

**TM 3-34.83** (FM 3-34.280/20 Dec 04)

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**ENGINEER DIVING OPERATIONS**

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**August 2013**

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**HEADQUARTERS, DEPARTMENT OF THE ARMY**

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# Engineer Diving Operations

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**\*This publication supersedes FM 3-34.280, 20 December 2004.**

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## Preface

Technical Manual (TM) 3-34.83 provides the doctrinal basis and the responsibilities, relationships, procedures, capabilities, constraints, and planning considerations for the conduct of engineer underwater operations throughout an area of operations (AO). Its primary purpose is to integrate engineer underwater operations into the overall sustainment and mobility engineering structure. The doctrine presented is applicable for joint interagency and multinational environments in full spectrum operations.

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

Terms that have joint or Army definitions are identified in both the glossary and the text. Glossary references: The glossary lists most terms used in TM 3-34.83 that have joint or Army definitions. Terms with an asterisk in the glossary indicate that this manual is the proponent TM (the authority). Text references: Definitions printed in boldface in the text indicate that this manual is the proponent. These terms and their definitions will be incorporated into the next revision of Field Manual (FM) 1-02/Marine Corps Reference Publication (MCRP) 5-12A. For other definitions in the text, the term is italicized, and the number of the proponent FM follows the definition.

The proponent for this publication is the United States Army Training and Doctrine Command (TRADOC). Send comments and recommendations on Department of the Army (DA) Form 2028 (*Recommended Changes to Publications and Blank Forms*) directly to Commandant, United States Army Engineer School (USAES), ATTN: ATZT-CDC, 320 MANSCEN Loop, Suite 270, Fort Leonard Wood, Missouri 65473-8929. Submit an electronic DA Form 2028 or comments and recommendations in the DA Form 2028 format by e-mail to <leon.cdiddcoddengdoc@conus.army.mil>.

Army Regulation (AR) 25-30 mandates that all Army programs and functions will use the metric system. A listing of preferred metric units for general use is contained in Federal Standard 376B <http://www.usaid.gov/policy/ads/300/fstd376b.pdf>.”

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

## Chapter 1

# Engineer Diving Missions

Engineer divers provide support to assured mobility for the forward movement of troops and equipment. Divers also provide support to general engineering operations in and around water. Supporting assets range from a small scuba team to multiple larger teams with a diverse range of capabilities. Divers enhance protection by conducting force protection swims and emplacement of underwater obstacles and barriers. Divers also enable expeditionary logistics by providing accurate waterway datum, surveys, and repair of existing waterfront facilities. Engineer dive missions assist in build capacity through infrastructure support and sustainment operations. D

### MAJOR ESSENTIAL MISSIONS

1-1. Dive detachment capabilities are tailored to the mission allowing the use of the surface-supplied diving (SSD) apparatus, scuba, remotely operated vehicles, and work closely with heavy equipment operators for large scale operations. The following major essential missions are identified for engineer divers:

- Mobility/countermobility.
  - River-crossing operations.
  - Bridge inspection and repair.
  - Hydrographic survey.
  - Obstacle emplacement/reduction.
- Port opening, construction, and rehabilitation.
  - Planning and inspection.
  - Clearance.
  - Repair.
  - Construction.
  - Quality assurance inspections.
- Salvage. Refloat and rig for towing.
- Search and recovery.
  - Lift-bags and inflatable pontoons.
  - Support underwater investigations.
  - Personnel and equipment.
  - Side-scan sonar.
- Force protection (physical security).
  - Underwater security of bridges, ports, locks, and dams.
  - Physical security systems and searches.
- Ships husbandry.
  - In-water hull inspections.
  - In-water maintenance.
  - Damage control and repair.
- Joint logistics over-the-shore (JLOTS).
  - Hydrographic survey (beachhead).

- Mooring systems.
- Offshore petroleum distribution systems (OPDSs).
- Civil assistance/civil defense.
  - Humanitarian support.
  - Port rehabilitation/construction.
  - Peacetime missions.

## MOBILITY/COUNTERMOBILITY

1-2. Engineer dive detachments support the mobility of troops and equipment. Divers provide critical support to the engineer commander for wet-gap crossing sites. A dive detachment can support bridge reconnaissance for all bridging operations. Regardless of the crossing means, each site needs a dive detachment to reduce obstacles and develop exit points on the far shore.

1-3. Divers can inspect and repair fixed or floating bridges. FM 3-34.343 is an excellent resource detailing bridge inspections and repairs. Since the basics of bridge design are similar to pier design, the same inspections conducted on piers and pilings are conducted on bridge components. Divers make temporary or permanent repairs to bridges, depending upon the time available and the degree and type of damage to be repaired.

1-4. Divers also provide support to countermobility. This includes such things as bridge demolition and obstacle emplacement.

## RIVER-CROSSING OPERATIONS

1-5. FM 3-90-12 establishes doctrine for conducting river crossings. Maneuver commanders require up-to-date intelligence of crossing sites in order to choose the most appropriate site or sites. The theater engineer brigade normally provides an engineer diving element consisting of 4 to 5 divers to support river-crossing operations. Divers work closely with bridge units in order to provide accurate information for the crossing site commander. Divers conduct nearshore and far shore reconnaissance and perform bottom composition surveys. FM 3-34.170 gives details on the type of information required. This information may include the following:

- Gap width.
- Stream velocity.
- Nearshore and far shore bank composition and characteristics.
- Bottom composition.
- Obstacle type and location.
- Approach and bypass information.

1-6. The survey of a river-crossing site is similar to other hydrographic surveys conducted by divers. The degree of accuracy delivered will depend upon the commander's requirements and the threat level. In an unsecured location, engineer divers require support from security personnel.

1-7. Dive detachments facilitate emplacement of bridging by neutralizing underwater obstacles, constructing underwater bridge structures, performing in-water repair to bridging and watercraft, recovering sunken equipment, and/or searching for and recovering casualties. Once the bridging is emplaced, divers assist in installing impact booms, antimine booms, and antismimmer nets to prevent damage caused by waterborne munitions and collision by floating debris. Antismimmer nets are placed both upstream and downstream to protect bridges from enemy swimmers or underwater demolition teams.

1-8. Dive detachments also conduct inspections and surveys of deepwater fording sites. When divers cannot easily span the distance between banks, an inflatable boat or a bridge erection boat can be used. Helicopters may be used to drop teams in the water or place teams on the far shore if the situation permits. Engineer dive detachments routinely conduct river reconnaissance at night.



## BRIDGE INSPECTION AND REPAIR

1-9. Engineer divers also provide critical support to bridge crossing sites. Divers conduct both underwater and surface reconnaissance of bridges to determine structural integrity and capacity. Divers may be used to repair or reinforce bridge structures and neutralize underwater obstacles in and around the bridge. Divers may also assist in installing impact booms, antimine booms, and antiswimmer nets to prevent damage to bridging.

1-10. Engineer divers support countermobility by denying the enemy access to bridging assets. Divers can be used to survey, emplace, prime, and detonate explosives on bridge supports to degrade or destroy bridges.

## HYDROGRAPHIC SURVEY

1-11. Hydrographic surveys provide underwater bottom profiles of bank characteristics of operational shorelines or port areas. Products from a survey may indicate bottom depth gradients, ship channels, and the location and type of obstructions that may impede vessel traffic in addition to entry and exit point slope characteristics.

1-12. Hydrographic surveys can be done with two levels of accuracy. A hasty survey gives the commander a general idea of the bottom profile, but the degree of detail is correspondingly less. A deliberate survey produces more accurate results and provides a complete picture of the underwater profile and bank characteristics to include obstacles.

## OBSTACLE EMPLACEMENT/REDUCTION

1-13. Underwater obstacles can be man-made or natural and may include mines and other explosive devices. FM 5-102 and FM 5-34 show many examples of obstacles that can be adapted and emplaced underwater. Divers can locate, identify, and reduce underwater obstacles.

1-14. Divers can be used to emplace or reduce underwater obstacles. Divers use demolitions underwater to destroy obstacles. Many of the same principles and techniques for using demolitions above water are used when employing demolitions underwater. Divers use sympathetic detonation to clear in-water munitions. This is accomplished by emplacing demolitions on or near underwater obstacles.

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*Note.* Always detonate demolitions from the surface.

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1-15. A dive detachment is fully capable of using available materials to deny access to any site that has aquatic or vehicular traffic. Steel can be welded into hedgehog or tetrahedron configurations and concrete can be poured into block, cylinder, or tetrahedron molds. In the event of retrograde operations, the diving team is fully capable of rigging a bridge substructure with explosives for command detonation.

1-16. Divers can breach underwater explosive hazards. They use mine detectors and side-scan sonar to locate underwater explosive hazards. The explosive hazards are then marked and, if necessary, neutralized to create a safe lane for passage. Sympathetic detonation of underwater explosive hazards is accomplished by emplacing demolitions on or near the hazard, dependant on the type of fuzing mechanism. Divers can also identify explosive hazards for removal by qualified explosive ordnance disposal (EOD) teams.

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*Note.* The Army does not have EOD-trained diving teams.

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1-17. Clearing an underwater explosive hazard is a slow and deliberate process and should only be used when other alternatives for crossing have been exhausted. ATTP 3-90.4 and FM 3-34.210 give clear guidance on the breaching of minefields and explosive hazards.

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*Note:* Engineer divers can clear mined areas by using sympathetic detonation with demolitions. Divers can also locate and mark suspected mined areas.

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## PORT OPENING, CONSTRUCTION, AND REHABILITATION

1-18. Port facilities are key factors to the movement of personnel and material for any military operation. Port facilities can either be improved for friendly forces or destroyed to deny use by the enemy. Engineer divers can be used in either capacity and can assist in the planning of any port operation to help determine priorities of work or prepare work estimates. Port facilities that have been damaged by either natural or man-made causes can have damage to piers and quay walls prohibiting the on-loading or off-loading of supply vessels. Vessels may be either partially or completely sunken to deny passage of supply vessels. Port equipment such as cranes, vehicles, and materials handling equipment may be sunken near piers to deny access to vessel berths.

