supporting the work of the BDE Engr and will be needed to act as in-theatre agents for him and for the ENG Br staff. However, the HQ FE Mil Eng staff are not a part of HQ ENG Br and do not report directly to HQ ENG Branch Head.

(4) Mil Eng staffs are responsible for assessing their Mil Eng requirements, priorities, scope of work and cost estimates for engineer works.

b. ENG Branch Critical Information Requirements.

(1) Any event or loss in capability that threatens the operation of the MSRs.

(2) Any event / accident of use or finding of IED/UXO stockpile.

(3) Significant delays to critical infrastructure works.

LEXICON

PART I – ACRONYMS AND ABBREVIATIONS

AAP	Allied administrative publication
AJP	Allied joint publication
AOR	area of responsibility
APOD	airport of disembarkation
ATP	Allied tactical publication
Bi-SC	of the two Strategic Commands
CC	component command
C-IED	countering – improvised explosive device
CIMIC	civil-military cooperation
CJEODC	combined joint explosive ordnance disposal cell
COA	course of action
CRO	crisis response operation
CUR	crises response operation urgent requirement
DIRLAUTH	Direct liaison authorized
EBS	environmental baseline study
ECS	environmental closeout study
EOD	explosive ordnance disposal
EP	environmental protection
ERW	explosive remnants of war
FMB	forward mounting base
FOB	forward operating base
FOM	freedom of movement
FP	force protection
FSB	forward support base
HN	host nation
HNS	host-nation support
HQ	headquarters
ICC	infrastructure coordination cell
IED	improvised explosive device
IEDD	improvised explosive device disposal
IO	international organisation
ISB	intermediate staging base

JFC	joint force command joint force commander
JFENGR	joint force engineer
JLSG	joint logistic support group
JOA	joint operations area
JOPG	Joint Operations Planning Group
LCC	land component command
LOC	lines of communications
MC	Military Committee
MCR	minimum capability requirements
MEIB	military engineering and infrastructure branch
MMR	minimum military requirements
MILENG	military engineering
NA5CRO	non-Article 5 crisis response operation
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organisation
NC3A	NATO C3 Agency (NATO Consultation, Command and Control Agency)
NGO	non-governmental organisation
NSIP	NATO Security Investment Programme
OLRT	operational liaison and reconnaissance team
OPLAN	operation plan
OPP	operations planning process
POD	port of debarkation
RDP	resources development plan
RECCCE	reconnaissance
ROE	rules of engagement
RSOM(I)	reception, staging, onward movement and integration
SC	strategic command(er)
SOR	statement of requirements
SPOD	sea port of disembarkation
TCN	troop-contributing nation
TFC	task force commander
TFENGR	task force engineer
TIF	theatre infrastructure framework
TRC	theatre reception centre
UXO	unexploded explosive ordnance

PART II – TERMS AND DEFINITIONS

Allied joint publication
A publication of joint interest containing doctrine applicable to NATO-led multinational forces, conducting operations involving more than one service. It is used by commanders of Allied joint forces, their subordinate commanders and staffs. (AAP-47)

civil-military cooperation
The coordination and cooperation, in support of the mission, between the NATO Commander and civil actors, including the national population and local authorities, as well as international, national and non-governmental organisations and agencies. (AAP-6)

collective defence
The fundamental guiding principle by which the Alliance works is that of common commitment and mutual cooperation among sovereign states in support of the indivisibility of security for all of its members. The Alliance works on the principle that the security of each member country depends on the security of them all. If the security of any one is threatened, all are affected. (AJP-01)

combined joint operation
An operation carried out by forces of two or more nations, in which elements of at least two services participate. (AAP-6)

countering – improvised explosive device
The C-IED approach aims to defeat an adversary's IED System. The approach has 3 mutually supporting and complementary pillars of activity which are: attack the networks, defeat the device, and prepare the force. These are all underpinned by understanding and intelligence.
(AJP-3.15(A)RD)

disaster
A sudden accident or a natural catastrophe that causes great damage or loss of life. (Concise Oxford Dictionary)

doctrine
Fundamental principles by which the military forces guide their actions in support of objectives. It is authoritative but requires judgement in application. (AAP-6)

environment
The surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation. (AAP-6)

environmental protection
The prevention or mitigation of adverse environmental impacts (NTMS)

explosive remnants of war
Explosive remnants of war means unexploded ordnance and abandoned explosive ordnance. (Protocol on explosive remnants of war (PROTOCOL V) - not NATO terminology, however it is used by UN, IO and NGO)

explosive ordnance disposal
The detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosives ordnance. It may also include explosives ordnance which has become hazardous by damage or deterioration. (AAP-6)

force protection
All measures and means to minimize the vulnerability of personnel, facilities, equipment and operations to any threat and in all situations, to preserve freedom of action and the operational effectiveness of the force. (AAP-6)

host nation
A nation which, by agreement:
a. receives forces and materiel of NATO or other nations operating on/from or transiting through its territory;
b. allows materiel and/or NATO organisations to be located on its territory; and/or
c. provides support for these purposes.
(AAP-6)

host-nation support
Civil and military assistance rendered in peace, crisis, or war by a host nation to NATO and/or other forces and NATO organisations which are located on, operating on/from, or in transit through the host nation's territory. (AAP-6)

infrastructure[88]
A term generally applicable for all fixed and permanent installations, fabrications, or facilities for the support and control of military forces. (AAP-6)

international organisation
An intergovernmental, regional or global organization governed by international law and established by a group of states, with international juridical personality given by international agreement, however characterized, creating enforceable rights and obligations for the purpose of fulfilling a given function and pursuing common aims.
Note: Exceptionally, the International Committee of the Red Cross, although a non-governmental organization formed under the Swiss Civil Code, is mandated by the

[88] AAP – 6 (2004 definition). To be deleted to use 'Concise Oxford English Dictionary' (COED) definition: "the basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise." (final deletion process by NTMS)

international community of states and is founded on international law, specifically the Geneva Conventions, has an international legal personality or status on its own, and enjoys some immunities and privileges for the fulfillment of its humanitarian mandate. (AAP-6)

joint force engineer
The principal advisor to a joint force commander on all military engineering issues. (AAP-6)

military engineering
Engineer activity, undertaken regardless of component or service to shape the physical operating environment. (AAP-6)

non-Article 5 crisis response operations
Multifunctional operations, falling outside the scope of Article 5, that encompass those political, military, and civil activities, initiated and executed in accordance with international law, and applicable national law, contributing to conflict prevention and resolution, and crisis management in the pursuit of declared Alliance objectives. (AJP-3.4)

non-governmental organisation
A private, not for profit, voluntary organization with no governmental or intergovernmental affiliation, established for the purpose of fulfilling a range of activities, in particular development-related projects or the promotion of a specific cause, and organized at local, national, regional or international level.
Notes:
1. A non-governmental organization does not necessarily have an official status or mandate for its existence or activities.
2. NATO may or may not support or cooperate with a given non-governmental organization.
(AAP-6)

operation
A military action or the carrying out of a strategic, tactical, service, training, or administrative military mission; the process of carrying on combat, including movement, supply, attack, defence and manoeuvres needed to gain the objectives of any battle or campaign. (AAP-6)

operational level
The level at which campaigns and major operations are planned, conducted and sustained to accomplish strategic objectives within theatres or areas of operations. (AAP-6)

reconnaissance
A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an adversant or potential adversant, or

ATP-3.12.1(A)(1)