

**AIR FORCE DOCTRINE PUBLICATION 3-34**

# **ENGINEER OPERATIONS**



**U.S. AIR FORCE**

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# **Air Force Doctrine Publication 3-34, *Engineer Operations***

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## FOREWORD

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Air Force Doctrine Publication (AFDP) 3-34, *Engineer Operations*, recognizes that from the beginning of military aviation, engineers have ensured airfields, facilities, and infrastructure set the conditions for airpower to achieve operational dominance. This publication also guides the United States Air Force (USAF) Civil Engineer (CE) enterprise in a new reality where operating in contested, degraded, and operationally limited environments is a primary concern. In this complex world, installations remain the power projection platforms (PPP) from which the USAF employs airpower. Engineers are critical because they build, maintain, and recover those installations. The underlying imperative for AFDP 3-34 is for Airman to understand how engineers employ wartime and contingency skills and execute mission-essential tasks in joint all-domain operations to ensure PPPs can support joint force commander (JFC) objectives.

To effectively organize and employ engineer forces throughout the competition continuum, AFDP 3-34 describes the principles and best practices of engineer operations by incorporating the joint functions and tenets of airpower. It communicates how the USAF's CE enterprise performs key functions, including general engineering, geospatial engineering, and installation support and services. This publication also discusses how USAF engineers organize into specialized teams with varying capabilities, such as Prime Base Engineer Emergency Force (Prime BEEF) and Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer (RED HORSE). Furthermore, it incorporates critical engineering capabilities, such as Integrated Base Response and Recovery (IBRR) and Rapid Airfield Damage Repair (RADR), that are essential to successfully executing the Agile Combat Employment (ACE) scheme of maneuver.

Finally, AFDP 3-34 highlights critical engineering capabilities that enable air and space operations in any environment, ultimately contributing to joint operations and enhancing a JFC's ability to accomplish their assigned mission. To meet this goal, Airmen should be trained to support operations in a distributed or decentralized manner, execute their mission when isolated from higher echelons, and be comfortable making decisions while operating in line with commander's intent. Therefore, AFDP 3-34 incorporates the philosophy of mission command with foundational CE doctrine and practice, making it a cornerstone within the USAF operational doctrine library.

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## CHAPTER 1: INTRODUCTION TO ENGINEER OPERATIONS



“Air bases are a determining factor in the success of air operations. The two-legged stool of men and planes would topple over without this equally important third leg.”

–**General Henry H. “Hap” Arnold**  
First General of the Air Force

The Civil Engineer (CE) enterprise is the primary provider of civil engineering support for United States Air Force (USAF) and United States Space Force (USSF) installations. The CE enterprise consists of a total force mix of active duty USAF, Air Force Reserve (AFR), Air National Guard (ANG), and civilian engineers who perform installation operations support, construction projects, and emergency response activities. Total Force USAF engineers are assigned or attached to numbered, specialized, or institutional units. They can complete their missions at bare bases, main operating bases, joint bases, forward operating bases, collocated operating bases, and combat outposts.

### FOUNDATIONAL PRINCIPLES OF CIVIL ENGINEERS

Engineers provide a critical capability because the USAF projects airpower from installations, and engineers build, maintain, and recover those installations. From the beginning of military aviation in the United States (US) to today, engineers have been pivotal players, ensuring airfields, facilities, and infrastructure help set the conditions for operational dominance.

Just as a runway is foundational to air operations, basic foundational beliefs of USAF civil engineers provide the basis for delivering USAF and USSF installations effectively and efficiently, using modern principles to maximize contributions to installations and their diverse mission sets. Engineers have an outward focus to support the warfighter and ensure their power projection platforms (PPP) are ready for employment by supporting broader mission-readiness issues and developing and sustaining a total force of civilian, active-duty, and air reserve engineers.

Engineers are innovative in their problem-solving approach. They seek effective and efficient solutions to problems across the doctrine, organization, training, materiel, leadership, education, personnel, facilities, and policy lines of effort. Modernization of CE capabilities, infrastructure, equipment, and tactics, techniques, and procedures (TTP) (including chemical, biological, radiological, or nuclear [CBRN] defense areas) is essential to keeping pace with capable adversaries. Infrastructure that provides redundancy, resiliency, and flexibility is critical to maintaining power projection capabilities in a highly contested environment. More innovative, more efficient practices reduce waste and promote the economy of assets. Engineers leverage emerging advances in control systems to improve energy efficiency and monitoring while eliminating and securing critical infrastructure from adversary cyberspace attacks. Modernization enables the USAF to outpace its competitors through industry technological innovations and increased resiliency.

Engineer operational doctrine provides a guide for effectively organizing and employing engineer forces across the complexities of the competition-to-conflict continuum. As the USAF continuously improves its airpower capabilities, its ability to identify the latest best practices and incorporate new concepts and technologies may revolutionize and shape future engineering operations and doctrine.

## **OPERATIONAL EMPLOYMENT IN CONTESTED ENVIRONMENTS**

Innovative Airmen are integral to improving and developing processes and practices, succeeding as they connect, share, and learn. Engineer operations in a contested environment against a peer require the air component to be adaptive, resilient, and agile in its deployment, employment, and leadership philosophies. Engineer teams and leadership typically need to employ core aspects of Mission Command by exercising disciplined initiative and accepting prudent risk to make decisions on critical, time-sensitive activities, such as rapid airfield repair, and to adapt engineering techniques.

Installations are PPP-built, maintained, and recovered by ready engineers, trained and equipped to carry out combat support operations within their assigned units of action. Engineers train at home station, combat support training ranges, exercise deployments, and Silver Flag sites on pre-identified engineering operations. This training permits the rapid employment of Prime Base Engineer Emergency Force (Prime BEEF), Emergency Services, and Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer (RED HORSE) Squadron (RHS) engineers to support global military operations. Additionally, by incorporating asset management and lifecycle practices into PPP, risks to the installation mission are reduced or mitigated through modernization. Finally, USAF engineers serve as a force multiplier in executing general engineering operations.<sup>1</sup>

USAF CE enhances a joint force commander's (JFC's) ability to accomplish the mission and enable joint operations. The primary task for USAF engineers is to enable USAF and USSF missions. USAF engineers are trained and equipped with organic capabilities to support all aspects of projecting air and space power. Secondly, they also provide general engineering support for other Service requirements. USAF engineers also conduct certain combat engineer functions in contingency and warfighting environments, both on the installation and off.

Engineers prepare for contingencies by training as units, applying lessons learned, and exercising their capabilities to deploy qualified engineer forces to rapidly establish airbases as PPP, repair battle-damaged facilities and infrastructure, and recover installations from man-made and natural disasters. A ready Airman engineer is prepared to employ wartime and contingency skills to execute mission-essential tasks and mission capabilities in all military operations, regardless of the location or type of military installation. The USAF sees these locations or installations in the context of an airfield, described as an area prepared for the takeoff, landing, and accommodation of aircraft (including any buildings, installations, and equipment required).

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<sup>1</sup> See Joint Publication (JP) 3-34, *Joint Engineer Operations*, for additional information,

Engineer operations integrate combat, general, and geospatial engineering capabilities to meet strategic and joint force commander (JFC) requirements and facilitate freedom of action necessary for the JFC to meet mission objectives. Joint engineers employ operational engineer capabilities to facilitate the mobility and survivability of friendly forces; counter the mobility of enemy forces; provide infrastructure to position, project, protect, and sustain the joint force; contribute to a clear understanding of the physical environment; and provide support to civilian authorities and partner nations.

**–JP 3-34, *Joint Engineer Operations***

Each Service possesses engineering forces that provide a capability to establish and maintain bases. However, each of those Services maintain core engineering capabilities stemming from traditional roles to meet specific operational needs. USAF civil engineers can open airfields once secured by ground or host nation (HN) forces. In highly contested and austere locations, engineer leadership should be prepared to accept higher levels of risk and allow USAF Civil Engineer teams to conduct airfield opening activities in locations without ground force security. USAF engineers have expertise in support of the maneuver of conventional and unconventional USAF warfighters.

Furthermore, USAF Civil Engineers enable airpower and space power operations in and through any environment through integrated base response and recovery (IBRR). Recovery activities directly contribute to the joint force's ability to counter adversary kill chains and operations by mitigating the effects of adversary attacks.<sup>2</sup> USAF engineers assist air and ground maneuver operations by constructing expeditionary landing surfaces and reinforcing structures to mitigate the impacts of direct and indirect weapons.

USAF civil engineers possess broad engineering skills to plan, build, maintain, operate, protect, recover, sustain, and close military facilities and infrastructure. These capabilities support combatant commanders (CCDR) in both peacetime and contingency operations. Through hands-on experience at home stations and deployments, combined with specialized training in technical tasks, combat skills, career education, and contingency equipment, USAF engineers are fully prepared to manage contingency bases, serve on Service or joint staffs, and perform theater-level engineering duties in any operational environment worldwide. The USAF embeds military engineers, civilians, and contractors into the home station workforce. Providing general engineering, geospatial engineering, installation support and service, emergency services, engineering logistics services, and partnership building capabilities in this manner is a force multiplier. Mixing military (active duty and AFR), civilian, and contractor personnel creates an environment to leverage the technical expertise and experience of long-term civilians to train military engineer forces, while simultaneously accomplishing the home station mission, which includes projecting airpower into multiple theaters simultaneously as well as ensuring readiness of the installation's primary weapon systems.

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<sup>2</sup> For additional information on kill chains, see to Air Force Doctrine Publication (AFDP) 3-60, *Targeting*.

## **ORGANIZATION AND CORE OPERATIONAL PILLARS**

Typically, USAF operational engineering forces are organized into flights or squadrons, with several instances of groups. Engineer forces are also assigned to USAF institutional organizations, such as above wing-level staffs, the Air Force Installation and Mission Support Center, the Air Force Civil Engineer Center (AFCEC), and the Air Force Institute of Technology.

AFCEC's Civil Engineer Capability Requirements, Research and Development, and Acquisition Division within the Readiness Directorate takes input from multiple sources to drive innovation, research, and development of new capabilities.

Engineer capabilities enable operational and tactical maneuvers by supporting actions necessary for the commander to meet mission objectives. CE core operational pillars, structured to meet JFC and other operational requirements, are:

- ★ Prime BEEF.
- ★ RED HORSE.
- ★ Explosive ordnance disposal (EOD).
- ★ Fire and emergency services.
- ★ Emergency management (EM), CBRN specialist teams.
- ★ Other specialized teams.
- ★ Staff augmentation teams (S-Teams).

Civil engineers participate in training activities that support base and homeland operations, major commands, numbered air forces, and their subordinate wings. The CE leadership structure provides standardized guidance, training, equipment, and procedures through a corporate process. While at home station, civil engineers establish main operating bases to establish resilience against potential attacks by capable adversaries. Preparation and training at main operating bases are designed to protect and recover the bases and PPP.

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## CHAPTER 2: CIVIL ENGINEER FUNCTIONS

USAF civil engineers are crucial to providing operational and installation support and services, which aims to ensure the power projection platform's success during multiple operations. These interconnected roles are essential for the USAF to prevail in great power competition. Engineer functions are categories of related activities grouped to enable installation and air component commander missions. CE provides engineering support to home stations and throughout all phases of military operations, including airbase opening, establishing operating locations, force beddown, sustainment, recovery, transitioning, and closure of operating locations. CE reconnaissance capability is also embedded in the contingency response wings and AFCEC to perform airfield site assessments. These functions contribute to achieving operational and tactical objectives. These capabilities allow the air component commander and JFC to integrate, synchronize, and direct engineer operations.

Engineer functions can be grouped into key areas: general engineering, geospatial engineering, and installation support and services. When combined, these functions enhance the readiness and status information for PPPs, enabling the air component commander and JFC to make informed decisions on the use of airpower capabilities across the competition continuum. In effect, this information is a critical engineering function that enables the USAF to operate from the PPP capabilities engineers provide. With the emerging potential of contested environments at main operating bases, engineers are prepared to employ in place to support joint all-domain operations at home station.