### PLANNING AND INSPECTION

1-19. Preliminary and detailed construction planning is accomplished before beginning construction work. Planning should include formulating a strategy for returning the port to operation as efficiently as possible. Headquarters should include a qualified planner (such as a team leader, executive officer, or senior/master diving supervisor) to identify diving requirements and to ensure proper allocation of diving assets. The planner assists in the development of an inspection plan and provides guidance to the inspection team for initial on-site surveys. After completing the initial inspections, the team leader designates the appropriate diving element most capable of performing the mission. In the event the operation requires extensive diving assets (such as major salvage, construction, or harbor clearance), multiple dive detachments may be task-organized to support the mission.

1-20. A completed inspection provides the water terminal commander with a report of the existing conditions of underwater port facility structures. A report may include a hydrographic survey depicting water depths, obstruction locations, and side scan sonar images. The information provided helps the area engineer and port construction units to determine the scope of construction required for port repair. The report may assist in the development of a port repair plan and time estimate.

1-21. A detailed report may include—

- Details of the port or facility.
- Assessment of underwater damage to existing pier facilities.
- Recommendations for restoration.
- The location and condition of sunken vessels or other obstructions.
- Water depths of ship channels within the port.
- Recommendations for vessel or obstacle removal.
- The location of underwater explosive hazards and munitions.

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*Note:* If the inspection is being done in an unsecure port, diving elements require the support of security personnel.

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### CLEARANCE

1-22. Clearance operations are undertaken to neutralize or reduce obstacles that are blocking the shipping channels in ports, loading facilities, mooring sites, marine railways, dry-dock facilities, lock and dam structures, and other navigable waterways. Clearance consists of locating, marking, surveying, and removing or reducing underwater obstructions. Operations include the removal of natural (underwater rock formations) or man-made obstacles, battle debris, or enemy-emplaced objects intended to prevent the use of navigable waterways or port facilities.

1-23. Demolitions provide an efficient method for reducing underwater obstacles in the port area. Most explosives are capable of being used underwater. Explosives are used to clear ship passages or to cut wreckage. In complimentary use with manual underwater-cutting techniques, explosive cutting has extensive application in cut-and-lift harbor clearance operations and in certain patch-and-pump situations when portions of an obstruction are refloated individually. Special precautions are required when employing demolitions underwater. Charges detonated near any vessel or personnel in the water can cause substantial damage or injury.

## **REPAIR**

1-24. The repair of port facilities is more desirable than initial construction because it is far less time and resource intensive. The repair may involve both underwater and surface operations and will depend on the close integration of both engineer divers and general engineer assets. Divers perform repairs to underwater structures such as bearing piles, fender and dauphin systems, and support walls. The inspection and repair of these structures may require specialized equipment. Repairs may be as simple as filling minor cracks with special epoxy; installing a concrete protective support jacket; or replacing wooden, steel, and concrete supporting structures and hardware. Repairs may be as extensive as major rehabilitation and replacement of the underwater structure supports.

1-25. The repair method used depends upon the original construction techniques and the material used in the initial construction. The construction techniques used are basically the same construction techniques used on the surface. However, underwater conditions (such as near to zero visibility and cold water) increase the time required to perform the same task as on the surface. The best analogy for planners to keep in mind is that just as efficiency decreases when Soldiers go to mission-oriented protective posture (MOPP) level 4, efficiency decreases when tasks have to be performed underwater.

## **CONSTRUCTION**

1-26. The construction of new ports and facilities is a major undertaking that usually requires extensive use of divers. Divers provide valuable information during the initial site selection and survey. Hydrographic surveys of the proposed area are conducted to determine water depths, sea-bottom contours, and the location of ship channels and underwater obstacles. The techniques for underwater construction are similar to the methods used on the surface.

1-27. Divers work with joint, interagency, intergovernmental, multinational port construction assets during construction operations. Heavy equipment necessary for port construction includes, but is not limited to cranes, pile drivers, and earthmoving equipment.

## **QUALITY ASSURANCE INSPECTIONS**

1-28. Divers provide a wide variety of inspections of waterfront facilities, vessels, and other submerged equipment. Quality assurance inspections depicts as-built or as is condition of the item being inspected. Quality assurance inspections provide the customer with the degree of quality of previously completed work by another party. Divers have the ability to provide live video feed to the surface enabling professional engineers to better determine structural damage and deterioration levels.

## **SALVAGE**

1-29. Major salvage operations include the clearance and removal of sunken vessels, equipment, supplies, or other materials from port channels, berthing and docking facilities, mooring sites, locks, dam facilities, and other navigable waterways. A diver's ability to salvage vessels or other equipment depends on the type, size, and location of the object and the time available for the salvage effort. Salvage methods range from simple operations to recovering sunken objects to large-scale operations requiring complex integration of surface-support assets, including multiple vessels and lift assets.

## **REFLOAT AND RIG FOR TOWING**

1-30. Dive detachments have the ability to weld or install temporary patches to achieve and regain water tight integrity. Once patches are installed and in-place, divers can use salvage pumps to dewater the object. After achieving buoyancy, the object can be extracted completely out of the water by the use of cranes, or be towed to deeper water for disposal.

1-31. The condition and disposition of a sunken object may dictate how it is to be salvaged. Raising a sunken object is a complex operation. The immediate tactical need to use a harbor or port may require the expedient removal of the obstruction. Unsalvageable vessels and other equipment can be marked and left in place, sectioned and removed, or flattened, dispersed, or settled with explosives.

## **SEARCH AND RECOVERY**

1-32. The majority of search and recovery operations conducted by divers are for missing personnel and/or sensitive items dropped or jettisoned. Engineer divers are not typically employed for lifesaving measures due to the time it takes to notify and mobilize a dive team.

## **LIFT BAGS AND INFLATABLE PONTOONS**

1-33. The use of lift bags, inflatable pontoons, and other floating devices will be dependent on the size, weight, and condition of the item being recovered. Dive detachments have the internal capability to float objects weighing up to 72,000 pounds without the need for welding patches and dewatering operations. Dive detachments can float objects or vessels by attaching lift bags to objects underwater and introducing air into the lift bags to float to the surface. Accurate information must be provided to the mobilizing dive team as early as possible in order to facilitate mission preparation. Pertinent information must be received from the requesting unit or personnel from the site location to retain information accuracy.

## **SUPPORT UNDERWATER INVESTIGATIONS**

1-34. Engineer divers can assist in underwater investigations to other government agencies by providing video, still, and/or sonar imaging of the site. Divers can also collect objects for investigators to examine on the surface. Divers may require on-site instructions before entering an investigation site to better facilitate evidence recovery.

## **PERSONNEL AND EQUIPMENT**

1-35. Divers assist in the search and recovery of equipment and casualties lost in or near water. The most important aspect of recovery operations is to have a clear idea of where the object or person was lost. Vague directions and indecisiveness will result in wasteful dedication of valuable work hours and decrease the likelihood of recovery. If possible, a person or vessel should remain in the immediate area, maintain security, and keep an eye on the objective. The success of the mission is facilitated by immediate notification and accurate information.

1-36. Engineer divers can perform underwater recovery operations, but often not within the time limits needed for emergency rescue. In the event that personnel are lost in or near water, divers may be used to conduct in-water searches for casualties. Recovery operations of this type are normally conducted using one or more dive elements to conduct a search of the area.

## **SIDE-SCAN SONAR**

1-37. If a recovery operation is conducted, there are several techniques that can be used to search underwater. The method chosen will depend upon many factors, including the size and sensitivity of the item. Environmental conditions such as the size of the search area, weather, surf, bottom topography, and underwater visibility will also affect the technique chosen. Using divers for an unaided visual search

over a large area is time-consuming and labor intensive. This type of search operation should incorporate the use of side-scan sonar and other search equipment whenever possible. A reconnaissance dive may be conducted before other scheduled dives to gather information that can save in-water time and identify any special hazards of the dive mission.

1-38. Diving skills are not recognized as a substitute for lifesaving skills. Tactical situations may require the use of engineer divers to prevent drowning. Such situations might include river-crossing operations where the far shore has been secured or during amphibious operations. Engineer divers are not trained, qualified, or equipped to perform as certified lifeguards and should not be used as such. Special training and equipment are required to safely perform lifeguard responsibilities. Agencies such as the American Red Cross can provide the necessary training and qualifications required for lifeguards.

## **FORCE PROTECTION (PHYSICAL SECURITY)**

1-39. Divers can be used to enhance protection in contingency operations or in response to national security concerns. Divers can be quickly deployed to emplace underwater security measures, visually check for tampering of ships, docks, piers, intakes, and other marine facilities targeted by the enemy. Planners and senior staff should be aware of the diver's capabilities and integrate them into any response plan.

## **UNDERWATER SECURITY OF BRIDGES, PORTS, LOCKS, AND DAMS**

1-40. Physical security of bridges, ports, locks, and dams may include both active and passive systems to protect or provide early warning of impending danger. Divers can assist in placing and maintaining physical security systems in port areas and waterways and on fixed bridges, locks, or dams. Divers provide security by swimming the area to be secured and providing an active early-detection system. Divers can perform physical security swims on the underwater portion of a vessel before it enters a facility or while it is moored outside a secured perimeter.

1-41. Divers must use specialized equipment when searching for mines or explosives. Although divers are capable of performing these inspections, they cannot remove any foreign explosive devices found during the inspection. The removal of these devices is the responsibility of underwater EOD teams.

## **PHYSICAL SECURITY SYSTEMS AND SEARCHES**

1-42. Physical security systems are not organic to a dive detachment's modified table of organization and equipment (TOE). Divers are used to place these systems at harbor entrances, along the open areas of port facilities, and around bridge abutments. The systems may be passive or active and are designed to stop or detect vessels, underwater swimmers, or floating mines. These systems usually require diving support for installation and maintenance. Barriers across a harbor entrance restrict approaches to the harbor. Electronic security systems are designed to detect and, in some cases, deter attacks by underwater swimmers. Divers place and secure the systems underwater after qualified personnel assemble the systems on shore. Periodic security swims are necessary on installed physical security systems to detect maintenance requirements and sabotage.

## **SHIPS HUSBANDRY**

1-43. Ship husbandry is the in-water inspection, maintenance, and repair of vessels. Vessels require periodic maintenance just like any other piece of equipment. Divers are tasked to provide maintenance assistance for these vessels to facilitate operational readiness.

