

A Four-Point Moor Is Taxing and Challenging

By Lt. Lee Shannon

Editor's note: Only a few salvage assets have and use the multi-point moor capability. However, it regularly is used when the Navy assists during airline-disaster recovery operations such as the 1996 crash of TWA flight 800 and the 1999 Egypt Air crash, or when recovering downed military aircraft.

The salvage and recovery ship USS *Grapple* and her crew made history in 2001 when partnering with the National Oceanic and Atmospheric Administration to conduct diving and salvage operations for recovering USS *Monitor's* engine. This mission was a precursor to the 2002 recovery of the Civil War ironclad's gun turret. To enable divers to dive 240 feet 16 miles off the coast of Cape Hatteras, N.C., the ship's bridge team saw the opportunity for USS *Grapple* to demonstrate the techniques involved in safely laying and operating from a multi-point moor.

The four-point moor is the most versatile of all the mooring configurations available to the ARS. Four mooring legs typically are laid at four points around a designated site, with the ship positioned in the center of the site. Once the moor has been laid, the ship will fair-lead its mooring lines through roller chocks and attach them to the spring buoys by using a small boat to access the buoys. The ship then can position itself in the moor by taking the lines to power on any of the ship's four capstans, then securing the lines to bits on deck. Even under the best conditions, the mooring lines carry much higher tensions in the open ocean than when the ship is pierside. Line-safety awareness

thus constantly is stressed to the crew throughout mooring operations.

The whole mooring evolution is extremely hazardous from start to finish and demands paying utmost attention to detail, keenly observing precautions, and maintaining exceptional seamanship. The mooring leg itself is composed of a 6,000-pound Stato anchor attached to one or more shots of two-and-a-quarter-inch die-lock chain, then is connected to a one-and-five-eighths-inch wire rope. The wire rope is carried on board in 300- or 600-foot lengths, the number of lengths added to the leg being dependent on water depth. The last length is connected to a flounder plate, to which a recovery pennant and a tension leg also are added. A massive 3,100-pound spring buoy is attached to the tension leg, providing the force necessary to lift the mooring-leg wire-rope (weighing seven pounds per foot) to the surface. The spring buoy also allows the ship access to attach its mooring line. Finally, a one-and-a-quarter-inch, wire-rope pennant is shackled to the crown of the anchor, and a crown buoy is secured to the other end to help recover the anchor itself.

The whole leg assembly weighs between 10 and 15 tons and must be moved about on-deck mostly by hand. All involved personnel must wear gloves, hard hats, and steel-toed boots. The senior petty officers and chief petty officers-in-charge must make sure that every piece of heavy gear is moved and positioned in the correct order and that the rigging will run when tripped. Rigging each leg is a complex process—an all-hands evolution on an ARS. It may take from eight hours to two days

per leg to complete, depending on the level of crew training and available manpower. Divers and more experienced salvors must train the remainder of the crew in rigging procedures beforehand. Safety briefs frequently are held, and anyone can stop the evolution by bringing a safety issue to the attention of the safety officers or chief petty officers.

Meanwhile, the two-and-a-quarter-inch chain is faked out on the fantail or suspended over the side, hanging in loops. It is secured with 21-thread line. Twenty-one or six-thread line is used to secure the one-and-five-eighths-inch wire rope in tight figures-of-eight forward of the chain, and then in loops along the outside of the ship, forward and up to the flounder-plate and spring-buoy assembly. In addition to the hazard presented by the sheer weight of the mooring leg, riggers also must be wary of lacerations from handling wire rope. For added safety, ship's force makes round-stock or re-bar guardrails and welds them over all cleats, bitts or obstructions that could snag the wire as it

deploys from the fantail. All four legs are rigged prior to the drop, and they cannot tangle or interfere with one another once released.

Letting go the anchor is accomplished by tripping the bail on the chain stopper, if the leg is rigged out of the stern chute, or by releasing the retaining bar, if the anchor is released from one of the ship's side pockets. Before the release, the rest of the leg is laid out on deck in a manner to allow the weight of the anchor and chain to pull it off of the deck. The small stuff offers just enough resistance before parting under strain to control the timing of the run, and thus ensures all bights are delayed long enough to prevent them from fouling one another or deploying too soon. Great care must be taken to make sure the leg will run freely when the anchor is let go.