**Misawa Air Base, Japan: 35th Civil Engineer Squadron and Japanese Air Self-Defense Force partners execute Rapid Airfield Damage Repair operations during Resolute Force Pacific 2025.**

### GENERAL ENGINEERING

General engineering consists of capabilities and activities that provide infrastructure, modify, maintain, or protect the physical environment, and respond rapidly to establish, sustain, and recover airbases. Examples include:

- ★ Planning.
- ★ Construction.
- ★ Infrastructure repair.
- ★ Infrastructure maintenance.

- ✦ Storage area requirements.
- ✦ Lines of communication (supply chain).
- ✦ Protection of natural and cultural resources.
- ✦ Terrain modification and reconstruction.

The general engineering requirements for an operation could exceed the capabilities of available military engineers. Air component commanders may need to employ military engineers, civilians, contractors, and multinational and HN capabilities to fulfill these requirements, depending on the operational environment.

## GEOSPATIAL ENGINEERING

Geospatial engineering encompasses tasks that provide geospatial information and services (GI&S) to enhance awareness, understanding, and effective use of the operational environment, meeting JFC and other operational requirements. Geospatial engineering requires highly technical and specialized capabilities, which may include:

- ✦ Nonstandard tailored map products.
- ✦ Precision survey.
- ✦ Geospatial data management.
- ✦ Baseline survey data.
- ✦ Identification of significant cultural sites and natural resources.
- ✦ Facility and infrastructure support.
- ✦ Force beddown analysis.
- ✦ Digital data.
- ✦ Existing topographic product and other collateral data.
- ✦ Geospatial engineer reconnaissance related to terrain, airfield, and site surveys.



**Civil engineers from the 4th Civil Engineer Squadron collect and use geospatial data.**

Geospatial engineering supports operational needs through reconnaissance, including terrain, airfield, and site surveys, to assist the air component commander's decision cycle on general engineering efforts. Engineers can assist in the predictive analysis of terrain and weather system effects during planning and construction. Geospatial engineering personnel evaluate potential construction sites and perform field tests on soils, asphalt, and concrete.

## INSTALLATION SUPPORT AND SERVICES

Engineers provide installation services to support military forces, including activities essential for effective real property lifecycle management. This capability focuses on managing real property facilities and infrastructure in the US and bases in other CCDR areas of responsibility while providing protection, safety, security, and sustainability for personnel and mission-critical built and natural assets. Installation support activities take place before, after, or concurrently with general engineering activities. These actions apply across military operations and include real property life cycle management, operations, emergency services, and related activities.

### REAL PROPERTY LIFE CYCLE MANAGEMENT

Engineers provide for planning, acquisition, recapitalization, disposal, and economic adjustment activities of real property assets to meet operational requirements.

- ★ **Planning:** With the mission owners, engineers identify mission priorities and the most pressing needs for the Department of the Air Force (DAF) or joint installations and then translate plans into base infrastructure through real estate, basing, and facility options. Effective planners understand the requirements. They look to the future created by high-technology weapons systems and new operational concepts, including cybersecurity concerns. Planning:
  - ★★ Focuses on base layout, environmental factors, infrastructure, and subsystems, ensuring all requirements meet theater construction standards.
  - ★★ Provides a logical progression of facilities and infrastructure development that fits with provisions for long-range growth or mission realignment and issues such as flexibility, redundancy, resilience, and survivability.
  - ★★ Maintains awareness of base support plans to identify resources and shortfalls required to support specific operation and concept plans.
  - ★★ Includes research, development, and funding needed to provide mission-capable facilities.
  - ★★ Takes into consideration force protection (FP) concerns wherever bases are to be developed.
- ★ **Acquisition:** Engineers translate base plans into infrastructure through a range of real estate, basing, and facility options. Engineers work with contracting and legal functions to purchase, lease, construct, or gain installation assets. An acquisition can include land, natural resources, buildings, structures, portable facilities, airfields, roads, installed equipment, and all interests in the property.
- ★ **Recapitalization:** Using asset management principles, engineers restore, modernize, and replace installation assets to meet mission requirements and comply with construction standards and statutory/regulatory requirements.

- ★ **Disposal of Installation Assets:** Disposal actions may become necessary when facilities and infrastructure deteriorate beyond the point of economical repair, become a safety hazard, interfere with new construction, or are no longer capable of meeting mission requirements, and disposal should not create a deficiency. Engineers do this by any authorized method (e.g., demolition, transfer) to permanently divest the Department of War (DoW) of accountability for and control of a real property asset of the US.



**Air Force Civil Engineers  
conduct demolition at Lajes  
Field, Portugal.**

- ★ **Economic Adjustment:** The engineering enterprise also assists communities impacted by base beddown, realignment, expansion, closure, or other significant military operations, including assessing hardships, evaluating alternatives for local recovery, identifying resource requirements, creating action plans, and implementing approved mitigation measures. Engineers in an expeditionary environment work with the Department of State (DoS) to assist communities in mitigating adverse impacts of military operations, promote local cooperation, and further US HN relations. At enduring bases, measurable reductions or expansions in operations require coordinating actions with the US Office of Economic Adjustment (for locations within US territory) or the DoS (for locations outside US territory).

## OPERATIONS

Continuing the real property cycle, engineers bridge the gap between new facilities and those at the end of their life cycle by applying smart and secure asset management principles to operate and sustain facilities and infrastructure.

- ★ **Installation Operations:** Engineers operate and maintain the infrastructure to support missions. The requirement is to balance mission effectiveness versus the efficient performance of infrastructure supporting base activities. They provide functional real property installation assets, including utilities such as energy, water, and wastewater disposal, and contract and real property management, pollution prevention, and other essential services.
- ★ **Sustainment:** Regular surveys of base layout, facilities, infrastructure, and equipment are conducted to enhance FP and strengthen the base's combat capability. Environmental and energy conservation and reduction plans are developed to protect the population's health, preserve the environment, and reduce waste. These include natural and cultural resources through practical assessment, maintenance, and repair of current assets and planning for future missions. Maintenance requirements are prioritized based on operational need, resources, cost, timing, energy efficiency, reliability, maintainability, environmental impacts, safety, and quality of life.

- ★ **Utilities:** Engineers provide production, infrastructure, and distribution for electrical, water, and wastewater systems. They plan and build backup and redundancy in utility systems to minimize impacts and enable continued supply to key missions. These utilities and services include power production with high and low voltage systems, well drilling, water storage, water treatment, collection and treatment or disposal of wastewater, and pest management.
- ★ **Cybersecurity:** Systems with integrated hardware and software designed to monitor and control the operation of equipment, infrastructure, or associated devices are becoming more capable within USAF facilities. These systems are a critical part of automation and are used extensively to optimize resources supporting nearly all aspects of the USAF's core mission areas. However, modernization requirements expose control systems, data infrastructure, and underlying networks to cyberspace threats. Engineers integrate cybersecurity assessments and best practices throughout facilities planning, design, commissioning, and sustainment lifecycles to reduce or eliminate threats and vulnerabilities related to control system access. Tailored and verified cybersecurity solutions for specific control system environments enable the ability to respond to threats, absorb cyberattacks, and recover to normal operations.

## EMERGENCY SERVICES

USAF emergency services include fire emergency services (FES), EOD, and EM activities. These activities protect the base from deliberate attack or unintentional damage, minimize loss of life, and protect property and the environment.

- ★ **Fire and Emergency Services:** FES engineers provide facility protection through a robust fire prevention program. They provide asset protection through facility systems and fire response capabilities. FES engineers also provide incident management expertise during installation incident response activities. They provide personnel protection and immediate pre-hospital care by responding to emergencies. In many cases, they respond to mutual aid requests from local communities and jurisdictions.



**156<sup>th</sup> Civil Engineer Squadron member practices extinguishing a fire at Aviano Air Base, Italy.**

- ★ **Explosive Ordnance Disposal:** EOD mitigates hazards to personnel and property posed by weapons and explosive materials in all physical domains, at the home station, and in the contingency environment. Their responsibilities range from small arms cartridges to nuclear weapons. EOD serves roles in defense support of civil authorities (DSCA) response as they execute military units' requirements to dispose of all military munitions discovered in the community, as well as the Joint EOD Very Important Person Protection Activity, providing counter-explosive search teams in support of the US Secret Service, Department of Homeland Security, and DoS.

- ★ **Emergency Management:** Emergency managers are multi-skilled Airmen specialized in preparing for, responding to, and recovering from all hazards, including CBRN defense and countering weapons of mass destruction (CWMD).<sup>3</sup> They are postured to operate across the competition continuum at home and abroad as both emergency managers and CBRN specialists. They are critical in the prevent, protect, respond, and recover realms. Their responsibilities include integrated risk management, emergency operations command and control (C2), force development, building partnership capacity, DSCA, international CBRN response, and support response to nuclear weapon accidents.

## OTHER RELATED ACTIVITIES

Engineers provide additional installation services at contingency locations and advance the CCDR's campaign objectives. These tasks are aligned with other joint functions.

- ★ **Contingency Base Services:** These are engineering activities that support logistical services. Examples include shelter beddown, water, waste management, hygiene services, and liquid fuel capabilities. When USAF forces are deployed in support of major operations where beddown and sustainment support is unavailable, the supported command, Service, or agency provides logistical sustainment requirements.
- ★ **Building Partnership Capacity:** Engineers execute a wide array of programs and integrate those programs into solutions that help accomplish national security objectives. These programs are designed to advance partner nation (PN) capacity and capabilities by providing training and equipment. They include humanitarian-based programs that enable DoW to accomplish national security objectives through military-civilian engagement. Engineers can provide C2 structures while working alongside local engineers, US Government (USG) agencies, and nongovernmental organizations (NGOs). Engineers support the development of the air component commander's campaign support plan and operations plans designed to shape the steady-state environment in support of a CCDR's campaign plan. Engineers facilitate security cooperation by exchanging knowledge, technology, and personnel. Providing engineering and construction expertise to PNs assists an air component commander's, JFC's, or CCDR's ability to influence and maintain access in critical regions. It helps build PN capability and capacity in essential services. Civil engineers advise, assist, train, and enable PNs to support themselves as well and respond to third-nation requests. Building this combined warfighter capability ensures other nations can contribute to an international engineering warfighting mission.
- ★ **Theater-level C2 and Specialized Technical Expertise:** Reserve component engineers provide specialized technical expertise gained as practicing engineers when not in uniform. Their industry contacts and specialized experience infuse the USAF with critical competencies for planning and coordinating theater-level engineering activities, including C2, cost effectively.

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<sup>3</sup> See AFDP 3-40, *Counter-WMD Operations*, for additional information.

- ★ **Power Projection Platform Readiness and Status Information:** Within the joint function of information, engineers consolidate and provide critical PPP readiness and status information throughout C2 actions. Engineers posture this information in support of air component and combatant command plans (readiness) and current operations (status). Furthermore, this information directly supports the JFC's ability to integrate, synchronize, and direct joint operations primarily concerning fires, movement and maneuver, sustainment, and FP. In simplest terms, if a disaster or enemy attack compromises or degrades PPP capability, engineers ensure tactical, operational, and strategic levels are informed to support operational decision-making (e.g., adjusting the air tasking order, time-phased force deployment data flow, availability of alternate PPPs).
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## CHAPTER 3: CIVIL ENGINEER TEAMS

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As part of an organized force, USAF engineers are organized into teams with varying capabilities who contribute general engineering, geospatial engineering, and emergency services to several joint functions including, sustainment and protection. Teams are generally presented as Prime BEEF (including emergency services) or RED HORSE.

### DEPLOYED ORGANIZATIONAL CONCEPT

USAF civil engineers deploy as combat support units to provide general and geospatial engineering capabilities, protection, response, recovery, and sustainment across the competition continuum. Agile Combat Employment (ACE) is the USAF's scheme of maneuver designed to increase base survivability while generating combat power.<sup>4</sup> The unique capabilities USAF civil engineers present to the joint force and air component leaders are a critical enabler to the USAF's ACE plans.

**Prime BEEF** organizations rapidly respond worldwide to offer a wide range of engineering support to establish, operate, sustain, protect, recover, and reconstitute installations.

**RED HORSE** is a self-sufficient, mobile heavy construction unit capable of rapid response and independent operations in a contested or terrorist threat environment. They provide heavy repair and construction capabilities that exceed Prime BEEF's capabilities.