## **IN-WATER HULL INSPECTIONS**

1-44. In-water inspections of military vessels are performed to assess the condition of the underwater hull and appendages. The inspections cover all parts of the vessel below the waterline and are part of the scheduled maintenance or damage assessment. The inspection provides the vessel master with the

information necessary to determine the condition of the vessel. These inspections provide the following information:

- **Hull.** Hulls are inspected to assess the damage and identify build-up from marine organisms growing on the hull, plus the condition of antifouling paint surfaces, and replacement of cathode protection devices.
- **Propulsion and steering systems.** The systems are inspected to check the condition of shafts, screw propellers, and rudders and the serviceability of protective coatings, seals, and bearings.
- **Vessel appendages.** Appendages are inspected to determine the general condition and operational ability.

## IN-WATER MAINTENANCE

1-45. In-water maintenance of military vessels is performed for scheduled maintenance or deficiency correction. In-water maintenance enables the Army water terminal commander to have immediate use of his watercraft. He can also keep the marine railway, dry dock, and other vessel maintenance facilities open for vessels requiring maintenance and repairs that divers cannot perform in the water. Divers provide in-water maintenance of propulsion and steering systems, sea chests, and heat exchangers; the clearing of lines, ropes, or other debris from the propeller; and the cleaning of any appendage located below the waterline.

## DAMAGE CONTROL AND REPAIR

1-46. Damage control and repair provides immediate assistance to a vessel in distress. Repairs are temporary in their application and are meant to keep the vessel afloat until permanent repairs are made. Divers can provide assistance ranging from installing small damage control plugs to welding on large patches. The vessel commander will direct the repair in coordination with the on-site diving supervisor.

## JOINT LOGISTICS OVER-THE-SHORE

1-47. JLOTS operations are the water-to-land transfer of supplies to support military operations. They are conducted over unimproved shorelines and through partially destroyed fixed ports, shallow draft ports not accessible to deep-draft shipping, and fixed ports that are inadequate without using JLOTS capabilities. Divers are an important asset during JLOTS operations because of the large number of watercraft involved in the transfer of supplies. The scope of JLOTS operations depends on geographical, tactical, and time considerations. JLOTS operations can replace terminals destroyed by enemy action, relieve congested lines of communication, reduce land transport distances in supporting combat forces, establishes terminal operations where none existed previously, supplement the capacities of existing fixed terminals (ports), or disperse supply and support operations.

1-48. As an initial step in planning a JLOTS operation, the terminal brigade or group commander selects beach sites. He may select beach sites based on intelligence information already on file in the theater or find it necessary to open new JLOTS beaches. Working with naval authorities, proposed sites are selected based on a study of maps, hydrographic charts, special reports prepared by intelligence agencies, and aerial reconnaissance reports. Final site determination is made after a beach reconnaissance party conducts a detailed ground and water reconnaissance of the selected areas.

1-49. Representatives of the terminal group commander organize and supervise the beach reconnaissance party. The commander of the battalion that is to operate the beach, the Operations and Training Officer (U.S. Army) (S-3), and other appropriate members of his staff make up a portion of the reconnaissance party. Other necessary members include, but are not limited to, engineer, signal, and quartermaster officers; representatives from amphibian and landing craft units; the Navy; military police; and units with special equipment.

1-50. Unloading and transporting supplies at sea may result in the loss of supplies into the water. Divers can recover these supplies quickly and assure continued support to fielded units. They can also assist vessel crews by clearing fouled anchor lines and screws.

1-51. The salvage of equipment during JLOTS operations is the same as that during normal salvage operations. Items salvaged can range from individual weapons and equipment to major equipment such as tanks or helicopters. Lift support is required from outside sources if the item to be salvaged is a large piece of equipment such as a tank.

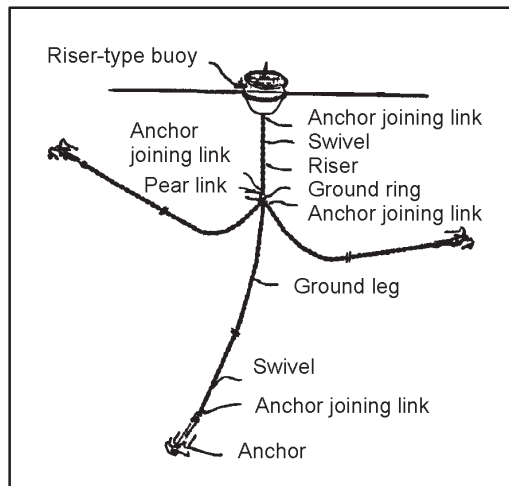
**HYDROGRAPHIC SURVEY (BEACH HEAD)**

1-52. Hydrographic surveys can provide the terminal brigade or group commander with a clear picture of underwater conditions at the selected sites. Products from a survey may indicate bottom depth gradients, ship channels, and the location and type of obstructions that may impede vessel traffic in addition to entry and exit point slope characteristics. Hydrographic surveys can be done with two levels of accuracy. A hasty survey is quicker to perform and will give the commander a general idea of the bottom profile, but the degree of detail is correspondingly less. A deliberate survey can take more time, but produces more accurate results and provides a complete picture of the underwater profile, including obstacles.

**MOORING SYSTEMS**

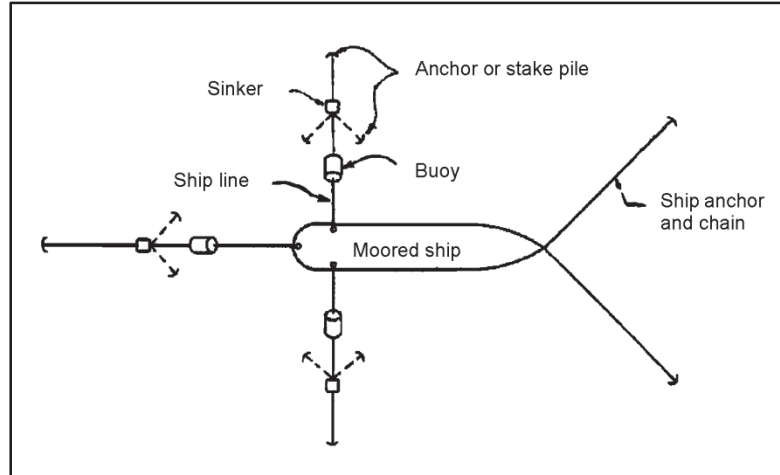
1-53. Divers can install and maintain offshore mooring systems to provide safe anchorage to cargo vessels, causeways, and landing craft supporting JLOTS operations. Mooring systems can be emplaced, maintained, and removed by divers. These mooring systems are a series of anchors and mooring buoys that allow a vessel to be anchored at a specific location to assist in the off-loading and on-loading of supplies.

1-54. Depending upon the type of vessel to be moored and the prevailing sea state or weather conditions, the anchors and buoys used may weigh many tons and be several meters long or several meters in diameter. A typical mooring system will consist of one or more anchors that lead to a mooring buoy. An example of a simple mooring system that allows a vessel to pivot around the buoy, depending upon the wind or current direction, is shown in figure 1-1.



**Figure 1-1. Single-point mooring system**

1-55. A more complex system using multiple anchor sites that keep a vessel in a fixed orientation is shown in figure 1-2. This type of mooring system is frequently used for petroleum distribution systems in order to avoid tangling flexible pipelines.



**Figure 1-2. Multiple-point mooring system**

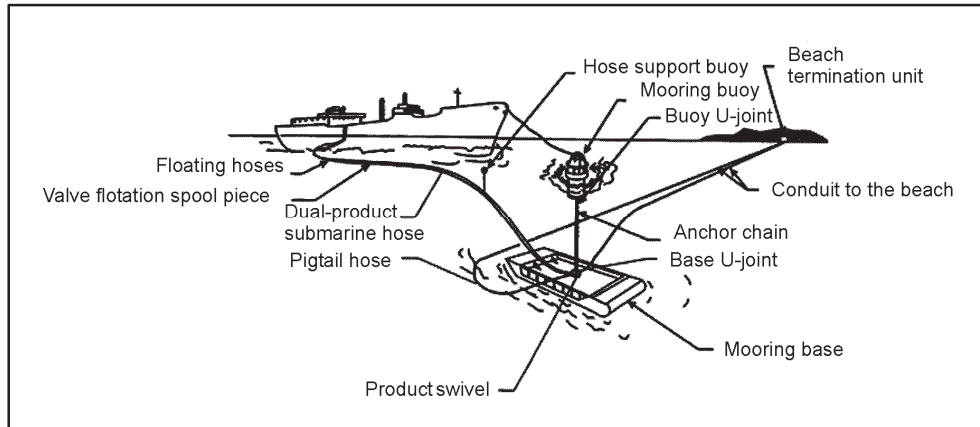
## OFFSHORE PETROLEUM DISTRIBUTION SYSTEMS

1-56. OPDSs are designed to facilitate the high-volume movement of bulk liquid cargo from ship to shore and are used extensively during fuel transfer operations. Port construction elements, engineer dive detachments, and transportation watercraft groups play an important role in the preparation, installation, repair, and operation of the OPDS in the joint operational area. FM 3-34.400 gives detailed instructions for the installation, inspection, and maintenance of the OPDS.

1-57. Figure 1-3 shows a single-anchor, leg-mooring system (SALMS) emplaced as a mooring station and discharge manifold. The SALMS provides a semipermanent installation for the bulk transfer of fuel directly from an offshore tanker to port storage. This system is employed during OPDS operations, and divers may be required to support it by—

- Performing hydrographic surveys to determine the beach gradient and underwater contour.
- Improving beach approaches.
- Clearing enemy-emplaced or natural obstacles from beach approaches.
- Supporting the installation of an OPDS.
- Connecting underwater pipeline components.
- Inspecting pipelines and their components.
- Performing maintenance on underwater pipeline components.
- Performing emergency repairs to damaged pipe sections.





**Figure 1-3. OPDS SALMS sunk to the bottom and acting as a mooring and discharge station**

1-58. The construction of a permanently installed submarine pipeline is not expected during mobilization. However, systems already in place may require extensive repair and maintenance.

