CHESDIV progresses in its role of ocean engineering and construction

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Ocean engineering and construction--a phrase that probably raises several questions. What is it? Why and how is the Naval Facilities Engineering Command (NAVFAC) involved? The purpose of this article is to help identify ocean engineering problems and to tell you where to go for help.

Ocean engineering is the application of classical engineering disciplines in the ocean environment. All the theories, equations and formulas of civil, mechanical, and other engineering disciplines are identical whether they are applied on land or in the ocean. Application of those principles in the dynamic ocean environment is the key challenge of ocean engineering. Construction in the offshore environment is equally challenging. Here again, the principles are similar but the tools and techniques are quite different.

The major difference between ocean engineering and construction projects and their terrestrial counterparts is the element of risk. There are certainly high-risk terrestrial facilities, but most are relatively low risk. Most ocean facilities projects are high-risk, high-tech projects. Risk assessment becomes a significant factor in the design, construction, and acquisition process. Failure to adequately address and assess risk can turn an ocean construction project into a very expensive salvage project. Unfortunately, there are many examples.

The Navy owns and operates a number of offshore platforms and undersea cables, pipelines, moorings, and sensors. The NAVFAC mission for these ocean facilities is identical to that for terrestrial facilities. NAVFAC executes its mission for planning, acquiring, and supporting the activities and claimants in the maintenance of ocean facilities through the Chesapeake Division (CHESDIV).

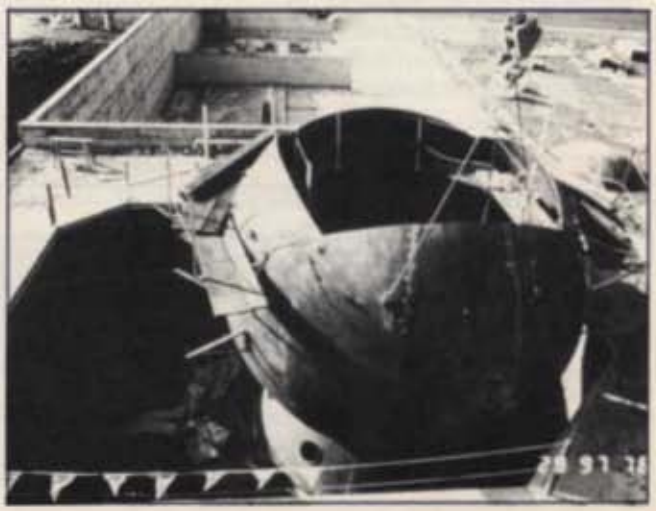
In addition to its normal geographic mission, CHESDIV has worldwide responsibility for ocean facilities. The Ocean Engineering and Construction Project Office (FPO-1), a CHESDIV department, has a staff of approximately 65 civilian and military personnel with specialized education, knowledge, and experience in the design, construction, maintenance, and repair of ocean facilities.

Many are engineers with undergraduate and advanced degrees in ocean engineering, and there are a number of technicians and marine specialists with a tremendous amount of experience working in the ocean. Some are also Navy-qualified divers. There are also important support personnel (secretaries, contract specialists, analysts, etc.) without whom an organization could not function.

In addition to its ocean engineering mission FPO-1 designs, constructs, and provides maintenance support of shore-based hyperbaric facilities. These facilities are used in support of diver training, treatment of diving-related illnesses, and medical treatment of non-diving illnesses. Projects range from standard diver recompression chambers to sophisticated and complex saturation diving systems.

Current examples include recompression chambers at Kaneohe, Hawaii; Roosevelt Roads, Puerto Rico, and Macrihanish, Scotland; an escape training facility at Groton, Conn.; and facilities to support swimmer delivery vehicle training and maintenance for the special warfare community.

There has been a growing use of hyperbaric facilities for treatment of a variety of nondiving illnesses such as gas gangrene, carbon monoxide poisoning and burns. There are documented cases where hyperbaric medical treatment has produced remarkable results. A large hyperbaric medical treatment facility is currently under construction at Travis Air Force Base,



Travis Air Force Base hyperbaric medical treatment facility under construction. The sphere is 23 feet in diameter.