Prime BEEF and RED HORSE force deployments are executed through the joint deployment system and conducted using guidance issued by Headquarters USAF. During deployments, CE forces are part of an air component unit of action and follow the command relationships that affect all Air Force forces. Most deployed Prime BEEF engineer units currently support an air expeditionary wing construct. Engineers may be placed under the tactical control of a joint force engineer command structure if established by the JFC. The air component commander, through the appropriate organizational structure, normally retains operational control of USAF CE units. Tactical control of CE elements, especially in ACE environments and in support of Distributed Control and Decentralized Execution C2 philosophies, can be delegated to leadership levels best suited to understand the needs of supported operational locations and to make informed, timely decisions to achieve mission objectives.

Organizing Prime BEEF and RED HORSE under a single USAF engineering commander is an alternate operational structure to support air component commander requirements. Under this structure, limited theater-wide engineering forces can be leveraged to prioritize, while mass engineering capabilities are deployed at the right time and place to meet demands. Maintaining unit integrity should be considered during design and planning. Unit integrity enables engineers to train and deploy together, providing the air component commander with an integrated mission-ready team. Additionally, contingency plans should be established to ensure CE capabilities remain responsive to air component units of action should the theater-level C2 structures become unavailable or unable to effectively understand and respond to the needs of lower echelon units.

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<sup>4</sup> See AFDP 3-0, *Operations*, for additional information.

Under air component commander tasking, engineers can be deployed as a Prime BEEF, RED HORSE, or specialized capabilities. They train as organic units and remain fully prepared to deploy rapidly as a complete unit type code (UTC) or as tailored force packages. UTCs are designed to provide the right capabilities and skill sets to meet mission requirements.

### **Air Expeditionary Wing 2.0 Concept**

Under the proposed Air Expeditionary Wing (AEW) 2.0 concept, the AEW Core UTC provides a fully integrated command and control and base operations support package, designed to sustain up to 2.5K personnel for up to 30 days without resupply and three weapon-system-agnostic Mission Generation Force Elements for up to six months. The AEW is capable of conducting ACE operations and is globally deployable to established bases within a Level 1 threat environment. For operations in higher threat environments or those requiring expanded capabilities, such as Base Operating Support functions, opening and establishing airbases, delivering advanced airfield repair, or providing expeditionary communications, the AEW must be augmented with Combat Enhancement Teams (CET) and/or Combat Generation Teams (CGT). The AEW is not designed for bare base operations.

- ★ **Combat Generation Teams:** REDHORSE, Contingency Response Group, Combat Communications, etc.
- ★ **Combat Enhancement Teams:** Prime BEEF, Prime Readiness in Base Services, Prime ABLES, Medical, Base Defense, etc.

## **PRIME BEEF**

Prime BEEF teams consist of total force personnel with USAF CE specialties and capabilities. These teams are capable of installation sustainment missions, and responding worldwide in support of ACE and other schemes of maneuver to provide engineering expertise and emergency services needed to establish, sustain, protect, and recover bases for the employment of USAF weapon systems supporting joint, interagency, and multinational operations.

Prime BEEF's core competencies are expeditionary general engineering and emergency services. Expeditionary engineering consists of those capabilities Prime BEEF teams provide to establish, sustain, and recover bases, while emergency services include FES, EOD, and EM activities. Prime BEEF units can deploy as part of an air component element to establish and maintain all joint operating locations throughout the operational area.

Prime BEEF capabilities consist of activities to establish, sustain, protect, and recover airfields and conduct force beddown operations, infrastructure maintenance, base sustainment activities, and FP, with a focus on the following capabilities:

- ✦ Installation development planning, project programming, and design, construction project and contract management, and construction quality assurance.
- ✦ Light horizontal and vertical construction.
- ✦ Construction of temporary, semi-permanent, or permanent facilities.
- ✦ Installation GI&S.
- ✦ Recover the installation after an attack or natural disaster, including repairs to facilities and infrastructure systems.
- ✦ Infrastructure support.
- ✦ Power generation and distribution systems.
- ✦ Utility system installation and maintenance.
- ✦ Airfield surface maintenance.
- ✦ Operating and maintaining aircraft arresting systems.
- ✦ Airfield lighting and emergency airfield lighting systems.
- ✦ Remote area lighting.
- ✦ Heavy equipment operations.
- ✦ Road construction and repair.
- ✦ Concrete and asphalt paving.
- ✦ Pest management and environmental services.
- ✦ Cybersecurity of industrial control systems.
- ✦ Collective protection operations and support.
- ✦ Structural firefighting.
- ✦ Aircraft rescue and firefighting.
- ✦ Disposal of unexploded ordnance or improvised explosive devices (IEDs).
- ✦ Emergency operations center operations.
- ✦ CBRN defense.
- ✦ Support passive defense and deception activities.

#### **PRIME BEEF SPECIALIZED TEAMS**

- ✦ Airfield damage assessment teams (ADAT) assess and report the condition of the

installation's airfield after an attack or disaster, providing leaders with responsive status updates.

- ★ Rapid airfield damage recovery (RADR) teams span most engineering specialties and include specialized logistics readiness specialties. It encompasses all actions required to rapidly repair runways and runway support structures to restore airfield operations after an attack. RADR teams directly contribute to countering adversary kill chains by mitigating the effects of adversary attacks.
- ★ Damage assessment and response teams (DART) provide damage assessments, reporting, and repair or demolition estimation for critical installation facilities, utilities, and infrastructure.
- ★ CBRN reconnaissance teams deploy to detect, identify, quantify, and collect CBRN material to confirm the presence of a CBRN agent presumptively.

## **GEOSPATIAL ENGINEERING**

Prime BEEF teams utilize geospatial engineering capabilities to provide terrain, geographic, line-of-sight, Base Expeditionary Airfield Resources (BEAR) base beddown, aircraft parking analysis, terrain obstacle visualization and analysis, general, baseline, expeditionary, and precision surveys, general and special purpose map products, and data management of the built and natural infrastructure.

## **EMERGENCY SERVICES**

Services include FES, EOD, and EM activities. These activities protect the base from intentional or unintentional damage, minimize loss of life, and protect property and the environment.

- ★ FES provides incident management, fire prevention, and protection to minimize loss of lives, property, and the environment occurring throughout all phases of military operations based on the following specializations:
  - ★★ Fire suppression.
  - ★★ Hazard mitigation.
  - ★★ Rescue.
  - ★★ Mitigation or containment of hazmat releases.
  - ★★ Emergency medical responses.
- ★ EOD can be employed alone or as part of an USAF, joint, interagency, or coalition force to support JFC or air component commander objectives. EOD provides USAF and joint commanders the capability to mitigate or defeat enemy or friendly explosive hazards, including CBRN, incendiary, or homemade explosives, and IEDs. It provides expertise to protect the mission, resources, and the environment in airfield operations, ground combat, homeland operations, Defense Security Cooperation Agency, and

worldwide contingencies, including traditional and irregular warfare. EOD flights provide very important persons with protective security and counter-explosive search teams in support of the US Secret Service and DoS.

- ✪✪ Primary support to airbase operations, mission sortie generation, and FP by eliminating explosive threats to airfield operations.
- ✪✪ Support of base security zones and EOD missions outside the base security zone in support of air operations or land operations, enabling freedom of maneuver.
- ✪✪ Weapons technical intelligence investigating explosive events to capture bomb emplacements, identify bomb builders, and unravel extremist networks.
- ✪ EM personnel can be employed as part of an USAF, joint, interagency, or coalition forces to support JFC or air component commander objectives. Emergency managers provide the USAF and joint commanders with an all-hazards EM and CWMD consequence management capability. They provide expertise to protect, prepare, respond, recover, and mitigate natural, man-made, or technological hazards.
- ✪✪ Primary core all-hazards mission area tasks include education and training, C2, incident response and recovery, and integrated risk management.
- ✪✪ Primary core CWMD consequence management tasks include building joint and combined partner CBRN defense inoperability, providing CBRN warning and reporting, and domestic and international CBRN response.

## RED HORSE

RED HORSE organizations are manned and equipped to provide highly mobile, rapidly deployable echelons to support force beddown and provide airfield and base heavy construction and repair capability, along with many specialized capabilities that allow the JFC to move and support missions, as operations dictate, at any level of global competition. RED HORSE teams achieve high mobility through air insertion, air delivery, or surface transportation. Some inherent specialized capabilities include water-well drilling, explosive demolition, quarry operations, rock crushing, concrete and asphalt batch plant operations, material testing, contingency airfield evaluations, and concrete and asphalt paving. RED HORSE provides CCDRs with a highly mobile heavy construction force capable of independent operations to meet theater construction requirements. These organizations contain self-sustaining logistical support for vehicle maintenance, secure communications, food service, supply, security, and medical support, with additional USAF specialties beyond engineers. This support allows the unit to operate independently for 30 days with resupply to sustain continued operations.

RED HORSE maintains other vital capabilities, including initial site survey or assessment for CBRN materials, removal or demolition of obstructions, expedient FP construction, repair of airfield surfaces for limited airlift operations, testing of potable water sources, and airfield pavement assessment. RED HORSE forces can be augmented by EOD to

conduct limited clearance of unexploded explosive ordnance (UXO), IEDs, and other explosive hazards, and by FES to perform limited firefighting, rescue, and emergency medical services.

During peacetime, continental US-assigned Air Force RED HORSE units report to the 800th RED HORSE Group. Pacific Air Forces (PACAF)-assigned RED HORSE units report to the 36th Contingency Response Group. ANG-assigned RED HORSE units report to ANG/A4X, and AFR Command-assigned RED HORSE units report to the 622d Civil Engineer Group. During contingency operations, RED HORSE units are typically used as a theater asset reporting to the air component commander or an engineer commander with theater-wide responsibilities. RED HORSE provides the air component commander with a dedicated, flexible airfield, base heavy construction and repair abilities, along with many unique capabilities that allow the JFC to move and support missions as the operation dictates.

## **AIR FORCE-LEVEL SPECIALIZED TEAMS**

The CE enterprise has other specialized teams working across installations. While not precisely aligned with Prime BEEF or RED HORSE, they are organized to support both home station and contingency installations.

- ✦ Civil Engineer Maintenance, Inspection, and Repair Team (CEMIRT). CEMIRT provides intermediate and depot-level repair support for power generation, electrical distribution, and aircraft arresting systems. CEMIRT also offers technical support for heating, ventilation, air conditioning systems, as well as electronic industrial controls and monitoring systems for infrastructure elements.
- ✦ Airfield pavement evaluation (APE) teams provide full-spectrum technical inspection and evaluation of airfields worldwide, testing the surface and subsurface strength and condition of airfield pavements.
- ✦ BEAR base teams provide technical expertise on War Reserve Materiel (WRM) assets. The 635th Materiel Maintenance Squadron (MMS) is the pilot unit for BEAR UTCs and advises on the acquisition of BEAR assets in support of USAF requirements. The 635 MMS provides expertise in planning, setup, and employment of BEAR assets in a contingency environment where little or no infrastructure exists. The 635 MMS is the sole training location for the construction, inspection, maintenance, and repair of large area shelters to ensure the life cycle management of these assets. As enablers, 635 MMS engineer teams deploy to support JFCs when needed. They can employ rapid response teams for camp beddown and recovery efforts after natural disasters where WRM assets may be required.
- ✦ AFCEC's Airbase Technologies Branch performs research and development and fielding for CE to close capability gaps with new equipment and materials to meet national defense objectives.

## **THEATER-LEVEL SPECIALIZED TEAMS**

- ✦ S-Teams provide command staff augmentation for engineer management, technical

design, construction management, and C2 in support of natural disaster response or during contingency planning and operations to synchronize the air component commander's global response commitments. S-Teams are aligned with the air component commander for theater- and operational-level capabilities at PACAF, US Air Forces in Europe, and Air Forces Central. They advise the air component commander on engineering-related issues affecting the JFC and provide input on global campaign plans, including theater posturing and infrastructure master plans to project airpower. They conduct operational area and environment assessments, contributing to both planning and intelligence preparation of the operational environment.

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## CHAPTER 4: CONTINGENCY OPERATIONS

Both civilian and military members staff engineer units. At home station, they are equally responsible for conducting activities to protect, respond to, and recover from a full spectrum of threats, both man-made and natural. For contingency operations away from home station, often referred to as expeditionary engineering missions, the military engineers deploy to contingency locations to perform these activities.