1-59. The underwater components and mooring assemblies for all types of distribution systems require periodic maintenance support. Specific areas of repair and maintenance performed by divers are as follows:

- **Tanker hose discharge assemblies.** These connecting hoses are of various types and require periodic replacement of gaskets and damaged sections. Control valves located at pipeline connections require periodic lubrication and seal replacement.
- **Mooring systems.** Mooring systems prevent ship movement during petroleum transfer operations. Maintenance includes periodic inspection and replacement of chain hardware connections and worn chain sections. Surface marking buoys require periodic cleaning and replacement.
- **Pipelines.** Permanently installed pipelines need periodic inspection and maintenance to ensure watertight integrity.

1-60. Divers repair or replace pipe flange connections, damaged pipe sections, and concrete encasements. They also conduct security swims along the length of the pipeline to verify pipeline integrity.

## CIVIL ASSISTANCE/CIVIL DEFENSE

1-61. Dive detachments can be used by homeland security agencies to assist in crisis and emergency situations that encompass bodies of water. Dive detachment contact information should be included in the emergency response plan of the supporting agency.

## HUMANITARIAN SUPPORT

1-62. Dive detachments can be deployed abroad to provide support to countries devastated by natural or man-made disasters. Divers can employ multiple capabilities to assist in situations requiring immediate action and also provide continued support for rebuilding structures.

## PORT REHABILITATION/CONSTRUCTION

1-63. As a continued support, dive detachments can remove debris caused by damage and rebuild structures; clear a channel of obstacles and open waterways, establish temporary navigational routes, and repair waterfront facilities.

## PEACETIME MISSIONS

1-64. Divers support other government and nongovernment agencies requiring diving assistance. They provide diving services to the Army Corps of Engineers for routine dam inspections and maintenance and assist the local police or sheriff department in search and recovery efforts. Divers train with other military agencies in a joint effort of innovative readiness training missions.

## Chapter 2

# Engineer Diving Organizations

Engineer dive detachments support nearly all specialized underwater missions on the battlefield. Engineer dive detachments are relatively small, specialized organizations. They normally provide general support to the Army Service Component Command (ASCC) commander. They also provide direct support to commanders below ASCC level when approved by the ASCC commander. The dive detachment (TOE 05530LA00) may be assigned or attached to supported units anywhere within the AO.

### ENGINEER DIVE DETACHMENT

2-1. A dive detachment is normally assigned to the ASCC and attached to the senior engineer command (ENCOM) to support commanders in ports, harbors, and coastal zones. The detachment may be attached or assigned to a subordinate headquarters or task-organized with supporting units to provide direct support diving capabilities. Dive detachments are capable of providing salvage, construction, or survey support.

2-2. Engineer dive detachment missions include the following:

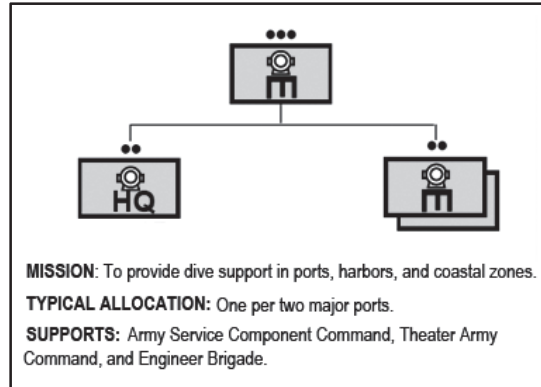
- Performs scuba and SSD to a maximum depth of 190 feet.
- Assists in constructing or repairing port facilities, logistics over-the-shore (LOTS) facilities, floating barriers, or bridges.
- Repairs damaged piers, docks, wharves, seawalls, breakwaters, bridges, locks, dams, pipelines, canals, or levees.
- Clears underwater obstructions and mark navigational waterways.
- Reduces and emplaces underwater obstacles and explosive hazards.
- Conducts underwater demolition.
- Recovers sunken material or vessels.
- Installs and maintains vessel moorings.
- Inspects and repairs watercraft.
- Collects underwater-terrain data in seas, ports, and rivers in support of port openings, LOTS operations, and river crossings.
- Installs and maintains the underwater portion of offshore petroleum and water distribution systems.
- Emplaces and installs underwater security systems.
- Performs security swims on vessels and facilities.
- Performs hyperbaric-chamber operations and emergency diving medical treatments.
- Conducts quality assurance inspections on underwater portions of marine facilities.
- Provides civil service support.
- Performs intermediate maintenance on diving life-support equipment, and maintain repair parts for diving equipment.
- Provides technical expertise and staff planning support to ASCC through brigade commanders.
- Provides assistance to bridging units in surveying sites, moorings, clearance, inspections, and maintenance.

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**Note:** While dive detachments are trained to perform underwater demolition operations, they do not perform underwater EOD operations. Specially trained EOD personnel must undertake these missions.

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2-3. An engineer dive team has enough personnel and equipment to conduct multiple diving operations concurrently. Figure 2-1 is an example of the organization of an engineer dive detachment. The responsibilities of Soldiers in the team are discussed below.



**Figure 2-1. Organization of an engineer dive team**

## COMMANDER (CAPTAIN)

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**Note.** The commander must be a qualified diving officer.

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2-4. The commander is responsible for all diving operations under his command and serves as the senior diving officer. The commander is the liaison to higher headquarters for diving matters.

## EXECUTIVE OFFICER/OPERATIONS OFFICER (FIRST LIEUTENANT)

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**Note.** The executive officer/operations officer must be a qualified diving officer.

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2-5. The executive officer/operations officer coordinates and assigns all diving missions for the detachment. He plans and schedules all training. The executive officer/operations officer also performs the duties of a diving officer during split-diving operations.

## MASTER DIVING SUPERVISOR (MASTER SERGEANT)

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**Note.** The master diving supervisor must be a qualified master diver.

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- 2-6. The master diving supervisor ensures that all diving operations are conducted safely. He also—
- Supervises demolition plans for training and operational missions.
  - Assists the commander with the liaison responsibilities to higher headquarters for diving matters.
  - Provides advice and expertise to staff planners and dive detachments.
  - Develops, writes, and implements doctrine.

- Regulates training and reviews safety material related to the accomplishment of diving missions.
- Implements equipment evaluations in conjunction with tactical command guidance and conducts routine safety inspections on the detachment's diving equipment.
- Oversees the operator through intermediate levels of maintenance of all assigned equipment.
- Supervises emergency medical or hyperbaric treatment for diving-related injuries.
- Performs equivalent duties as a first sergeant (E-8).

## **OPERATIONS NONCOMMISSIONED OFFICER/SENIOR DIVING SUPERVISOR (SERGEANT FIRST CLASS)**

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*Note.* The operations noncommissioned officer/senior diving supervisor must be a qualified master diver.

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2-7. The operations noncommissioned officer/senior diving supervisor performs duties as the senior diving supervisor during split diving operations. He—

- Ensures that all diving operations are conducted safely.
- Supervises demolition plans for operational and training missions.

2-8. The operations noncommissioned officer/senior diving supervisor assists the executive officer in the planning, scheduling, and the execution of training and operational missions. He—

- Provides expertise to staff planners and diving teams.
- Develops and writes doctrinal, regulatory, training, and safety material related to the accomplishment of diving missions.
- Supervises emergency medical or hyperbaric treatment for diving-related injuries.
- Supervises operator through intermediate levels of maintenance on diving and life-support equipment.
- Manages the unit's diver qualification program according to AR 611-75.
- Performs equivalent duties as a platoon sergeant.

## **DIVING SUPERVISOR (STAFF SERGEANT)**

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*Note.* The diving supervisor must be a qualified first-class diver according to appendix C of AR 611-75.

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2-9. The diving supervisor performs as a senior diver and diving supervisor during diving operations. He—

- Directs and supervises the preparation and operation of the diving equipment used during training and diving missions.
- Supervises the diving operation using externally driven power tools (hydraulic, electric, and pneumatic) and ensures the safety of the diver.
- Ensures that watercraft support to be used for transporting and/or as a diving platform is adequately sized to support the mission.
- Supervises and ensures accuracy of the calculations used in explosive applications.
- Supervises hyperbaric treatment operations of diving-related injuries, trauma, and other diving emergencies.
- Assists the master diver and diving officer during the preparation of the operations order.
- Coordinates and conducts the detailed planning portion of the diving operation.
- Supervises the operator through intermediate levels of maintenance on diving and other life-support equipment.

## SUPPLY SERGEANT (SERGEANT)

- 2-10. The supply sergeant performs as the supply sergeant for the team. The supply sergeant—
- Maintains diving supplies and repair parts.
  - Coordinates depot-level repair for diving and other life-support equipment.
  - Receives, inspects, and inventories installation supplies and equipment.
  - Operates the unit level computer and prepares all unit organizational supply documents.
  - Maintains the automated supply system for accounting of organizational and installation supplies and equipment.
  - Issues and receives small arms; secures and controls weapons and ammunition in security areas.
  - Schedules and performs preventive and organizational maintenance on weapons.
  - Inspects completed work for accuracy and compliance with established procedures.
  - Reviews and annotates changes to the unit material condition status report.
  - Inputs and updates data to include supporting transaction files into the organizational and installation property books.
  - Determines the method of obtaining relief from responsibility for lost, damaged, or destroyed supply items.

## LEAD DIVER (SERGEANT)

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*Note.* The lead diver must be a qualified salvage diver according to appendix C of AR 611-75.

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- 2-11. The lead diver performs as a lead diver. As lead diver he—
- Performs operator level and intermediate levels of maintenance on diving and other life-support equipment.
  - Prepares rigging and lifting devices, pumping equipment, and patching materials for salvage operations.
  - Prepares explosives for placement during training and demolition operations.
  - Assists the diving supervisor in the operational preparation, inventory, staging, and loading of equipment for diving operations.
  - Performs as the primary operator on air systems and underwater-support equipment during diving and recompression chamber operations.

## ENGINEER DIVING MEDICAL TECHNICIAN (SERGEANT)

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*Note.* The engineer diving medical technician must be a school trained diving medical technician and meet medical screening requirements in AR 40-501.

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- 2-12. The engineer diving medical technician performs as a diving medical technician. He—
- Acts as the inside tender during the hyperbaric treatment operations.
  - Assists the diving supervisor in the diagnosis and treatment of diving-related injuries.
  - Performs operator through intermediate levels of maintenance on the hyperbaric chamber.
  - Maintains all required medical supplies and medications on hand.
  - Coordinates pertinent medical training and medical supplies with the ASCC diving medical officer.
  - Assists the commander and operations officer in the planning and scheduling of medical training requirements for team members to maintain proficiency.
  - Screens medical records and monitors the medical condition of all team members.