Calif., as part of the hospital replacement project. The officer in charge of construction at Travis designed and is constructing the hospital, and CHESDIV is the agent for the $10 million hyperbaric facility.

Adequate maintenance of hyperbaric facilities is critical and often local activities do not have the necessary expertise. FPO-1 provides the facilities management support in much the same way as any field division 09B. For some facilities, major overhauls similar to ship overhauls are programmed and executed. Such is the case at the Naval Diving and Salvage Training Center, Panama City, Fla., where FPO-1 is completing the second regular overhaul of the Center's hyperbaric facilities. Testing all systems to ensure the facility operates as originally designed is one major objective of these projects. Repairs are made to correct deficiencies thereby reducing the maintenance and downtime and maximizing training availability.

CHESDIV FPO-1 designs and installs specialized moorings and manages the NAVFAC Fleet Mooring Maintenance Program. The Fleet Mooring Maintenance Program integrates and coordinates a global effort for the inspection, maintenance, overhaul, and installation of moorings and provides criteria to accomplish this work.

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Many moorings are used on a temporary basis and standard designs are available in the Mooring Design Manual (DM-26). When a specialized design is required, such as a mooring which must survive during a hurricane or typhoon or the bottom conditions prevent the use of conventional anchors, FPO-1's unique design and installation expertise is necessary.

For example, when cost estimates for conventional solutions to berthing a training ship next to a pier far exceeded the project budget, FPO-1 was asked to assist. Because the ship had an active nuclear power plant but could not get underway, the design requirements were extremely stringent. FPO-1 designed a mooring that met all the requirements and could be built within the available funds.

Submarine approaches CHESDIV-installed mooring in St. Croix U.S. Virgin Islands.

At some sites the bottom consists of hard material, such as coral, that prevents the use of drag-type anchors. In such cases, propellant embedment anchors (PEAs) are used. PEAs use a propellant charge to push an anchor deep within the seafloor. FPO-1 maintains the special expertise and equipment for preparing and installing PEAs.

FPO-1 has developed upgraded moorings with innovations like higher grade chain, replaceable chain-link zinc anodes for cathodic protection and foam buoys. These improvements increase the design life of a mooring from 5 to 15 years. Together with new high-efficiency anchors developed by the Naval Civil Engineering Laboratory, the upgraded moorings are a vast improvement over existing ones.

The Navy operates a variety of underwater ranges--instrumented areas of the seafloor--for airborne, surface, and subsurface training and testing. FPO-1 plays a vital role in the planning, design, installation, and repair services that are required to establish and maintain these ranges. There are two major types of ranges: acoustic and magnetic.

Acoustic ranges consist of arrays of hydrophones which transmit data, via cables, to shore-based processing equipment. Ships, submarines, weapons, and simulated targets are tracked in real time during antisubmarine warfare (ASW) exercises on training ranges. This type of training is vital to ASW readiness.

Other ranges measure the noise generated by these vessels. This data is used to design quieter vessels to minimize the risk of detection and for weapons development. FPO-1 has installed and repaired acoustic ranges in St. Croix, Southern California, the Bahamas, and Hawaii.

Magnetic, or degaussing, ranges are used to measure the distortion of the earth's magnetic field caused by ships and submarines. This distortion is referred to as the magnetic signature of the vessel. The signature is critical if the ship is to avoid magnetic homing mines and torpedoes or, in the case of submarines, detection.

A degaussing range consists of a row of sensors in a channel over which a vessel passes to measure its signature. If the magnetic signature becomes too large, it is decreased using on-board electronic equipment.

If the signature is larger than the on-board equipment can handle or the vessel has no equipment, it must be treated in a deperming facility. To accomplish this, the vessel is wrapped in large electrical conductors which are energized to decrease the vessel's signature.

CHESDIV FPO-1 performs a variety of tasks to ensure that the sensors and cables for all types of ranges are properly designed and installed. FPO-1 has pioneered techniques of ocean construction involving the placement of these sensors on the seafloor within precise bands of tolerance.