### EXPEDITIONARY ENGINEERING

USAF engineering capability consists of engineers' activities to open, establish, operate, sustain, protect, recover, and close bases. It can operate at any level of global competition through ACE. It focuses on operating and maintaining aircraft arresting systems, airfield lighting, heavy equipment, airfield surfaces, roads, and temporary, semi-permanent, or permanent facilities, and includes specialized capabilities in power generation and distribution systems. Teams perform horizontal and vertical construction, provide pest management and environmental services, provide overall installation development planning, design, and contract support, including specialized augmentation at echelons above wing level. Engineers also conduct base response and recovery to facilities, infrastructure systems, and airfield damage. In contested environments, engineers' ability to execute recovery and hardening activities directly contributes to countering adversary kill chains. Engineers can move around the operational area using air or ground transportation. Engineers are fully weapons qualified and can provide work-party security and participate in integrated base defense.



**Air Force Civil Engineers build bunkers at an undisclosed location in Southwest Asia.**

Expeditionary engineer units are generally organized as an expeditionary civil engineer squadron (ECES) or a flight within an air expeditionary wing. The ECES is usually assigned as the general engineer and emergency services support to a specific installation. This expeditionary organization mirrors home station squadron with the normal flights in the unit. Engineers can also be presented as an expeditionary civil engineer group (ECEG). An ECEG can be organized in a hub-and-spoke configuration with direct reporting to the air component commander.

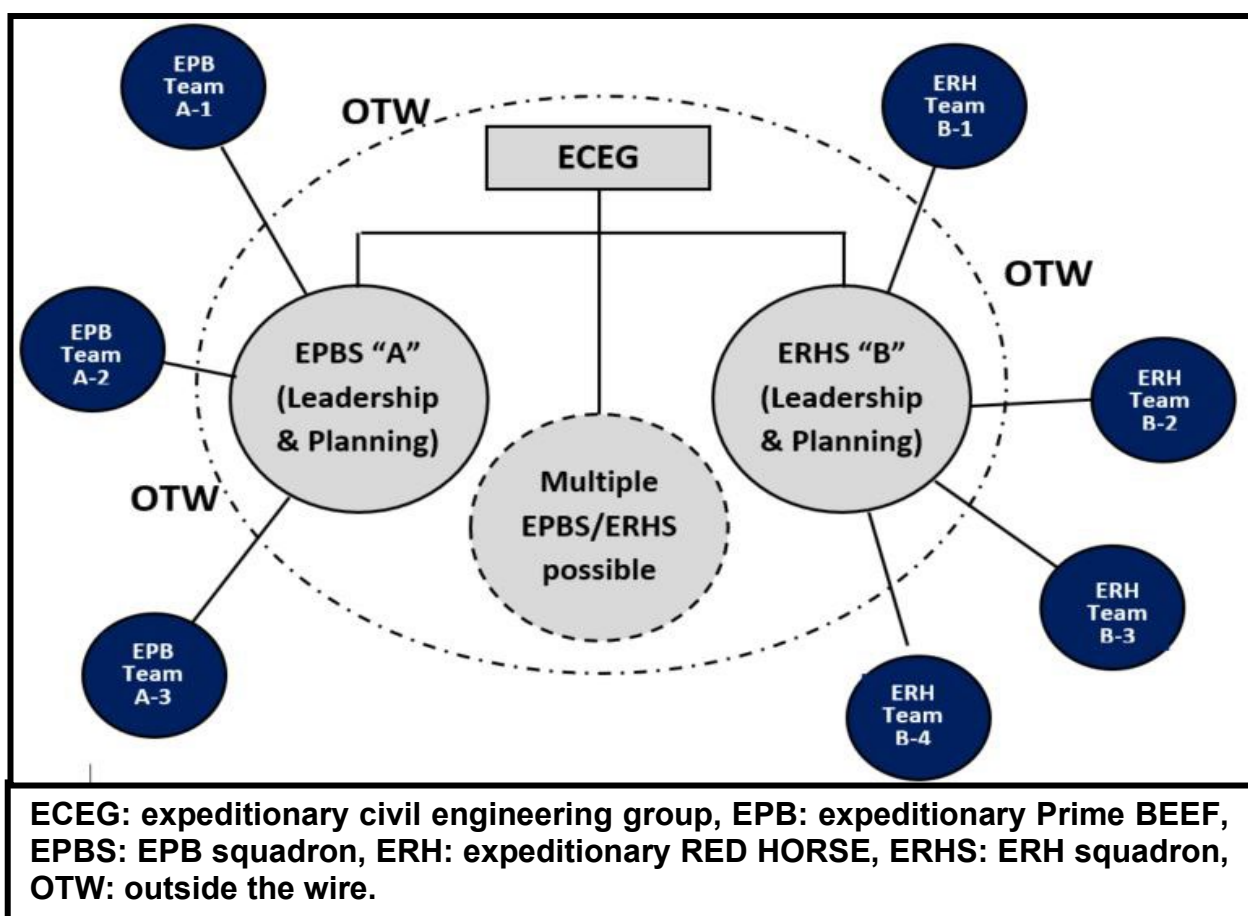
### HUB-AND-SPOKE CONFIGURATION

This configuration provides unity of command and effort while offering robust installation engineering, master planning, project management, and repair and construction, as illustrated in "Expeditionary Civil Engineering Group Hub and Spoke Configuration." CE forces support theater plans, joint engineer constructions, or sustainment. They provide robust capabilities for contingencies and other operating locations, focusing on priorities

and maximizing the efficiency of limited engineering resources. This allows USAF engineer leadership increased responsiveness, flexibility, and theater-wide integration of engineer forces, ensuring the most efficient and effective use of assets in meeting the air component commander's priorities.

An ECEG provides construction and repair capabilities throughout the combatant command's area of responsibility when requirements or threat levels exceed assigned engineer unit capabilities. Additionally, ECEGs offer a model to meet theater engineer requirements through effective, efficient engineering capabilities. The ECEG can surge engineer capability to existing or new locations and provide an immediate engineer response force.

### Expeditionary Civil Engineering Group Hub and Spoke Configuration



An ECEG can be comprised of USAF, AFR, and ANG members. The ECEG can range in size and provide more than 600 engineers to meet a full range of mission requirements. The group consists of a group staff, one or more Prime BEEF squadrons (PBS), and one or more RED HORSE squadrons. Within the hub-and-spoke structure, each expeditionary Prime BEEF squadron (EPBS) and expeditionary RED HORSE squadron (ERHS) has its leadership and planning functions for the hub, with elements at spoke locations as required. Additionally, engineering leadership at hubs and spokes should maintain

coordination relationships with the appropriate units of action. For contingencies that require a significant level of engineering support and to ensure timely, expert engineering support, engineering forces should consider embedding an engineering representative into the supported commander's and unit of action staff.

## CONTRACT SUPPORT

Contingency operations beyond initial beddown and support could not be accomplished without contract support. AFCEC runs the Air Force Contract Augmentation Program (AFCAP), which provides a critical capability to augment CE government capabilities during natural disasters, humanitarian relief, and military operations. AFCAP can respond within hours of emergencies. AFCAP contract support provides design/construction, commodities, and support services for all CE missions (less mitigation of unexploded ordnance) and most other USAF combat support missions (aircraft maintenance, food services).

## INTEGRATED BASE RESPONSE AND RECOVERY

Engineers undergo specialized training to respond to, recover from, and reconstitute installations. This training encompasses basic medical procedures, casualty collection, closing gas valves, isolating electrical breakers, and other essential skills. Furthermore, each unit identifies and trains Airmen as cohesive teams to conduct post-attack reconnaissance in their areas of responsibility. These proficient teams are the eyes and ears of C2 after an attack or event, supplying invaluable information to determine an appropriate response. Through collaborative efforts, engineers spearhead IBRR initiatives for an installation, working with other units,



**The Air Force Civil Engineer Center's Natural Disaster Recovery Division conducts planning at Tyndall AFB.**

teams, and personnel to facilitate the restoration of operations. In contested environments, engineers' ability to conduct recovery activities directly mitigates the effects of adversary kill chains. Knowing the importance of preparing for, responding to, recovering from, and reconstituting an installation after any event is crucial for the installation's mission during any level of global competition. Engineers are proficient in executing their part of IBRR actions. IBRR's focus is on restoring mission (operational support and installation service support) after a damaging event that degrades the installation's missions. Damaging or mission-impacting events range from natural and man-made disasters to CBRN, kinetic, and cyber-attacks. Engineers are trained and ready to perform life-saving measures and prioritize and expedite repairs.

Engineers are typically assigned to specialized teams to perform several critical functions for IBRR. The DARTs conduct rapid evaluations and inspections for each facility. The team determines whether a building is safe to occupy and, if not, decides what restrictions to place on its use or re-entry. An ADAT surveys airfields for damage, such as craters and unexploded ordnance. They coordinate with the minimum operating strip selection team and optimize repair time and efforts to launch mission aircraft as soon as feasible. CBRN reconnaissance teams deploy and maintain the base CBRN detection network and conduct post-attack reconnaissance of the installation. These teams coordinate with C2 nodes and enable rapid threat assessments and safe mission accomplishment, repair damage, and return the installation to an operational condition.

## **RAPID AIRFIELD DAMAGE REPAIR**

Emerging threats drive engineers to improve airfield damage repair equipment and TTP for airfield recovery. Adversaries continuously seek to counter USAF mission strengths using the anti-access and area denial (A2/AD) approach. Engineers are expected to respond to attacks that could leave hundreds of craters and thousands of UXOs on an airfield. Modernization of RADR addresses these threats and enables recovery of the airfield within a drastically reduced timeframe by leveraging an assembly line concept.

### **Counter Kill Chain**

Advancements in adversary anti-access, area denial capabilities greatly expand the range and lethality of adversary kill chains. These enhanced lethal kill chains limit friendly freedom of action and raise risk to mission while making achievement of the joint force commander's objectives more difficult. The need to ensure friendly movement and maneuver and achieve friendly effects in the operational environment has elevated the importance to counter adversary kill chains.

To attack friendly forces, an adversary must complete a sequence of actions to implement their kill chain. They detect friendly forces, communicate via command and control networks, decide on engagement options, employ fires, and then accomplish post-attack assessments. Engineers help counter adversary kill chains by enabling sortie generation, maneuver operations, and other ACE-related activities through passive defense, hardening, and recovery operations. Engineer support to deception activities, such as camouflage, concealment, and decoys (CDD), tactical deception (TAC-D), and deception in support of operational security (DISO), serves to complicate adversary intelligence, surveillance, reconnaissance and targeting (ISRT) processes and post-attack damage assessments. Hardening critical infrastructure degrades the effects of enemy weapons, while recovery operations, such as rapid airfield damage repair, can decrease the effectiveness of adversary attacks.

Engineers seek opportunities to improve RADR processes as adversaries continue to advance their A2/AD. Equipment, materials, and TTPs provide effective and robust crater repair capabilities that maximize available aircraft sortie generation while minimizing

mission downtime. The USAF maintains the ability to rapidly recover damaged airfield surfaces to continue air operations after an A2/AD attack at locations with various manpower levels to receive and launch all airframe types. This capability becomes even more vital when ACE is in play.

## **DISASTER RESPONSE AND LIMITED CONTINGENCY OPERATIONS**

Engineers can respond to crises or limited contingencies anywhere. Initial engineering assessments are critical to identifying available support and other resources needed to meet anticipated requirements based on the situation. Plans are tailored to the actual capability required for the response. As operations continue, some efforts may be transferred to contractors, local governments, other federal agencies, or HNs. AFCAP can provide a tool to augment the initial response and short-term recovery efforts.

## **CIVIL ENGINEER SUPPORT TO AGILE COMBAT EMPLOYMENT**

USAF Civil Engineers are indispensable to the execution of ACE. Their expeditionary skills and technical expertise enable the USAF to establish, sustain, and recover combat power from dispersed and contested locations. Civil Engineers provide the infrastructure, protection, and essential services that underpin the maneuverability and resilience of ACE forces. By integrating engineering, EM, and FP functions, Civil Engineers extend the operational reach of commanders and enable mission continuity across the spectrum of conflict.