## **DIVER (PRIVATE/SPECIALIST)**

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*Note.* A diver must be a qualified second-class diver.

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2-13. The diver performs as a diver. He—

- Performs diving tasks as directed from the diving supervisor or lead diver.
- Operates and performs operator level and intermediate levels of maintenance on diving and other life-support equipment.
- Operates externally driven underwater tools, emplaces demolitions, and performs as secondary air-systems operator during diving and recompression chamber operations.

## **LIGHT WHEELED VEHICLE MECHANIC (SPECIALIST)**

2-14. The light wheeled vehicle mechanic performs as a light wheeled-vehicle mechanic. He—

- Maintains power assisted brake systems, wheeled-vehicle suspension systems, wheeled-vehicle wheel/hub assemblies, wheeled-vehicle mechanical (manual) steering systems, wheeled-vehicle hydraulic (power) steering systems, and wheeled-vehicle crane/hoist/winch assemblies.
- Performs maintenance on nondiving and nonlife support equipment.
- Assists qualified divers with repairs to diving life support compressors, tools, and equipment.

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## Chapter 3

# Employment of Engineer Divers

The primary objectives of engineer diving operations are to conduct general engineering diving operations and to support mobility and countermobility operations anywhere on the noncontiguous battlefield. Engineer divers are also an integral part of a task organization that provides the means (for example, port construction/repair and bridging) for movement of logistics from port harbors, beachfronts, and rivers to forward units.

### COMMAND AND CONTROL

3-1. Engineers at the ASCC headquarters and the theater support command formulate the plans and requirements for port facilities (location, capacity, wharfage, and storage). The theater support command is responsible for port operations, including liaison with the Navy, Coast Guard, and other military services and authorized civilian agencies from the United States (U.S.) and allied countries.

3-2. Theater ENCOMs provide command and control to the ASCC engineer force and manage construction and repair tasks that cross-service boundaries and require divers. The theater ENCOM is the echelons above corps engineer headquarters responsible for constructing, maintaining, and repairing the sustainment base. When tasked, responsibilities include providing support to other allied military forces in joint or combined AOs. The number and type of engineer units in the theater ENCOM depends on the size of the sustainment base, availability of host nation support, and the perceived threat to the rear area. Engineer dive detachments are normally assigned to the theater ENCOM. If more than one theater ENCOM is in the AO, the detachments are assigned to the senior Army theater ENCOM. Diving assets may be further task-organized to subordinate headquarters for command and control based on mission, enemy, terrain and weather, troops and support available, time available, and civil considerations (METT-TC).

### ENGINEER DIVING SUPPORT PRIORITIES

3-3. Engineer diving expertise is required throughout the AO. The theater ENCOM commander allocates assets in the communications zone and combat zone according to the priorities established by the combatant commander. Since there are only a limited number of divers, the theater ENCOM commander may choose to allocate diving assets only to the most critical mission sites. Early integration of divers into the planning process is critical to successful diving missions.

3-4. Engineer diving tasks in the combat zone usually support engineer mobility and countermobility functions. In the communications zone, the tasks usually center on sustainment operations, such as port opening, heavy salvage, JLOTS, and ships husbandry. Divers also assist in immediate and interservice recovery operations.

### DIVING SUPPORT REQUEST PROCEDURES

3-5. After completing the engineer estimate, the theater ENCOM commander assigns divers to the appropriate organizational level. If a unit requires diving assets for underwater missions, the requests are forwarded through normal channels to the combatant command. Requests must include the mission details and the estimated time for work completion. Army Tactics, Techniques, and Procedures (ATTP) 3-34.84, table 1, provides an easy to follow request format for use by all services. The ASCC commander, who assigns diving priorities, will task approved requests to the ENCOM. For short-term missions, diving assets

are assigned in direct support through command channels to the requesting unit. For long-term or complex missions, divers normally establish a theater Army area command relationship with a company or battalion-size unit.

### **DIVER SUPPORT OF UNITED STATES AIR FORCE OPERATIONS**

3-6. Engineer divers can support Air Force immediate recovery operations for downed aircraft in ports or water locations to depths of 190 feet of seawater. The Combined Forces Air Command Air Force manager for these operations is the Survival Recovery Center. The Survival Recovery Center coordinates closely with the ENCOM. Air Force requests for immediate recovery operations go directly to the ENCOM, which responds according to combatant command mission priorities. Immediate recovery operations are usually assigned to divers as an on-order, direct-support mission.

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*Note.* Engineer dive detachments can conduct emergency medical treatment for altitude sickness.

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### **DIVER SUPPORT OF UNITED STATES NAVY OPERATIONS**

3-7. Engineer divers may support Navy operational commitments for construction, salvage, watercraft maintenance, and force protection dives. Navy maintenance organizations may request diving support through command channels to the ENCOM, detailing the urgent need for divers to support naval operations.

3-8. If divers are on-site supporting Army terminal operations, the Army water terminal commander may temporarily place the Army diving assets in direct support of a specific naval maintenance unit. This is based on work priorities and higher-command guidance.

### **DIVER SUPPORT OF UNITED STATES COAST GUARD OPERATIONS**

3-9. Engineer divers may support the United States Coast Guard operational commitments for ships husbandry. This includes—

- Surveying ports and harbors.
- Searching for and recovering equipment .
- Searching and locating sunken watercraft and vessels.
- Locating and marking expedient waterways and channels in the absence of accurate and available navigational charts.

### **DIVER SUPPORT OF THE HOST NATION**

3-10. Host nation support is common during port construction and repair. Engineer divers are requested through the higher command. The request must include the mission details and the estimated time for work completion.

3-11. Divers may also support host nation immediate recovery operations for civilian aircraft or equipment downed in ports or bodies of water. Civilian authorities request divers directly from the nearest engineer battalion, brigade, or area support group. These units forward requests to the theater ENCOM for approval. The assignment of diving support is done according to command guidance and workload. Immediate recovery operations are usually assigned to divers as an on-order, direct-support mission.

3-12. A dive team that consists of one or more personnel that can be sent on temporary duty, often to a foreign nation, to give instruction. The mission of the team is to train indigenous personnel to operate, maintain, and employ engineer divers or to develop a self-training capability in particular skills related to engineer diving. The National Command Authorities may direct a team, either military or civilian indigenous personnel, depending upon host nation requests.

## Chapter 4

# Considerations

There are many factors that affect the operation of engineer dive detachments. The primary considerations are the diving modes, environmental considerations, manning, equipment, external support, safety and risk assessment, and security.

### DIVING MODES

4-1. Engineer divers use two distinct modes of diving. These modes are discussed below.

### SCUBA

4-2. Scuba operations are normally conducted to give the diver greater mobility to cover a larger area. Under normal conditions, a scuba mission requires a minimum staffing level of four personnel. A typical scuba side has a footprint that is approximately 200 cubic feet and an approximate weight of 1,200 pounds. This footprint with air recharging capability will increase to 325 cubic feet and a weight of about 1,900 pounds. The weight of the storage container or 463L pallet used for shipping is not included.

4-3. The following is a list of standard equipment (figure 4-1):

- Four sets of scuba cylinders.
- Three diver kit bags.
- Two tending lines.
- Emergency medical equipment.
- Fifty pounds of diver's weights.
- One diver recall system.



**Figure 4-1. Standard equipment**

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*Note:* The basic equipment requirement for a routine scuba dive is described above. Additional equipment will be added to the equipment list dependent on mission location, description, and mission specific tools required.

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- 4-4. Missions for scuba diving may include the following:
- Search and recovery.
  - Inspection.
  - Ship husbandry.
  - Hydrographic surveys.
  - Obstacle emplacement and reduction.
  - Wet-gap crossing support.
  - JLOTS support.
- 4-5. Advantages of using scuba operations include the following:
- Rapid deployment.
  - Portability.
  - Minimum support requirements.
  - Excellent horizontal and vertical mobility.
- 4-6. Disadvantages of using scuba diving include the following:
- Limited endurance ( depth and duration).
  - Limited physical protection in a contaminated environment.
  - Influenced by the current.

## **SURFACE SUPPLIED**

4-7. Engineer divers working on heavy salvage or increased exposure missions require an uninterrupted air supply and physical protection from in-water hazards. SSD equipment provides air to the diver via a hose fed from a compressor or an air bank located on the surface. Additionally, SSD equipment includes a diving helmet and chafing gear worn by the diver to provide protection from the elements. Under normal conditions, a surface-supplied mission requires a minimum of seven personnel.

4-8. There are two main types of SSD operations—lightweight SSD (see figure 4-2) and standard SSD. Lightweight SSD operations can be accomplished with five personnel and equipment tailored more towards riverine, smaller-scale construction, and salvage operations. The air supply is significantly greater than scuba but can be limited by the amount of room available on the dive platform.

4-9. A lightweight SSD side has a footprint of about 350 cubic feet and a weight of about 1,600 pounds. This footprint with air recharging capability will increase to 625 cubic feet and a weight of about 2,500 pounds. The weight of the storage container or 463L pallet used for shipping is not included. The SSD side includes—

- Lightweight SSD kit.
- Six sets of scuba cylinders.
- Three diver kit bags.
- Four diving helmets.
- Three diving umbilicals.
- One air control console.
- One portable air compressor.
- Emergency medical gear.
- Diver communications equipment.

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**Note:** The basic equipment requirement for a routine lightweight SSD operation is described above. Additional equipment will be added to the equipment list dependent on mission location, description, and mission specific tools required.

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**Figure 4-2. Basic lightweight surface supplied dive side**

4-10. A standard SSD side (see figure 4-3, page 4-4) has a footprint of about 800 cubic feet and a weight of about 7,500 pounds. This footprint with air recharging capability will increase to 1,600 cubic feet and a weight of about 10,000 pounds. The weight of the storage container and compressors are included.

4-11. A standard SSD kit (800 cubic feet; 7,500 pounds) includes the following:

- Special divers air supply system.
- Three diver kits bags.
- Four diving helmets.
- Three diving umbilicals.
- One air control console.
- One large volume air compressor.
- Emergency medical gear.
- Diver communications equipment.
- Diving oxygen gas cylinders (used during decompression dives).