Several safety walk-throughs are conducted before the actual release, including a final walk-through by the ship's commanding officer. It is impossible to stop the leg from running after the



Sailors release the pelican hook; this starts the release of the leg of beach gear.

anchor has been released, and, if the wire rope fouls after tripping, the consequences could be disastrous—there is absolutely no room for error after letting go the anchor.

The navigation team is key to executing the drops. They must have a plot that exactly details the ship's final desired position over the salvage project. From that plot are derived the coordinates at which the ship must drop anchors for a proper lay and orientation in the moor. Before the drop, all supervisory personnel, the drop crew, and safety observers must attend a special navigation brief on the bridge.

After the briefings and when all coordinates have been plotted and verified, the navigator, officer-of-the-deck, and conning officer will discuss the evolution and conduct practice runs to familiarize themselves with the environmental effects on the ship. Local shipping traffic is notified via bridge-to-bridge radio to stay clear of the drop area. When everyone is satisfied all is safe, the final mooring run is executed, and the navigator then will give the drop signal to the anchor detail. Unlike conventional anchoring evolutions, the ship maintains course and speed (about five knots) while the leg (up to 1,500-foot long) runs from the

ship. The conning officer then throws the rudder over full in the direction where the spring buoy falls from the ship—this is to clear a path as the buoy drifts toward the stern. Once the run is completed, the ship will repeat the process until all four legs are deployed. A notice to mariners also is broadcast to alert maritime traffic of the evolution.

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The ship then can launch small boats and hook into the moor. Two types of boats provide versatility: the 35-foot work boat and the RHIB, which is more nimble than the work boat but lacks its hauling power. The work boats are used to pass the eight-inch mooring lines from the ship to the four spring buoys in the order the navigator determines, based on the current sea state. The boats deploy to haul the lines, stretch the mooring leg from the



A spring buoy is released from its cradle. This is the last part of the leg of beach gear to let go during its deployment.



The challenging recovery effort begins as preparations are made to retrieve the anchor, the anchor chain, and, finally, the spring buoy itself.

surface toward the ship via the spring buoy, and connect the pelican hooks to the mooring lines from the spring buoys. Pelican hooks are used to make it easier to trip out of and return to the moor should the ship have to leave the area before completing the mission. A risk assessment for this phase of the operation is conducted and will include the boat and deck crews and the bridge team. The boats will be used again in a similar fashion for the recovery. Recovering the moor when the mission is complete is the most difficult part of the process.

While mooring legs can be rigged in port, they obviously can be recovered only at sea, where weather conditions are unpredictable. During recovery, many events take place simultaneously: The ship must use its boom and aft capstans, small boats, and many crew members to recover the mooring legs. Once the ship has tripped out of the moor and recovered all mooring lines, the ship then must maneuver close to the small crown buoy above the anchor on the first leg to be retrieved.

The conning officer maintains a stationary position as close as possible to the buoy while a messenger line is passed from the fantail to the small boat. Riggers in the boat then shackle the messenger to the thimble eye of the one-and-a-quarter-inch crown pennant and disconnect the

crown buoy. This can be quite difficult since the boat coxswain must battle the seas to remain on station at the buoy. A safety harness tended by another person in the boat is attached to the rigger, who actually disconnects the buoy. The small boat then clears the area as the messenger and crown pennant are taken to power on the capstan to raise the anchor and chain to the waterline. This load is transferred to the ship's aft boom, which raises the anchor and chain and places it onto the deck. The detachable link on the chain is broken, and the one-and-five-eighths-inch wire rope is taken to power on the capstan to be recovered next. When the final length of rope is brought on board, the pelican hook on the bottom of the flounder plate is tripped, allowing the one-and-a-half-ton spring buoy to be released and recovered. The time from receiving the messenger until the spring buoy is re-stowed averages four hours if all goes smoothly. Once all legs are recovered, the ship returns to port to offload equipment and to arrange for final disposition of salvaged wreckage. The crew is debriefed and awaits its next assignment. Ⓢ

Lt. Shannon was the supply and safety officer aboard USS Grapple when he wrote this story. He is currently attending Explosive Ordnance Disposal School.