### **KEY CAPABILITIES CIVIL ENGINEERS DELIVER IN SUPPORT OF ACE INCLUDE:**

- ★ Airfield and Infrastructure Readiness.
  - ★★ Rapid assessment, repair, and construction of runways, taxiways, and aprons.
  - ★★ Establishment of expeditionary facilities and shelters at austere locations.
  - ★★ Sustainment of utilities and critical infrastructure under contested conditions.
- ★ Expeditionary Support Systems.
  - ★★ Provision of power generation, water supply, and waste management systems.
  - ★★ Deployment of environmental control and life-support systems for dispersed forces.
  - ★★ Adaptation of engineering solutions to diverse climates and operational environments.
- ★ FP and EM.
  - ★★ Integration of base defense measures into dispersed operating locations.
  - ★★ EM planning and response for CBRN hazards.
  - ★★ Fire protection and disaster response capabilities to safeguard personnel and

assets.

- ★ Explosive Ordnance Disposal (EOD).
  - ★★ Clearance of airfields, facilities, and operating areas from explosive hazards.
  - ★★ Counter-improvised explosive device operations to secure maneuver routes and operating sites.
  - ★★ Technical intelligence support to enhance survivability and operational tempo.
- ★ Operational Agility and Resilience.
  - ★★ Rapid mobility of engineering teams to establish or recover multiple operating locations.
  - ★★ Integration with joint and coalition partners to expand operational reach.
  - ★★ Engineering solutions that enable adaptive basing and sustain combat power in contested domains.

Through these capabilities, Civil Engineers ensure that ACE forces can maneuver, generate, and project airpower from multiple adaptive locations. Their contributions are foundational to the resilience and effectiveness of the USAF in contested and uncertain environments.

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## **CHAPTER 5: OPERATIONS ACROSS THE COMPETITION CONTINUUM**

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Engineers are critical to military operations, applying their expertise and critical thinking across the entire competition continuum, from initial theater setup to post-conflict transition. Their planning, execution, and assessment functions are tailored to the specific demands of each operation.

### **SETTING THE THEATER**

Engineering operations are fundamental to the joint force's ability to set the theater. They establish the necessary physical, logistical, and infrastructure conditions required to enable freedom of action, sustainment, and operational reach. Through deliberate planning, engineers shape the environment to support the rapid deployment, reception, staging, onward movement, and integration (RSOI) of forces. Engineers are active in all phases, from setting and shaping the theater to returning control to civil authority post-conflict.

#### **CORE ENGINEERING CAPABILITIES FOR SETTING THE THEATER**

Engineers contribute decisively to setting the theater by transforming the operational environment to support joint force objectives. Key activities include:

- ★ **Infrastructure Development and Repair:** Constructing, expanding, and maintaining critical facilities such as ports, airfields, roads, and base camps. These efforts ensure the joint force can project power, receive reinforcements, and sustain operations across extended lines of communication.
- ★ **Mobility and Access:** Enhancing maneuverability by improving routes, clearing obstacles, and bridging gaps, which maintains operational tempo and enables forces to move freely.
- ★ **Protection and Survivability:** Providing FP through the construction of defensive positions, protective barriers, and hardened facilities to safeguard personnel, equipment, and critical nodes against environmental hazards and enemy action.
- ★ **Sustainment Enablement:** Establishing essential life-support infrastructure, including power, water, and waste management systems, allowing forces to endure and operate effectively in austere environments.
- ★ **Theater Security Cooperation:** Engaging in projects that strengthen alliances and build HN capacity, fostering access, legitimacy, and stability.

In essence, engineering operations are decisive contributors, not just enablers, transforming the operational environment to support joint force objectives and ensuring commanders have the freedom to act, sustain, and prevail.

### **COOPERATION, DETERRENCE, AND SPECIALIZED SUPPORT**

Engineer planning, execution, and assessment for engagement, cooperation, and deterrence operations generally parallel those activities required in support of other

military operations. However, engineers should be familiar with different C2 structures, cultures, and languages while working alongside local engineers, USG agencies, and NGOs. Engineers support the development of the air component commander's support plan and country plans designed to shape the steady-state environment in support of a CCDR's or other JFC's campaign plan.

### **SECURITY COOPERATION**

Engineers facilitate security cooperation by exchanging knowledge, technology, and personnel. Providing engineering and construction expertise to PNs assists a CCDR's or other JFC's ability to maintain access in influential critical regions. It helps build PN capability and capacity in essential services. Engineers advise, assist, train, and enable PNs to promote themselves as support to third-nation requests.

### **FORWARD PRESENCE AND FORCE PROJECTION**

Engineers support both forward presence and force projection as deterrence options. Engineers establish and maintain basing platforms, including forward operating bases and combat outposts, to project airpower. These bases may be permanent, semi-permanent, or temporary, depending on US international agreements and the JFC's intent. As ACE becomes an increasingly necessary aspect of USAF operations, engineers will typically be called upon to perform duties in direct support of such operations.

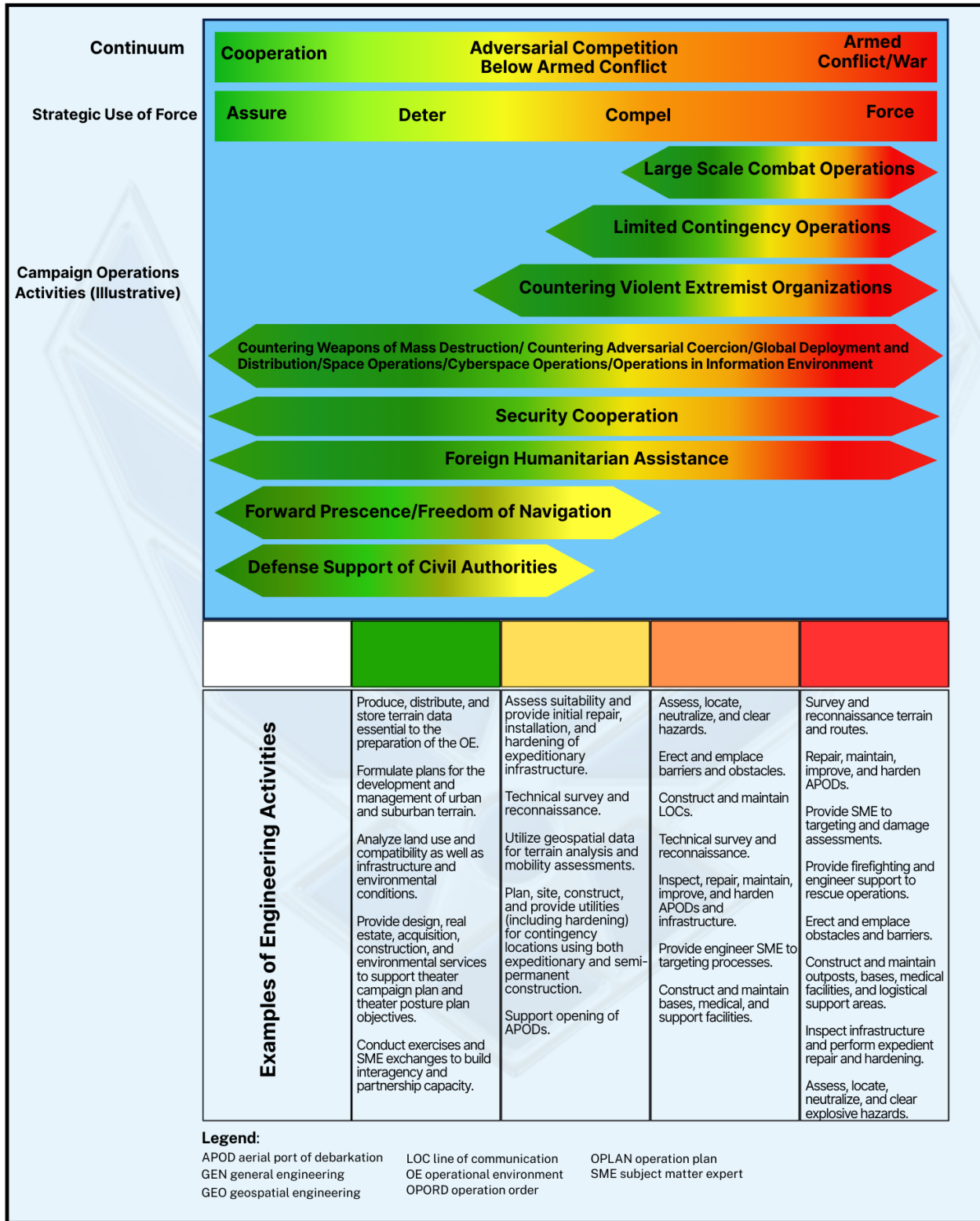
### **NUCLEAR OPERATIONAL INFRASTRUCTURE**

Engineers maintain critical infrastructure and emergency services in support of the nuclear enterprise. Engineers provide nuclear incident response, render safe capabilities, decontamination expertise, and consequence management expertise.<sup>5</sup>

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<sup>5</sup> See AFDP 3-72, *Nuclear Operations*, for additional information.

**Air Force Doctrine Publication 3-34, *Engineer Operations***



**Engineer Support Across the Competition Continuum**

## **STABILITY AND HUMANITARIAN OPERATIONS**

### **FOREIGN HUMANITARIAN ASSISTANCE**

Engineer competencies developed for wartime also lend themselves well to assisting NGOs during humanitarian crises. When a response is authorized, engineers respond with the following capabilities:

- ✦ Plan and construct surface transportation systems.
- ✦ Drill wells.
- ✦ Clear debris.
- ✦ Dispose of solid waste.
- ✦ Provide sewage treatment.
- ✦ Provide flood control.
- ✦ Construct relief centers and camps for dislocated persons.
- ✦ Provide environmental management to control hazardous waste and disposal.
- ✦ Provide potable water production and distribution.
- ✦ Provide emergency power and lighting.
- ✦ Restore public facilities and transportation routes.
- ✦ Provide incident command and emergency response.
- ✦ Construct temporary facilities for governmental services and others as required.

In supporting NGOs, it is critical to establish effective communications with an engineering liaison to coordinate and execute engineering support. Based on the severity of a disaster, the level of support can be limited or involve specialized Prime BEEF or RED HORSE capabilities.

### **FOREIGN NATION STABILITY ACTIONS**

This capability requires a different approach to planning. Stabilization tends to be of long duration, requiring sustained support of forces and significant resources. Engineers may be working within communities in high-threat areas, making FP a critical aspect of planning. Engineers assist local communities by providing emergency services and restoring essential services such as:

- ✦ Electrical power.
- ✦ Potable water production.
- ✦ Sewage treatment.

- ✪ Expedient repair of critical infrastructures, like shelters, clinics, schools, and roads.

Engineers also focus on permanent infrastructure development (e.g., roads, railways, airports, electrical power sectors, and municipal services). These projects should employ local populations and contribute to stabilization. While executing stability actions, the engineers focus on training HN personnel and assisting local communities in sustaining themselves. It is essential to involve the host population in all stages of the construction process, including planning, construction, maintenance, and operation of any facilities and infrastructure. Without host community support, the infrastructure may lack long-term value and purpose, ultimately becoming a waste of resources.

## **IRREGULAR WARFARE AND ARMED CONFLICT**

### **IRREGULAR WARFARE OPERATIONS**

Engineers building partnerships outside a secure area should be familiar with culture and languages while working with local nationals or combined forces. Engineers maintain the ability to assist communities in restoring essential services and becoming self-sufficient, reducing their dependence on insurgents, and reinforcing US support for the PNs. Commanders should consider employing the local populace to perform some tasks, even though it may be more efficient for engineers to do so in the long term.

### **ARMED CONFLICT**

Engineers provide combat support to the air component commander during military operations. Engineers provide sustainable installations as PPP through general, geospatial engineering installation support, installation services, emergency services, and building partnerships support across the full mission spectrum.

## **SUPPORT TO CIVIL AUTHORITIES**

### **HOMELAND OPERATIONS**

Engineer planning for homeland operations differs from major operations planning in the way it coordinates efforts between installations and the community. All other aspects of engineering beddown planning remain the same for homeland humanitarian and disaster response or contingency operations.

Additionally, engineers support joint task forces with DSCA in the immediate aftermath of natural or man-made disasters. When military support to civilian operations is approved, engineers assist federal, state, and local emergency response agencies. Engineers support the Federal Emergency Management Agency (FEMA) by providing beddown support as an incident support base or when the DoW establishes a base support installation, helping recover communities and missions as needed.