4-12. Missions for SSD include the following:

- Clearance.
- Inspection.
- Light or heavy salvage.
- Ships husbandry.
- Port construction or rehabilitation.
- Obstacle emplacement or reduction.
- JLOTS support.



**Figure 4-3. Standard surface supplied dive side**

4-13. Advantages of using a SSD kit includes the following:

- Unlimited air supply (longer duration).
- Maximum physical and thermal protection (safety).
- Communication capabilities.

4-14. Disadvantages of using a SSD kit includes the following:

- Limited organic lift assets to move equipment (logistics support is required).
- Larger deployable footprint than scuba.

## **ENVIRONMENTAL CONSIDERATIONS**

4-15. The mission, available divers, and weather help determine the type of diving and the equipment used. SSD provides the best safety for the diver and enhances the supervisor's ability to control and direct the divers underwater. Special equipment may be required to provide additional protection for the diver in extremely cold or polluted waters. Factors that influence the selection of diving teams include the following:

- Current.
- Tide.
- Visibility.
- Bottom condition and type.
- Sea state and wave height.
- Air temperature.
- Water temperature.
- Depth.
- Pollutants.

## **CURRENT**

4-16. A diver's ability to work effectively and efficiently is directly affected by the velocity of the current. Scuba divers can navigate in currents up to 1 knot or 0.5 meters per second without difficulty. Currents in

excess of 1 knot or 0.5 meters per second, however, creates conditions that could tire the diver quickly and depletes the available air source much faster than in normal diving condition. Surface-supplied divers are normally lowered onto the project or to the sea floor and walk to and from the objective. SSD divers have an unlimited air supply and may wear additional weights for stability and assist in movement in and around the diving area. SSD divers can navigate in currents up to 2.5 knots or 1.3 meters per second without much difficulty. Past diving operations have shown that engineer divers have the ability to work in currents in excess of 4 knots after various controls have been emplaced by the master diver on-site. Surface current velocity greatly affects the ability of the diving platform to maintain a moored position. Additional mooring systems must be emplaced to safeguard topside personnel and the working divers in the water. Normal working limitations are shown in table 4-1.

**Table 4-1. Normal working limitations**

<i>Equipment Type</i>	<i>Depth (Feet)</i>	<i>Water Current (Knots)</i>	<i>Water Current (Meters per Second)</i>	<i>Water Current (Feet per Second)</i>
Surface-supplied	190	2.5	1.3	4.27
Scuba	190	1.5	.77	2.53

**TIDE**

4-17. Tide can greatly influence the current and limit opportunities to conduct diving operations. Divers may have to synchronize diving operations to correspond favorably with the periods of lower tidal flows. In some parts of the world, tidal flows can reach many meters per second and change drastically within a 1-hour period. Tide can also affect the depth of the dive which will add additional safety precautionary measures to the diving operation. While certain portions of the world have a tidal range of only inches between high and low tide, other parts of the world can have a tidal range of over 50 feet between high and low tide. Extreme tidal flows also affect the positioning of the diving platform and its ability to maintain position.

**VISIBILITY**

4-18. Divers work and are accustomed to working in water of near zero to zero visibility conditions. Divers working under these conditions operate strictly through sense of touch. The use of underwater lights may increase the visibility, but due to the suspended particles in the water, light is often reflected right back at the diver, negating any benefit. Lack of visibility can affect the duration of the assigned task. Searches for relatively small objects will take considerably longer in zero visibility water since divers have to resort to crawling on their hands and knees over the entire search area. Underwater construction and cutting and welding operations will take longer due to the extreme precautionary measures that the diver must take to avoid any accidental cutting. In extremely cold water conditions, a decrease in efficiency will be evident due to loss of manual dexterity. The use of thick gloves or mittens may be required for use in extremely cold water conditions which perpetuates inefficiency.

**BOTTOM CONDITION AND TYPE**

4-19. The bottom condition and type can drastically affect the efficiency of a diver by hindering both visibility and mobility. See table 4-2, page 4-6, for a listing of bottom types and the effects on divers.

**Table 4-2. Bottom conditions and effects chart type characteristics visibility diver mobility on bottom**

<i>Type</i>	<i>Characteristics</i>	<i>Visibility</i>	<i>Diver Mobility on Bottom</i>
Rock	Smooth or jagged, minimum sediment	Generally unrestricted by diver movement	Good. Exercise care to prevent line snagging and falls from ledges.
Coral	Solid, sharp and jagged, found in tropical waters only	Generally unrestricted by diver movement	Good. Exercise care to prevent line snagging and falls from ledges.
Gravel	Relatively smooth, granular base	Generally unrestricted by diver movement	Good. Occasional sloping bottoms of loose gravel impairs walking and causes instability.
Shell	Comprised principally of broken shells mixed with sand or mud	Shell-sand mix does not impair visibility when moving over the bottom. Shell-mud mix does impair visibility. With higher mud concentrations, visibility is increasingly impaired.	Shell-sand mix provides good stability. High mud content can cause sinking and impaired movement.
Snad	Common type of bottom, packs hard	Generally unrestricted by diver movement	Good
Mud and silt	Common type of bottom, composed of varying amounts of silt and lay, commonly encountered in river and harbor areas	Poor to zero. Work into the current to carry silt away from the job site, minimize bottom disturbance. Increased hazard presented by unseen wreckage, pilings, and other obstacles.	Poor. Can readily cause diver entrapment. Crawling may be required to prevent excessive penetration. Fatiguing to the diver.

### SEA STATE AND WAVE HEIGHT

4-20. The term sea state generally refers to the condition of the waves and wind. The sea state can affect the divers' ability to safely enter and exit the water and affects topside support personnel when performing their assigned tasks. Wave action can affect the stability of the moor and subject the crew to unsafe conditions and seasickness. Additional mooring systems may be used to assist in the stabilization of the dive platform, but increases the possibility of entanglement for the divers working underwater.

4-21. Divers are not particularly affected by the action of surface waves unless operating in the surf zone, shallow waters, or if the waves are exceptionally large. Surface waves may become a serious problem when the diver enters or exits the water and during decompression stops near the surface.

### AIR TEMPERATURE

4-22. Affects of air temperature on the diver is more adverse upon exiting the water. Divers will be more susceptible to chilling after a long duration dive when fatigue and dehydration has set in. Personnel on topside support will have to endure the condition for the duration of the operation and are more susceptible to the affects of the ambient temperature.

### WATER TEMPERATURE

4-23. A diver's physical condition, amount of body fat, and thermal protection equipment determine how long exposure to extreme temperatures can be endured safely. In cold water, ability to concentrate and work efficiently will decrease rapidly. In water temperatures between 73° Fahrenheit (F) and 85°F, divers can work comfortably in their wet suits, but will chill in 1 to 2 hours if not working strenuously. In water



temperatures above 85°F, the divers may overheat. The maximum water temperature that can be endured, even at rest, is 96°F. At temperatures below 73°F, unprotected divers will be affected by excessive heat loss and become chilled within a short period of time. In cold water, the sense of touch and manual dexterity decrease in time and the ability to work with the hands are affected.

## **DEPTH**

4-24. The depth of the dive limits the diver's bottom time. The depth and duration of the dive determines the selection of the diving media. The diver's bottom time is also limited by physical and environmental conditions. The depth of the dive will also affect the footprint of the dive team. Deeper dives often require decompression procedures which increases the manning requirement. Dives are classified as decompression or no-decompression dives.

### **Decompression Diving**

4-25. The decompression requirement is a major concern for a dive team. Increasing depths coupled with longer dive durations will increase decompression obligations. Longer decompression obligation for a diver increases the chance for serious and debilitating injuries due to decompression sickness.

4-26. The SS521-AG-PRO-010 includes decompression tables that are used to determine the rate of ascent and the time required to stop for decompression. These tables must be followed during ascent to ensure that the diver receives adequate decompression and mitigates the possibility of diving-related injuries. Decompression sickness may range from slight pain to extensive paralysis; severe cases may result in complete stoppage of major organ functions and death.

4-27. The following are the special considerations for decompression diving:

- Divers are limited to the number of dives they can safely perform in any given period.
- Decompression dives must be performed using SSD equipment.
- Planned decompression dives require the presence of a master diver and a diving officer.
- A recompression chamber must be available at the site during decompression dives.
- A recompression chamber must be available on-site according to the SS521-AG-PRO-010.

### **No-Decompression Diving**

4-28. No-D tables in the SS521-AG-PRO-010 limits the maximum time a diver can spend at a specified depth without requiring decompression. Divers performing no-decompression dives can safely ascend to the surface traveling at a prescribed rate without decompression stops. No-decompression dives can be performed in scuba or SSD equipment.

### **Altitude Diving**

4-29. Divers may be required to dive in bodies of water at higher altitudes. Planning should address the effects of the atmospheric pressures that may be much lower than those at sea level. Standard decompression tables are authorized for use at altitudes up to 300 feet above sea level without corrections. Refer to the SS521-AG-PRO-010 for the corrections and altitude diving protocols for altitudes above 300 feet. Transporting divers out of the diving area, which may include travel to higher elevation by a vehicle or aircraft, requires special consideration and planning.

## **POLLUTANTS**

4-30. Several types of pollution can impact the divers' safety. A detailed list of constraints and safety precautions diving in contaminated waters can be found in SS521-AJ-PRO-010. Primary types of pollution that divers routinely encounter are—

- Thermal pollution.
- Chemical contamination.
- Biological contamination.

4-31. Certain pollutants require divers to wear additional personal protective equipment. A dry suit or hazardous material diving suit may be used dependent on the type of pollutants present. The dive team's overall footprint will be dependent on the decontamination efforts and safety precautions required by the contaminant.

## **MANNING**

4-32. As few as four divers are required to safely conduct routine dive operations. Construction and salvage diving operations normally require 12 to 15 divers. Requirements depend on the mission, diving mode, and environmental conditions. Engineer dive detachments are structured to work independently due to the limited availability of outside diving support. All divers are required to support dive station functions, such as arecompression chamber operator, diver tender, machinery/compressor operator, radio operator, logs keeper, and winch operator. Dive detachments often provide their own drivers, mechanics, boat operators, and medics. Two divers are normally required to conduct construction and salvage missions which increases topside personnel support. Safety is the key factor in considering manning requirements. A dive detachment operating with insufficient personnel will compromise the accomplishment of the mission and safety of the diver. The minimum staffing levels required for various types of air diving operations are shown in AR 611-75.