FPO-1 also designs, installs, stabilizes, and protects other near-shore and deep-sea cables for power, communication, and data transmission.

FPO-1 is currently planning for the design, procurement, and installation of a fiber optic communication cable from Okinawa to Sasebo, Japan, to Korea. This 700-mile cable will dramatically improve defense communications in that part of the world.

The Navy has over 1,800 waterfront facilities at over 160 activities throughout the world. There are over 100 miles of berthing space at piers and wharves. In addition, bulkheads and quay walls total over 140 miles in length. The waterfront facilities inspection program, conducted by CHESDIV, provides for periodic underwater inspections of these facilities to assess the integrity of the structures, make recommendation for maintenance and repair, and provide cost estimates for maintenance and repair.

The program is part of the NAVFAC Specialized Inspection Program and its main objectives are to supplement the normal facilities inspection conducted by activities and inspect all Navy waterfront facilities. During the first eight years of the program (Fiscal Years 1980 through 1987) 46 percent of the Navy's facilities were inspected at least once and many have had subsequent inspections. CHESDIV also performs underwater quality assurance inspections for new construction and repairs of waterfront facilities.

CHESDIV FPO-1 designs, analyzes, installs, and repairs a variety of ocean structures, including off-shore towers. These towers are used to support equipment for tactical aircrew combat training systems (TACTS), a vital part of fighter pilot training for the Navy, Marine Corps, and Air Force. The Navy has one operational offshore TACTS range off Kitty Hawk, N.C.

Three hundred-fifty ton deck section of Charleston tactical aircrew combat training system (CTACTS) being lifted for placement.

Ocean construction platform SEACON.

FPO-1 is currently repairing hurricane damage to the towers and planning for the expansion of that range. Towers for the Charleston TACTS were recently constructed and that range is scheduled to become operational in 1989 upon installation of associated electronic equipment by the Naval Air Systems Command.

Underwater pipelines for POL, water, and sewage represent another area of FPO-1's expertise. FPO-1 has developed and installed unique designs such as flexible pipelines to ease installation and reduce cost. The capability to design, construct, inspect, and repair underwater pipelines of all types exists within FPO-1.

CHESDIV executes the wide range of ocean and hyperbaric projects in a number of different ways. Because of the high-risk, high-tech nature of this work, negotiated contracts are the preferred acquisition method. In some cases, the two fleet Underwater Construction Teams (UCT ONE at Little Creek, Va., and UCT TWO at Port Hueneme, Calif.) perform the work.

On the recent installation of the underwater range in Southern California, people from UCT TWO, Naval Mobile Construction Battalion SEVENTY-FOUR, several contractors, other Navy activities, and FPO-1 made up the construction force. FPO-1 has successfully managed many projects involving multiple construction organizations.

CHESDIV maintains an inventory of specialized ocean construction equipment. The Ocean Construction Equipment Inventory (OCEI) includes such items as cranes, winches, navigation systems, electronic test equipment, cable-handling machinery, specialized diver tools, and the Ocean Construction Platform SEACON. The OCEI is based at Portsmouth, Va. Items of the OCEI are available for use by other organizations through formal loan agreements.

SEACON is a seagoing vessel 260 feet long with a beam of 48 feet. It accommodates up to 50 people. SEACON is specially configured for ocean work and has dynamic positioning capability, sophisticated navigation systems, center well, and on-board cranes. It is capable of conducting sustained, at-sea operations for a variety of tasks.

NAVFAC ocean engineering and construction is exciting and challenging. Many projects require the use of the latest state of the art analysis, equipment fabrication, and construction techniques. But the most important part is that these projects provide direct support to the fleet, and that is what we're all here for. The Navy has an investment of well over $10 billion in ocean, hyperbaric, and waterfront facilities. CHESDIV can help with planning, design, construction, repair, maintenance, and inspection of those facilities but only if someone asks for help. If you have a problem or question in any of the areas described, contact CHESDIV FPO-1 at Autovon 288-5365 or (202) 433-5365. □