**New Jersey Air National Guard Engineers assist civilian authorities in Hurricane Sandy cleanup.**

## APPENDIX A: PRIME BEEF AND RED HORSE CAPABILITIES

This appendix describes the capabilities of Prime BEEF and RED HORSE teams when organized, trained, and equipped to support military operations. These are consistent with established precepts, typical operational plan phases, CE wartime task standards, and current joint engineer operations.

It is essential to differentiate between primary and secondary capabilities listed in the table below. A primary capability (P) is one in which the ability to perform the function is organic to the unit and is a specified task within the unit's mission, the unit is also equipped and trained to accomplish the task. A secondary capability (S) is one in which the unit has a limited ability (training, expertise, equipment) to achieve the task.

Note: Planners should refer to Air Force Generation (AFFORGEN) Support Plans for planning purposes. These documents describe the capabilities listed in more detail. Refer to Appendix B for more detailed capability descriptions.

KEY	
P-	Primary capability
S-	Secondary capability
1-	Prime BEEF Construction Trades
2-	RED HORSE
3-	Prime BEEF Explosive Ordnance Disposal (EOD)
4-	Prime BEEF Fire Emergency Services (FES)
5-	Prime BEEF Emergency Management (EM)
6-	Prime BEEF Specialized Team
Task	Type
ENGINEERING	
General Engineering	
The ability to develop, rehabilitate, and maintain bases and installations by providing design, real estate, construction, and environmental services, which extend through final disposition. Base development is accomplished through a process of planning, programming, project development, design, and construction.	
Base Denial	P <sub>1,2,3,4,5</sub>
Batch Plant Operations	P <sub>2</sub>
Contingency Contract Management	P <sub>1,6</sub> S <sub>2</sub>
Engineer Recon/Site Survey	P <sub>1,2</sub>
Explosive Demolition Operations	P <sub>2,3</sub> S <sub>1</sub>
Provide Technical Engineer Advice	P <sub>1,2,3,4,5,6</sub>
Quarry Operations	P <sub>2</sub>
Staff Augmentation (Air component commander staff)	P <sub>6</sub>
Targeting Assistance	P <sub>1,6</sub> S <sub>2</sub>

<b>Develop and Maintain Facilities</b>	
The ability to develop, rehabilitate, and maintain bases and installations by providing design, real estate, construction, and environmental services, which extend through final disposition. (Joint Capability Areas [JCAs])	
Area Lighting	P <sub>1</sub> S <sub>2</sub>
Asphalt Paving Operations	P <sub>1,2</sub>
Installation Management	P <sub>1</sub>
Berm and Dike Construction	P <sub>1,2</sub>
Concrete Paving Operations	P <sub>1,2</sub>
Construct Temporary Facilities	P <sub>1,2</sub>
Construction Materials Testing	P <sub>1,2</sub>
Construction Surveying	P <sub>1,2</sub>
Cybersecurity of CE industrial control systems	S <sub>1</sub>
Disease Vector Surveillance/Control	P <sub>1,5</sub> , S <sub>2</sub>
Erect Expeditionary Facilities	P <sub>1,2</sub>
Expedient Locksmith	P <sub>1</sub>
Fire Protection Systems	P <sub>1</sub> S <sub>4</sub>
Horizontal Construction	P <sub>2</sub> , S <sub>1</sub>
HVAC/Refrigeration Systems	P <sub>1</sub>
Lightning Arresting Protection	P <sub>1</sub> S <sub>2</sub>
Installation Development Planning	P <sub>1,6</sub>
Pest, Animal, and Vegetation Control	P <sub>1</sub> S <sub>2</sub>
Power Generation/Distribution Systems	P <sub>1,2</sub>
Project Management & Execution	P <sub>1,2,6</sub>
Project Planning & Programming	P <sub>1,2,6</sub>
Service Contract Management	P <sub>1</sub>
Vertical Construction	P <sub>1,2</sub>
Waste Collection/Disposal Systems	P <sub>1,2</sub>
Wastewater Collection/Disposal Systems	P <sub>1</sub>
Water Production/Distribution Systems	P <sub>1</sub> S <sub>2</sub>
Well drilling (up to 1500 feet)	P <sub>2</sub>
<b>Establish Lines of Communication (Airfield)</b>	
The ability to assess, construct, repair, and improve routes, railroads, intermodal facilities, and supporting infrastructure allows the speedy flow of personnel, supplies, and equipment into the theater and forward to tactical units.	
Aircraft Arresting System	P <sub>1,2,6</sub>
Airfield Damage Assessment/Repair	P <sub>1,2,3,5</sub>
Airfield Lighting and Marking	P <sub>1</sub>
Airfield Pavement Evaluation	P <sub>1,6</sub> S <sub>2</sub>
Asphalt/Concrete Milling Operations	P <sub>2</sub>
Asphalt/Concrete Paving Operations	P <sub>2</sub> S <sub>1</sub>
Installation Management	P <sub>1</sub>
Improve Airfields	P <sub>1,2</sub>

Limited CBRN Assessment/Support	P <sub>5</sub>
Limited Firefighting/EMS	P <sub>4</sub>
Limited Explosive Ordnance Disposal (EOD)/Unexploded Explosive Ordnance (UXO)/Improvised Explosive Device (IED) Clearance	P <sub>3</sub>
Revetments	P <sub>1,2</sub>
Snow/Ice Control	P <sub>1</sub>
<b>Repair and Restore Infrastructure</b>	
Rehabilitate critical infrastructure. This capability includes repairing or demolishing damaged buildings, restoring utilities such as electrical power, and bringing essential facilities such as hospitals, water treatment plants, and waste management facilities online. (JCAs)	
Airfield Damage Assessment/Repair	P <sub>1,2</sub>
Area Lighting	P <sub>1</sub> S <sub>2</sub>
Installation Management	P <sub>1</sub>
Facilities/Infrastructure Damage Assessment/Repair	P <sub>1,2</sub>
HVAC/Refrigeration Systems	P <sub>1,6</sub>
Petroleum and Liquid Fuels Storage and Distribution Systems	P <sub>1</sub>
Power Generation/Distribution Systems	P <sub>1,2,6</sub>
Waste Collection/Disposal Systems	P <sub>1</sub> S <sub>2</sub>
Wastewater Collection/Disposal Systems	P <sub>1,2</sub>
Water Production/Distribution Systems	P <sub>1,2</sub>
Well drilling (up to 1500 feet)	P <sub>2</sub>
<b>Harden and Protect Key Infrastructure and Facilities</b>	
The ability to apply site- and threat-adaptable plans and designs, advanced construction techniques, and materials to enhance the prevention or mitigation of hostile actions against materiel resources, facilities, and infrastructure. (JCAs)	
Fixed and Expeditionary Collective Protection	P <sub>1,2,5</sub>
Develop Force Protection Plans	P <sub>1,3,4,5</sub> S <sub>2</sub>
Provide Installation Force Protection Measures	P <sub>1,3,4,5</sub> S <sub>2</sub>
Passive defense measures, such as CDD, TAC-D, and DISO	P <sub>1</sub>
<b>Facility Design</b>	
The ability to integrate land use, bills of material and forecasts, and construction requirements facilitates project execution and development of infrastructure and facilities. (JCAs)	
Installation Management	P <sub>1,6</sub>
Installation Master Planning	P <sub>1,6</sub>
Project Planning & Programming	P <sub>1,2,6</sub>
Project Design	P <sub>1,2,6</sub>

<b>Geospatial Engineering</b>	
Portray and refine data about the geographic location and characteristics of natural or constructed features and boundaries to provide engineering services. Examples include terrain analysis, terrain visualization, digitized terrain products, nonstandard tailored map products, facility support, and force beddown analysis.	
<b>Use Geospatial Data</b>	
The ability to provide the joint force commander with the foundation layer of the operational environment for collaborative decision-support and terrain analysis tools. (JCAs)	
Geospatial Information Systems	P <sub>1,2</sub>
<b>INSTALLATION SUPPORT</b>	
<b>Real Property Life-Cycle Management</b>	
The ability to provide for the acquisition, operation, sustainment, recapitalization, realignment, and disposal of real property assets to meet the requirements of the force. (JCAs)	
Installation Management	P <sub>1</sub>
Installation Development Planning	P <sub>1</sub>
Staff Augmentation (Echelon Above Wing)	P <sub>1,3,4,5,6</sub>
<b>Provide Installation Assets</b>	
The ability to purchase, lease, program for construction, or gain real property installation assets by any other means, including all land, natural resources, anything growing on the land, buildings, structures, housing, stationary, mobile facilities, linear structures, firmly attached and integrated equipment (such as light fixtures), plus all interests in the property such as easements, oil and mineral rights, or use water and airspace. (JCAs)	
Installation Management	P <sub>1</sub>
Identify Facility Requirements	P <sub>1</sub> S <sub>2</sub>
<b>Facilities Support</b>	
The ability to provide functional real property installation assets with utilities, energy, water, and wastewater, contract and real property management, pollution prevention, and essential services throughout natural or man-made disasters. (JCAs)	
Installation Management	P <sub>1</sub>
Base Operating Support	P <sub>1</sub>
Design Management	P <sub>1</sub>
Utilities Security	P <sub>1</sub>
Operational Range Clearance (Testing & Training) Support	P <sub>3</sub>
Petroleum and Liquid Fuels Storage and Distribution Systems	P <sub>1</sub>
Real Property Collective Protection Systems	P <sub>1</sub>
Real Property HVAC/Refrigeration Systems	P <sub>1,6</sub>
Real Property Management	P <sub>1</sub>

Real Property Power Generation/Distribution Systems	P <sub>1,6</sub> ,
Real Property Waste Collection/Disposal Systems	P <sub>1</sub> ,
Real Property Wastewater Collection/Disposal Systems	P <sub>1</sub>
Real Property Water Production/Distribution Systems	P <sub>1</sub>
<b>Sustainment of Installation Assets</b>	
The ability to assess, preserve, maintain, and repair any built, natural, and cultural installation assets. Includes regular surveys and inspections and measures to comply with environmental and conservation requirements. (JCAs)	
Installation Management	P <sub>1</sub>
Environmental Program Management and Compliance	P <sub>1</sub>
Preventive Maintenance & Inspection of Installation Facilities, Utilities, Petroleum Distribution Systems, and Infrastructure	P <sub>1</sub>
<b>Recapitalization of Installation Assets</b>	
Perform the restoration, modernization, and replacement of installation assets to meet tenant requirements and comply with safety and environmental laws to include cleanup of contamination from hazardous substances, pollutants, and contaminants.	
Installation Management	P <sub>1,6</sub>
Installation Master Planning	P <sub>1,6</sub>
Project Design	P <sub>1,2,6</sub>
Project Management & Execution	P <sub>1,2,6</sub>
Project Planning & Programming	P <sub>1,2,6</sub>
Remediation/Restoration of Environmental Sites	P <sub>1,6</sub>
<b>Disposal of Installation Assets</b>	
The ability to conduct demolition and disposal activities resulting in the removal of installation assets from the asset inventory by any means, considering the impact on local communities. (JCAs)	
Installation Management	P <sub>1</sub>
Redeploy AF Expeditionary Facilities, Utilities, Infrastructure, and Vehicles/Equipment	P <sub>1</sub>
<b>Installation Services</b>	
Selected services not related to real property (or personnel services) to meet mission requirements.	
<b>Emergency Services</b>	
The ability to protect and rescue people, facilities, aircrews, aircraft, and other assets from loss due to accident or disaster. (JCAs)	