## **EQUIPMENT**

4-33. Divers have a large selection of equipment to draw from in order to accomplish their mission. The divers' equipment list enhances their array of capabilities.

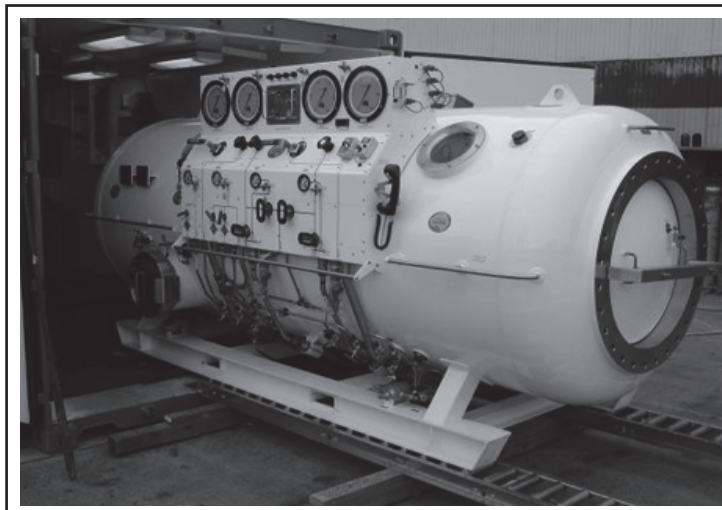
## **COMPRESSORS AND AIR SUPPLY**

4-34. Divers have several different compressors to supply air for either scuba or SSD. Divers also have bulk air storage systems that are used to store and deliver air to surface-supplied divers.

## **RECOMPRESSION CHAMBER**

4-35. The recompression chamber (see figure 4-4) is used to treat decompression sickness (also referred to as the bends) or during surface decompression diving operations. The chamber may be used to treat diving injuries, such as decompression sickness or air-gas embolisms. When pressurized with air, the chamber can simulate the pressure placed on the human body by a corresponding depth of water. Immediate recompression of the stricken diver in the hyperbaric chamber reduces the size of the lodged air bubbles within the bloodstream and restarts blood flow to the tissues. The stricken diver breathes 100 percent oxygen, which further aids in bubble resolution and absorption. Treatment tables listed in the SS521-AG-PRO-010 dictate the depth and duration of the treatment

4-36. based on the differential diagnosis. The hyperbaric chamber can also be used to perform surface decompression for certain types of decompression dives.



**Figure 4-4. Standard Navy double-lock recompression chamber**

## **UNDERWATER TOOLS**

4-37. Divers have a large variety of hand- and hydraulic-powered tools that are used in construction and salvage. The hydraulic tools include drills, jackhammers, impact wrenches, and chain saws. The detachments have the power supply for the tools and are virtually self-sufficient. Engineer diving teams also have specialized cutting and welding equipment for underwater operations.

## **CAMERAS**

4-38. Diving detachments employ underwater cameras, video equipment, and remotely operated vehicles that allow them to take digital pictures or videos of ongoing work, for inspections, or for quality assurance. The pictures or videos can be sent directly to commanders to provide an accurate picture of the underwater conditions.

## **HYDROGRAPHIC SURVEYING AND SONAR EQUIPMENT**

4-39. Engineer diving detachments are equipped with side-scan sonar and hydrographic surveying equipment. This equipment is ideal for conducting surveys of rivers, ports, and harbor bottoms. Obstacles and hazards to navigation can be identified and charted to inform vessel captains and crossing site commanders to safely plan and conduct their operations.

## **EXTERNAL SUPPORT**

4-40. Dive detachments may require support from other units to accomplish the mission and safely conduct diving operations.

## **MAINTENANCE**

4-41. Dive detachments are trained to perform operator through direct-support level maintenance on diving equipment. The teams have the capability to perform operator through intermediate support level maintenance on their vehicles and motorized equipment, but require support for direct support level maintenance.

## MEDICAL

4-42. Dive detachments have medical technicians specially trained in diving-related injuries but require support for more advanced forms of medical care. Senior rated divers are trained to provide specialized treatment for many diving-related injuries. Advanced diving medical care is normally provided by a diving medical officer. A diving element requires either direct or indirect ability to contact a diving medical officer. A diving medical officer offers additional medical advice to the diving supervisor during the treatment of diving-related injuries.

## MOBILITY

4-43. Dive detachments do not have the organic ability to pick up or move large and heavy equipment. The hyperbaric chamber, the underwater construction set, SSD set, compressors, and air storage systems require materials-handling equipment. Engineer diving teams may require augmentation with transportation support to move unit equipment once deployed to an AO.

## GENERAL

4-44. Dive detachments are not structured to have the general and administrative support they require. Divers depend on support units for the following combat support and survivability needs:

- Enemy air attack suppression.
- Enemy indirect-fire suppression.
- Scatterable- and fixed-mine clearing.
- Chemical, biological, radiological, and nuclear decontamination.
- Ammunition.
- Survivability position construction.
- Religious, legal, financial, personnel, and administrative support.
- Field feeding.
- Communication and security equipment maintenance.
- Power generation equipment maintenance.

## SAFETY AND RISK ASSESSMENT

4-45. Many Soldier tasks that are performed on the surface have some degree of risk associated with them. Performing those same tasks underwater often increases the associated risks. Many of these risks can be reduced or mitigated through the application of risk management. Following established diving doctrine as outlined in SS521-AG-PRO-010 reduces many of the risks associated with diving operations. The risk assessment of the type of work performed will identify the specific risks associated with a task and the appropriate countermeasure.

4-46. As the risk assessment is conducted, particular attention must be paid to underwater conditions. In many instances, little to nothing is known about a particular underwater environment. Surface conditions such as temperature, wind, and waves are not always indicative of the conditions the diver will be facing. Water temperature can vary as the diver descends or works in thermo clines. Currents can change direction and intensity as tidal flows change. Visibility can change as the diver works on the bottom or through a ship traffic channel that stirs up the bottom.

4-47. Diving-related injuries, such as decompression sickness and arterial gas embolisms, have been known to occur in divers that have followed established safety procedures and diving protocols. The occurrence of these injuries does not in itself indicate that an unsafe act occurred. Any diving-related accident should be investigated according to the procedures outlined in AR 385-10.

4-48. Divers should not fly for at least 24 hours following a decompression dive or for 12 hours after surfacing from a no-decompression dive. Refer to table 9-6 in the SS521-AG-PRO-010 for surface interval requirements before traveling to higher elevation.

## SECURITY

4-49. Engineer dive detachments are not structured to conduct diving operations and sustain security operations simultaneously. Tasked dive teams are manned at a minimum staffing level to support split diving operations. Every member of the team is selected to perform a specific function for the duration of the diving operation and cannot deviate from the task.

4-50. Dive detachments do not possess crew-served or large-caliber weapons and should not be used in an offensive capacity. Diving operations in unsecured environments will require security forces support.

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## Appendix A

# Engineer Dive Field Overview

### FLOW OF INFORMATION

A-1. The chief diving supervisor (CDS) facilitates the flow of information to higher commands down to the engineer dive teams. See figure A-1.

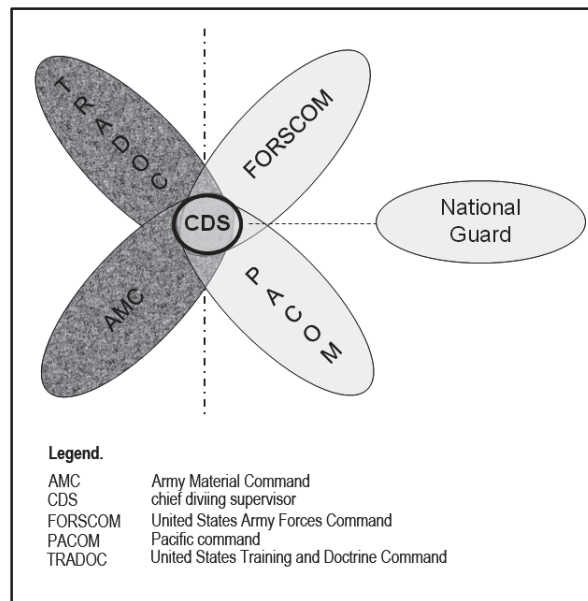


Figure A-1. Information flow

### UNITED STATES ARMY FORCES COMMAND

A-2. The United States Army Forces Command contains the following five Active Component Engineer Dive Detachments: 74<sup>th</sup>, 86<sup>th</sup>, 511<sup>th</sup>, 544<sup>th</sup>, and 569<sup>th</sup>.

### PACIFIC COMMAND

A-3. The Pacific Command contains one Active Component Engineer Dive Detachment—7<sup>th</sup> Engineer Dive Detachment.

### ARMY NATIONAL GUARD

A-4. The ARNG contains two ARNG Engineer Dive Detachments—627<sup>th</sup> Corpus Christi, Texas and the 232<sup>nd</sup> Ceiba, Puerto Rico.

## UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

### CHIEF DIVING SUPERVISOR, MASTER DIVER

A-5. The CDS, master diver is responsible for ensuring that diving concepts, regulations, and joint technical manuals are developed to support current and future joint combined arms doctrine. He—

- Serves as an USAES subject matter expert and acts as the senior training developer. Prepares Training Requirements Analysis System documents and soldier training publications for the engineer diver.
- Provides input to the Army training evaluation plan.
- Manages diving safety issues and modifications to AR 611-75 and this publication.
- Conducts inspections on diving life support equipment maintenance and qualification programs for all diving units.
- Serves as the USAES North Atlantic Treaty Organization representative for all diving matters and publications.

A-6. The CDS works closely with the Tank-Automotive Armaments Command (TACOM), the combat developer, and the training developer to ensure that the engineer dive field receives the equipment and training required to fulfill its obligation to the Engineer Regiment and the U.S. military. The CDS also works closely with the Engineer Personnel Proponency Office to highlight retention issues, bonuses, and incentives. The CDS provides the United States Army Recruiting Command (USAREC) with changes to initial entry requirements for divers based on feedback from the dive school.

### COMBAT DEVELOPER, MASTER DIVER

A-7. The combat developer, master diver is responsible for the preparation and recommendation of changes primarily for, but not limited to, engineer TOE, basis of issue plans, and manpower requirements criteria studies. He also—

- Provides expertise as a subject matter expert on diving issues.
- Updates and approves modifications to supply catalogs for engineer sets, kits, and outfits (SKO) valued over fifty million dollars.
- Writes requirement documents for changes to the diving SKO and serves as the Maneuver Support Center of Excellence Capabilities Development and Integration Directorate point of contact for the engineer diving materiel and force structure.

### TRAINING DEVELOPER, MASTER DIVER

A-8. The training developer, master diver is responsible for the management of the curriculum for the Engineer Diver Phase I course. He—

- Revises soldiers training publications for the dive field.
- Coordinates with the course curriculum model manager (C2M2) in Panama City, Florida, in regards to four diving courses attended by the Army enlisted and officers.
- Manages the dive field's quarterly publications and reviews doctrine involving engineer diving.
- Assists the CDS in keeping USAREC updated on the entry level requirements for diving.

### COURSE CURRICULUM MODEL MANAGER, MASTER DIVER

A-9. The C2M2, master diver maintains all administrative documents for the four diving courses attended by the Army enlisted and officers. He works with the Army Training Requirements and Resource System (ATRRS) community to adjust quotas, prerequisites, and course start dates.

A-10. The master diver has collateral duty as the Army equipment acquisition specialist at the Navy Experimental Dive Unit. He assists the TACOM and the Capabilities Development and Integration



Directorate noncommissioned officers in developing joint service acquisition projects for diving equipment.

### **PHASE I PREQUALIFICATION COURSE**

A-11. The Phase I Prequalification Course, sergeant first class (E-7) and staff sergeant (E-6) is responsible for the training and preparation of initial entry training and reclassified Soldiers for the Army engineer diver course A-433-0024 Phase II. Instructors run a three week prequalification course that selects Soldiers that successfully completed Phase I to continue to Phase II.

### **DIVE SCHOOL, COMPANY COMMAND AND SENIOR NONCOMMISSIONED OFFICERS**

A-12. The company commander (captain [O-3]), E-8, and instruction positions are filled by senior noncommissioned officers from E-8 to E-6. This unit teaches alongside the U.S. Navy, Coast Guard, Air Force, and Marines. They manage the following four levels of Army engineer diver courses:

- A-433-0024 – Army Engineer Diver (Advanced Individual Training [AIT]).
- A-433-0058 – Army First Class Diver Advanced Leadership Course.
- A-433-0054 – Army Master Diver Senior Leadership Course.
- A-4N-0024 – Army Marine Engineer Dive Officer.

### **ARMY MATERIAL COMMAND, SUBCOMPONENT: TANK-AUTOMOTIVE AND ARMAMENTS COMMAND, MASTER DIVER**

A-13. The Army Material Command, Subcomponent: TACOM, master diver serves as the subject matter expert on diving-related issues and the liaison between the product manager—SKOs, tools, TACOM, Army Engineer, and United States Army Special Operations Command diving units. He is responsible for the review and coordination of all supply catalogs, reviews the provisioning master record, coordinates of unit fielding actions, and maintenance procedures. He also—

- Reviews requirement documentation and specification for program items; assist the program manager in the development, modernization and procurement of diving equipment; and verifies changes to maintenance, operating, and emergency procedures for equipment.
- Assists in the development of future equipment packages and coordinates and validates the input of diving sets kits, and outfits into the logistics support active database.

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# Glossary

## SECTION I – ACRONYMS AND ABBREVIATIONS

Acronym/Term	Definition
AIT	advanced initial training
AO	area of operations
AR	Army regulation
ARNG	Army National Guard
ARNGUS	Army National Guard of the United States
ASCC	Army Service Component Command
attn	attention
ATRRS	Army Training Requirements and Resource System
ATTP	Army tactics, techniques, and procedures
C2M2	course curriculum model manager
CDS	chief diving supervisor
DA	Department of the Army
E-6	staff sergeant
E-7	sergeant first class
E-8	first sergeant
ENCOM	engineer command
EOD	explosive ordnance disposal
F	Fahrenheit
FM	field manual
IET	initial entry training
JLOTS	joint logistics over-the-shore
LOTS	logistics over-the-shore
MANSCEN	Maneuver Support Center
MCRP	Marine Corps reference manual
METT-TC	mission, enemy, terrain and weather, troops and support available, time available, and civil considerations
MOPP	mission-oriented protective posture
O-3	captain
OPDS	offshore petroleum distribution system
S-3	Operations and Training Officer (U.S. Army)
SALMS	single-anchor, leg-mooring system
SKO	sets, kits, and outfits
SSD	surface-supplied diving
TACOM	Tank-Automotive and Armaments Command
TOE	table of organization and equipment
	United States Training and Doctrine Command

<b>TRADOC</b>	United States
<b>U.S.</b>	United States Army Engineer School
<b>USAES</b>	United States Army Reserve
<b>USAR</b>	United States Army Recruiting Command
<b>USAREC</b>	

## **SECTION II – TERMS**

**Term**

None

# References

## SOURCES USED

These are the sources quoted or paraphrased in this publication.

### ARMY PUBLICATIONS

- AR 25-30. *The Army Publishing Program*. 27 March 2006.
- AR 40-501. *Standards of Medical Fitness*. 14 December 2007.
- AR 385-10. *The Army Safety Program*. 23 August 2007.
- AR 611-75. *Management of Army Divers*. 20 August 2007.
- ATTP 3-34.84. *Multi-Service Tactics, Techniques, and Procedures for Military Diving Operations*. 12 January 2011.
- ATTP 3-90.4. *Combined Arms Mobility Operations*. 10 August 2011.
- FM 3-34-170. *Engineer Reconnaissance*. 25 March 2008.
- FM 3-34.210. *Explosive Hazards Operations*. 27 March 2007.
- FM 3-34.343. *Military Nonstandard Fixed Bridging*. 12 February 2002.
- FM 3-34.400. *General Engineering*. 9 December 2008.
- FM 5-34. *Engineer Field Data*. 19 July 2005.
- FM 5-102. *Countermobility*. 14 March 1985.
- SS521-AG-PRO-010. Revision 6. *U.S. Navy Diving Manual*. 15 April 2008.
- SS521-AJ-PRO-010. *Guidance for Diving in Contaminated Waters*. 15 March 2008.
- Federal Standard 376B <http://www.usaid.gov/policy/ads/300/fstd376b.pdf>.”

### DOCUMENTS NEEDED

These documents must be available to the intended users of this publication.

- FM 1-02. *Operational Terms and Graphics*. 21 September 2004.
- JP 1-02. *Department of Defense Dictionary of Military and Associated Terms*. 12 April 2001.

### READINGS RECOMMENDED

These readings contain relevant supplemental information.

- ADP 3-0. *Unified Land Operations*. 10 October 2011.
- ADP 4-0. *Sustainment*. 31 July 2012.
- ADP 5-0. *The Operations Process*. 17 May 2012.
- ATTP 3-34.23. *Engineer Operations-Echelons Above Brigade Combat Team*. 8 July 2010.
- FM 3-34. *Engineer Operations*. 4 August 2011.
- FM 3-34.214. *Explosives and Demolitions*. 11 July 2007.
- FM 5-19. *Composite Risk Management*. 21 August 2006.
- FM 10-67. *Petroleum Supply in Theaters of Operations*. 18 February 1983.
- FM 55-60. *Army Terminal Operations*. 15 April 1996.
- TM 3-34.55. *Construction Surveying*. 3 August 2012.
- TM 3-34.73. *Port Construction and Repair*. 14 January 2013.
- PAM 611-21. *Military Occupational Classification and Structure*. 22 January 2007.

## References

---

- NAVFAC P-990. *Conventional Underwater Construction and Repair Techniques*. May 1995.
- NAVFAC P-991. *Expedient Underwater Repair Techniques*.
- NAVFAC P-992. *UCT Arctic Operations Manual*. June 1994.
- NAVSEA 0994-LP-017-3010. *Emergency Ship Salvage Material Catalog*. January 1987.
- NAVSEA SW060-AA-MMA-010. *Technical Manual, Demolition Materials, Volume 1*. 24 August 2008.
- NAVSEA SW061-AA-MMA-010. *Use of Explosives in Underwater Salvage*. 1 March 1987.
- NAVSHIPS 0994-012-4010. *Emergency Ship Salvage Material Manual*. April 1974.
- S0300-A6-MAN-010. *U.S. Navy Salvage Manual, Volume 1, Strandings and Harbor Clearance*. 30 September 2006.
- S0300-A6-MAN-030. *U.S. Navy Ship Salvage Manual, Volume 3 (Firefighting and Damage Control)*. 1 August 1991.
- S0300-A6-MAN-040. *U.S. Navy Ship Salvage Manual, Volume 4 (Deep Ocean Operations)*. 1 August 1993.
- S0300-A6-MAN-050. *U.S. Navy Ship Salvage Manual, Volume 5 (POL Offloading)*. 31 January 1991.
- S0300-A6-MAN-060. *U.S. Navy Ship Salvage Manual, Volume 6 (Oil Spill Response)*. 1 December 1991.
- SO400-AA-SAF-010. *U.S. Navy Salvage Safety Manual*. 25 December 1988.
- STP 5-21D12-SM-TG. *Soldier's Manual and Trainer's Guide, MOS 21D, Diver, Skill Levels 1 and 2*. 30 April 2007.
- STP 5-21D34-SM-TG. *Soldier's Manual and Trainer's Guide, MOS 21D, Diver, Skill Levels 3/4*. 20 May 2010.

## REFERENCED FORMS

DA forms are available on the Army Publishing Directorate Web site ([www.apd.army.mil](http://www.apd.army.mil)). DD Forms are available on the OSD Web site ([www.dtc.mil/whs/directives/infomgt/forms/formsprogram.htm](http://www.dtc.mil/whs/directives/infomgt/forms/formsprogram.htm)).

DA Form 2028. *Recommended Changes to Publications and Blank Forms*.

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**TM 3-34.83 (FM 3-34.280)**  
**2 August 2013**

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