Aerospace Vehicle Mishap Response/Recovery	P <sub>1,3,4,5</sub>
Aircraft Rescue Firefighting	P <sub>4</sub>
All-Hazards Response	P <sub>4,5</sub> S <sub>1,3,6</sub>
Antiterrorism (Counter-IED Operations)	P <sub>3</sub>
Detecting, Sampling, and Analyzing/Identification of CBRN and Toxic Industrial Material (TIM) Hazards.	P <sub>5</sub> S <sub>3</sub>
Emergency Medical Service (Basic Life Support)	P <sub>4</sub> S <sub>1,2,3</sub>
EOC Operations	P <sub>5</sub> S <sub>1,3,4</sub>
EOD Initial Threat Assessment, Confirmation, Risk Mitigation, Site Stabilization	P <sub>3</sub>
Federal Agency & Civil Authority Support	P <sub>1,3,4,5,6</sub> S <sub>2</sub>
Fire Prevention	P <sub>1,4</sub>
Hazardous Material Incident Response	P <sub>4,5</sub> S <sub>1,2</sub>
Incident Command	P <sub>4</sub>
Integrated Early Warning	P <sub>5</sub>
Integrated Incident Management	P <sub>1,4,5</sub>
Mortuary Services—Explosive Hazard Analysis/Removal	P <sub>3</sub>
Nuclear Weapons/Accident Response	P <sub>3,4,5</sub> S <sub>1,2</sub>
Operational Range Clearance	P <sub>3</sub>
Spill Prevention and Control (Petroleum Distribution Systems)	P <sub>1</sub>
Structural Firefighting	P <sub>4</sub>
Structural/Aircraft Rescue	P <sub>4</sub>
UXO Recovery Operations	P <sub>3</sub>
Urban Search and Rescue	P <sub>4</sub>
WMD (CBRN) Incident Response	P <sub>3,4,5</sub> S <sub>1,2</sub>
Weapons Technical Intelligence	P <sub>3</sub>
<b>BUILDING PARTNERSHIPS (Shape)</b>	
<b>Build Capabilities and Capacities of Partners and Institutions</b>	
<b>Enhance Partner Capabilities and Capacities</b>	
Engineer Skills Training for Building Partnerships	S <sub>1,2,3,4,5,6</sub>

## APPENDIX B: PRIME BEEF, RED HORSE, AND OTHER SPECIALIZED TEAM CAPABILITIES DESCRIPTIONS

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### ENGINEERING

#### GENERAL ENGINEERING

- ✦ **Base Denial:** Removal of resources from a threatened area, rendering resources unusable by fire or explosives, removal of parts, contamination (other than by nuclear, biological, or chemical means), immobilizing, partially or destroying military equipment, supplies, or infrastructure.
- ✦ **Batch Plant Operations (Asphalt and Concrete):** Performing batch plant operations, training, procuring, maintaining the batch plant, designing, and planning asphalt and concrete batch mix and operations.
- ✦ **Contingency Contract Management:** Managing and inspecting construction and maintenance contracts and interpreting plans, specifications, and other contract documents and coordinating, evaluating, monitoring, and documenting contract activities and progress and preparing recommendations for contract modifications and reviewing material submittals for compliance with contract specifications and conducting pre-final, acceptance, and post-acceptance inspections.
- ✦ **Engineer Reconnaissance and Site Survey:** Conducting reconnaissance, site location, construction, and mapping surveys.
- ✦ **Explosive Demolition Operations:** Conducting explosive demolition for construction purposes, quarry operations, facility demolition, or base denial.
- ✦ **Provide Technical Engineer Advice:** Provide technical advice on general engineering and installation support (e.g., force beddown and sustainment, capabilities, and limitations, environmental concerns, installation geospatial data).
- ✦ **Quarry Operations:** Using explosives, rock drilling, rock crushing, and conveyor operations to produce aggregate to support asphalt and concrete operations.
- ✦ **Staff Augmentation (Echelon Above Wing):** Providing command force staff augmentation for operational planning, engineer management, technical design, construction management, C2 expeditionary site planning, and reporting in support of wartime or stability operations.
- ✦ **Targeting Assistance:** Providing advice on the effects of targeting to avoid unnecessary destruction of infrastructure and estimate repairs for friendly forces.

#### DEVELOP AND MAINTAIN FACILITIES

- ✦ **Area Lighting:** Installing, operating, and maintaining remote area lighting systems.
- ✦ **Asphalt Paving Operations:** Designing and constructing asphalt paved surfaces for lines of communication and other purposes.

- ✦ **Berm and Dike Construction:** Constructing and maintaining berms and dikes for FP and control of other resources.
- ✦ **Concrete Paving Operations:** Designing and constructing concrete surfaces required for lines of communication and other purposes.
- ✦ **Construction Materials Testing:** Performing soil exploration, classifying soils in field conditions, and determining the strength of materials.
- ✦ **Construction Surveying:** Determining distances, areas, and angles, establishing reference points for horizontal and vertical control, marking lines, grades, and principal points, preparing maps, and layout structures, determining the vertical and horizontal placement of utilities.
- ✦ **Construct Temporary Facilities:** Erecting temporary facilities and equipment, including wooden structures, storage structures, underground water, and power distribution systems.
- ✦ **Disease Vector Surveillance and Control:** Coordinating pest, animal, and vegetation control activities with medical personnel to address health hazards.
- ✦ **Erect Expeditionary Facilities:** Erecting expeditionary facilities and equipment to include deployable shelter systems, latrines, shower and shave units, environmental control units, generators, boilers, and water production equipment.
- ✦ **Expedient Locksmith:** Troubleshooting, repairing, and installing commercially manufactured locking devices such as key, combination, cipher, panic hardware and exit devices, and padlocks, this does not include General Services Administration certification unless line items require it.
- ✦ **Fire Protection Systems:** Inspecting, testing, repairing, and maintaining wet pipe, dry pipe, deluge, foam, and specialized fire protection systems.
- ✦ **Horizontal Construction:** Airfield repair and new construction, asphalt milling and paving, concrete repair, heavy earthwork including fuel and munitions berms, roads, and expedient airstrips and specific specialized capabilities quarry operations, asphalt batch plant operations, and concrete batch plant operations.
- ✦ **Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC/R) Systems:** Installing, operating, and maintaining HVAC/R systems, combustion equipment, and industrial air compressors.
- ✦ **Lightning Arresting Protection:** Installing, maintaining, testing, and troubleshooting lightning protection systems.
- ✦ **Installation Development Planning:** Comprehensive planning is conducted to address issues related to the installation's development. This involves defining goals, identifying problems, gathering information, developing alternatives, and selecting a preferred solution for implementation.

- ★ **Pest, Animal, and Vegetation Control:** Performing integrated pest management functions and conducting pest management surveys, determining pest management actions needed to control and prevent infestations by plant and animal pests.
- ★ **Power Generation and Distribution Systems:** Installing and operating electrical power production systems and equipment.
- ★ **Project Management and Execution:** Planning, organizing, and overseeing installation facility and infrastructure projects, ensuring the entire scope of work is accomplished by performance work statements and other predetermined criteria, on time and within budget.
- ★ **Project Planning and Programming:** Providing quality facilities needed to perform the mission. Ensuring project requests meet validated requirements, comply with all applicable standards, are programmed at the lowest lifecycle cost, achieve optimum resource efficiency, minimize damage to the natural and human environments, and are within authorities and available resources.
- ★ **Service Contract Management:** Validating contract requirements, preparing performance work statements, preparing surveillance plans, and conducting quality assurance evaluations for facilities operation and maintenance activities.
- ★ **Vertical Construction:** Managing, constructing, repairing, and modifying temporary or permanent structural systems and wooden, masonry, metal, and concrete buildings. Fabricating and repairing components of structures, utility systems, and real property including pre-engineered buildings and super spans.
- ★ **Waste Collection and Disposal Systems:** Establishing and maintaining field sanitary landfills or other similar systems for disposal of trash and refuse. Providing design and construction services for waste collection disposal.
- ★ **Wastewater Collection and Disposal Systems:** Installing, maintaining, and repairing wastewater collection systems. It does not include support for operating and maintaining domestic wastewater treatment plants. Wastewater disposal is limited to evaporation and facultative lagoons.
- ★ **Water Production and Distribution Systems:** Operating and maintaining water production in field conditions. Installing, maintaining, and repairing water production system components (e.g., pumps, valves, motors). It does not provide support to operate and maintain domestic water treatment plants. Installing, maintaining, and repairing water distribution piping systems (e.g., valves, fire hydrants, booster stations, well pumps, and chlorination).
- ★ **Well Drilling (up to 1,500 feet):** Drilling and piping groundwater sources to produce potable and non-potable water. Capacity is 6-inch-diameter wells to a maximum depth of 1,500 feet.

## ESTABLISH LINES OF COMMUNICATION (AIRFIELDS)

- ✦ **Aircraft Arresting System:** Installing equipment used to stop aircraft by absorbing its momentum via a mechanical, hydraulic, or pneumatic braking system for routine and emergency landings or aborted takeoffs.
- ✦ **Airfield Assessment Repair, Initial (RED HORSE):** Rapidly deploying to establish initial airfield operations with personnel from supporting units. Assessing airfield capabilities, preparing helicopter or aircraft landing areas, clearing obstacles, making expedient airfield damage repairs, and providing an initial assessment of required follow-on forces and material resources to establish airfield operations. It does not include the capture of airfields via forcible entry, operating on airfields controlled by other US or PN forces, or opening airfields not held by enemy forces.
- ✦ **Airfield Damage Assessment and Repair:** All actions, including damage assessment, explosive ordnance reconnaissance, minimum airfield operating surface selection, UXO hazard mitigation, pavement repair, airfield marking, airfield lighting, arresting system installation, and utility system repairs, required to establish, sustain, or recover flying operations capability at an airfield.
- ✦ **Airfield Lighting and Marking:** Installing and maintaining airfield lighting to permit night flying and defining the boundaries of an aircraft landing strip or pad. Note: RED HORSE does not support this capability.
- ✦ **Airfield Pavement Evaluation:** Performing tests and training personnel in airfield pavement standards, procuring and maintaining equipment, and generating reports.
- ✦ **Asphalt and Concrete Milling Operations:** Conducting asphalt and concrete milling operations. Heavy transport is required for milling equipment.
- ✦ **Asphalt and Concrete Paving Operations:** Conducting asphalt and concrete paving operations to include roads, taxiways, runways, ramps, ramp expansions, airfield damage repair, and other concrete operations. Heavy transport is required for paving equipment.
- ✦ **Improve Airfields:** Conducting pavement evaluations, expanding width and length of runways, reducing obstacles to air operations, improving runway surfaces, marking, lighting, arresting systems.
- ✦ **Limited UXO, EOD, and IED Clearance:** Performing rapid, narrow-scoped clearance of UXO, EOD, and IEDs needed for initial beddown and site survey operations. During this phase, the initial EOD teams should conduct surveys to determine the need for follow-on forces, with additional resources (people, equipment, and explosives) to conduct large-scale, sustained operations.
- ✦ **Limited Firefighting and EMS:** Containing or hindering the spread of fires and assisting trained firefighters in protecting RED HORSE resources.

- ✦ **Limited CBRN Assessment and Support:** Conducting limited site assessments to determine the presence of toxic industrial materials (TIM) or CBRN hazards, including aircraft CBRN contamination assessments.
- ✦ **Revetments:** Assembling and erecting revetments to protect aircraft, critical equipment, and facilities.
- ✦ **Snow and Ice Control:** Maintaining continuous mission capability by removing snow and ice from airfields and base pavements.

## REPAIR AND RESTORE INFRASTRUCTURE

- ✦ **Airfield Damage Assessment and Repair:** Assembling and installing fiberglass foreign object damage covers on runways, and assembling and installing aluminum matting for taxiways and ramps, based on aircraft use. Performing airfield marking operations.
- ✦ **Area Lighting:** Installing, operating, and maintaining remote area lighting systems.
- ✦ **Facilities and Infrastructure Damage Assessment and Repair:** Inspecting damaged facilities, determining the priority of repairs based on information provided from the emergency response plan, and performing expedient repairs and permanent repairs at a later time.
- ✦ **HVAC/R Systems:** Repairing HVAC/R systems, combustion equipment, and industrial air compressors.
- ✦ **Petroleum and Liquid Fuels Facilities:** Maintaining and repairing installation petroleum and liquid fuel tanks utilizing Water and Fuel Expedient Repair System (WaFERs) and similar capabilities.
- ✦ **Power Generation and Distribution Systems:** Maintaining, modifying, and repairing electric power generating and control systems.
- ✦ **Waste Collection and Disposal Systems:** Providing design and construction services for waste collection disposal.
- ✦ **Wastewater Collection and Disposal Systems:** Providing design and construction services for wastewater collection disposal.
- ✦ **Water Production and Distribution Systems:** Repairing water production system components and water distribution piping systems, and providing design and construction support for water distribution.
- ✦ **Well Drilling (up to 1,500 feet):** Drilling and piping groundwater sources to produce potable and non-potable water. Capability is 6-inch diameter wells to a maximum depth of 1,500 feet.

## **HARDEN AND PROTECT KEY INFRASTRUCTURE AND FACILITIES**

- ★ **Collective Protection:** Instructing the assembly of systems to the owner users to protect personnel inside a building.
- ★ **Develop Force Protection Plan:** Assisting in developing an FP plan consisting of specific measures to protect facilities and critical assets. Engineer aspects of the FP plan should include elements that contribute to protecting personnel and essential aspects of FP, such as site layout, barrier placement, berm construction, security lighting, backup power, water source protection, expedient hardening, terrain modification.
- ★ **Provide Installation FP Measures:** Protect personnel using site layout methods, barrier placement, berm construction, security lighting, backup power, water source protection, expedient hardening, and terrain modification.
- ★ **Passive Defense Measures:** Ensuring appropriate standoff, designing effective facility and road layouts, constructing berms, revetments, ditches, and fences, employing barriers, installing lighting, assisting in asset dispersal, deception activities, and facility hardening.

## **MASTER FACILITY DESIGN**

- ★ **Project Planning and Programming:** Identifying and validating requirements for facilities and infrastructure needed to satisfy current and future requirements, determining the most economical methods based on construction standards, developing estimates, obtaining funding, and developing a project timeline and schedule.
- ★ **Project Design:** Designing facilities and utilities to support the estimated population, mission, and anticipated life span.

## **GEOSPATIAL ENGINEERING: USE GEOSPATIAL DATA**

- ★ **Geospatial Information Systems (GIS):** Collecting and using GIS data for installation planning.
- ★ **Collect and Develop Accurate Information:** Collecting, extracting, and developing geospatial data to portray the operational environment accurately. Geospatial data provides the foundation for analysis and visualization.
- ★ **Data and Information Management:** Providing up-to-date data and information in pace with changes to the operational environment.
- ★ **Develop Geospatial Knowledge:** Identifying needed data, verifying data integrity, completeness, and consistency and constructing analysis as required to produce plans, decision-support aids, and providing actionable information for supported commanders and staffs.

- ✦ **Geospatial Visualization:** Assembling geospatial data for visual presentation to decision makers. Using standardized symbology and processes to assure quality products and services.
- ✦ **Share Geospatial Knowledge:** Distributing geospatial data and information through databases, standard and tailored products, and services to all echelons when and where needed.

## INSTALLATION SUPPORT

### REAL PROPERTY LIFE-CYCLE MANAGEMENT

- ✦ **Installation Master Planning:** Identifying requirements, planning alternatives, and proposing facilities and infrastructure to support assigned missions and operation plan requirements. Installation master planning is focused on the base layout, considering the environment, base infrastructure, and subsystems, ensuring requirements meet theater construction standards and comply with unified criteria.
- ✦ **Staff Augmentation:** Providing command force staff augmentation for operational planning, engineer management, technical design, construction management, C2 expeditionary site planning, and reporting in support of wartime or stability operations.

### PROVIDE INSTALLATION ASSETS

- ✦ **Identify Facility Requirements:** Coordinating with contracting and legal functions to purchase, lease, and program for construction, or gain installation assets, including all land, natural resources, buildings, structures, portable facilities, airfields, roads, and installed equipment.

### FACILITIES SUPPORT

- ✦ **Base Operating Support:** Directly assisting, maintaining, supplying, and distributing support of forces at the operating location to achieve the mission and maintain the operation of its infrastructure.
- ✦ **Cybersecurity:** Preventing damage to, protecting, and restoring control systems, including information contained therein, enables availability, integrity, authentication, confidentiality, and non-repudiation.
- ✦ **Design Management:** Providing technical support and contract management for planning and designing base infrastructure.
- ✦ **Installations and Facilities:** Providing, operating, maintaining, restoring, and protecting the built and natural infrastructure to support the USAF mission.
- ✦ **Operational Range Clearance (Testing and Training) Support:** Clearing operational ranges and testing and evaluation ranges of UXO. Normally, surface clearance, operational test, and evaluation of ranges sometimes require the recovery of deeply buried experimental ordnance.

- ★ **Petroleum and Liquid Fuels Facilities:** Operate and maintain petroleum and liquid fuel system facilities.
- ★ **Real Property Management:** Maintaining an accurate inventory of all USAF-controlled real property and real property installed equipment with descriptions of current physical condition, capacity, sizes, and uses.
- ★ **Real Property Power Generation and Distribution Systems:** Installing, operating, maintaining, and repairing electrical power production systems and associated equipment.
- ★ **Real Property HVAC/R Systems:** Installing, operating, maintaining, and repairing heating, ventilation, air conditioning, refrigeration systems, combustion equipment, and industrial air compressors.
- ★ **Real Property Waste Collection and Disposal Systems:** Developing performance work statements to procure waste collection and disposal equipment and services, developing waste management plans, and providing administrative oversight for waste collection and disposal activities.
- ★ **Real Property Wastewater Collection and Disposal Systems:** Installing, inspecting, maintaining, troubleshooting, modifying, and managing wastewater treatment systems.
- ★ **Real Property Water Production and Distribution Systems:** Installing, inspecting, maintaining, troubleshooting, modifying, and managing plumbing and water distribution systems.
- ★ **Utilities Security:** Establishing and executing a facility infrastructure utility program.

## SUSTAINMENT OF INSTALLATION ASSETS

- ★ **Environmental Program Management and Compliance:** Developing environmental plans to protect the health of the population, preserve the environment, reduce waste, and comply with international treaties, overseas environmental baseline guidance documents, and the final governing standards.
- ★ **Preventive Maintenance and Inspection of Installation Facilities, Utilities, and Infrastructure:** Providing practical assessment, maintenance, and repair of current assets and planning for future missions and regularly surveying the installation layout, facilities, and equipment, and performing preventive maintenance as needed.

## RECAPITALIZATION OF INSTALLATION ASSETS

- ★ **Installation Management:** The process of better quantifying, articulating, and managing risk, while supporting the mission with assets of the right size, condition, and cost to maximize the value and utility of built and natural infrastructure. Installation management applies standard levels of service across the USAF and integrates existing processes across all CE divisions and flights. Installation management provides resource visibility, supports advocacy and resource allocation,

and enables analysis to balance costs, risks, and benefits.

- ★ **Installation Master Planning:** Planning focused on the base layout, considering the environment, base infrastructure, and subsystems, ensuring all requirements meet theater construction standards and comply with unified facilities criteria.
- ★ Project Planning and Programming: See the previous description.
- ★ Project Design: See the previous description.
- ★ Project Management and Execution: See the previous description.
- ★ Environmental Cleanup: Conducting cleanup of spills and environmental contamination that poses imminent and substantial endangerment to the health and safety of US and PN forces and HN noncombatants.

### **INSTALLATION SERVICES: EMERGENCY SERVICES**

- ★ **Aircraft Rescue and Firefighting:** Firefighting actions taken to rescue persons and to control or extinguish a fire involving or adjacent to aircraft on the ground.
- ★ **All-Hazards Response:** Describing an incident, natural or man-made, that warrants action to protect life, property, environment, and public health or safety, and to minimize disruptions of government, social, or economic activities.
- ★ **Aerospace Vehicle Mishap Response and Recovery:** Supporting sortie generation and space operations by responding to airfield emergencies to render safe ordnance and aerospace launch platforms during inflight and ground emergencies. Planning, organizing, directing, and assisting in safing, removing, and disposing of explosive ordnance, explosive hazards, and classified components on or in operational aerospace platforms during crash situations.
- ★ **Antiterrorism:** Locating, identifying, and neutralizing explosive hazards and triggering devices, defeating criminal and terrorist explosive devices, training others on IED recognition, risks, and precautions, and providing terrorist response and terrorist consequence management planning and operations.
- ★ **Detect, Sample, and Identify CBRN and Toxic Industrial Material Hazards:** Locating CBRN and TIM hazards using CBRN detectors or monitoring or survey teams and collecting representative amounts of gas, liquid, solid, or characteristics of one of these, such as gamma or pH, to analyze and determine which CBRN or TIM material or pathogen is present.
- ★ **Emergency Operations Center:** The C2 support element directs, monitors, and supports the installation's actions before, during, and after an incident. The physical location where coordination of information and resources to support incident management activities usually occurs.
- ★ **EOD Initial Threat Assessment, Confirmation, Risk Mitigation, and Site Stabilization:** Obtaining as much information as possible to develop a plan of attack,

including gathering information on the perpetrator or target, threat analysis, employing detection assets, providing a safe approach, and conducting diagnostics.

- ★ **Emergency Medical Service (Basic Life Support):** Services provided to patients facing immediate medical emergencies occur outside military treatment facilities.
- ★ **Federal Agency and Civil Authority Support:** Assisting federal and civil authorities by preparing for, deterring, or responding to terrorist or criminal acts, accidents, finding explosive items, and other requests for support. (Note: Support includes US Secret Service, DoS, and Joint EOD very important person protection support activity taskings.)
- ★ **Fire Prevention:** Measures such as training, public education, plans, reviews, surveys/inspections, engineering reviews, and life safety code enforcement are intended to prevent the initiation of fire and minimizing consequences if a fire occurs.
- ★ **Hazardous Material Incident Response:** Responding to an incident where hazardous material is present. A hazardous material is a substance (solid, liquid, or gas) that when released, is capable of creating harm to people, the environment, and/or property.
- ★ **Incident Command:** Providing incident command system organizational element responsible for the overall management of the incident and consisting of the incident commander (either single or unified command structure) and any supporting staff.
- ★ **Integrated Incident Management:** Assisting with the broad spectrum of activities and organizations, providing effective and efficient operations, coordination, and support applied at all levels of government, using both governmental and nongovernmental resources to plan for, respond to, and recover from an incident.
- ★ **Mortuary Services-Explosive Hazard Analysis and Removal:** Detecting, identifying, and removing explosive hazards left on or embedded in human remains during port mortuary operations, theater remains processing, POW and MIA recoveries, mass fatality support operations, and other operations involving human remains.
- ★ **Nuclear Weapons, Weapons of Mass Destruction (WMD), and CBRN Accident and Incident Response:** Locating CBRN contamination, assessing the damage, and aiding in the recovery and cleanup following a WMD attack. For nuclear weapons, efforts include locating, securing, assessing, and recovering a nuclear weapon involved in an accident, and additionally preparing the recovered weapon for transfer to the Department of Energy.
- ★ **Operational Range Clearance:** Clearing active bombing and gunnery ranges in coordination with range management officials and environmental agencies.
- ★ **Petroleum and Liquid Fuels Spills and Mishaps Response:** Performing activities to stop spills and return installation petroleum and liquid fuel tanks to safe operational status in line with installation spill plans.

- ✦ **Structural Firefighting:** Performing rescue, fire suppression, and property conservation activities in buildings, enclosed structures, aircraft interiors, vehicles, vessels, aircraft, or properties involved in a fire or emergency.
- ✦ **Unexploded Explosive Ordnance Recovery Operations:** Clearing UXO during runway and airbase recovery operations and neutralizing hazards from explosive-related incidents, which, because of unusual circumstances, present a threat to operations, installations, personnel, or materiel.
- ✦ **Weapons Technical Intelligence:** Conducting post-blast analysis and explosive device exploitation to gather information to build a common picture of enemy capabilities, inform commanders of new enemy TTP, and support material developers in developing countermeasures.

#### **BUILDING PARTNERSHIPS: ENHANCE PARTNER CAPABILITIES AND CAPACITIES**

- ✦ **Engineer Skills Training for Building Partnerships:** USAF CEs are a valuable asset to building partnerships, providing skills, knowledge, and experience to assist local governments in recovery from disasters or becoming self-sufficient.
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## REFERENCES

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All websites accessed 2 March 2026.

**US AIR FORCE DOCTRINE:** <https://www.doctrine.af.mil/>

- ★ AFDP 3-0, [Operations](#)
- ★ AFDP 3-40, [Counter-WMD Operations](#)
- ★ AFDP 3-60, [Targeting](#)
- ★ AFDP 3-72, [Nuclear Operations](#)

### JOINT DOCTRINE

- ★ JP 3-34, [Joint Engineer Operations](#)
-