

A Diver Method For Replacing the Thrash Zone Section on Mooring Chains

OVERVIEW

The Port Security Barriers (PSB) were originally developed by Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC) in 2012 in order to increase the Anti-Terrorism & Force Protection (ATFP) posture of U.S. Navy ports worldwide. The system consists of floating barriers that are moored at regular intervals providing a rugged and secure perimeter.

As with any subsea system, the mooring chains on the PSBs are susceptible to deterioration caused by the harsh ocean environment with which they're exposed to. A particularly vulnerable portion of any mooring chain is the section of chain between the ground leg and the riser known as the thrash zone. In areas with significant wave action and tidal swing, the thrash zone can deteriorate rapidly due metal on metal wear between the chain links caused by the wave and tidal induced motions. This deterioration, if unabated, will significantly downgrade the rated capacity of the mooring and could lead to catastrophic failure.

To protect against a catastrophic failure of the mooring system, regular inspections are needed and, at times, it is necessary to replace the deteriorated sections of the mooring chain. The traditional technique to accomplish this is to utilize a crane barge to pull the mooring system (buoy and chain) on deck and replace the sections as needed. A typical crane barge can cost upwards of \$30,000/day for vessel, tug and crew in addition to mobilization expenses, which makes this maintenance a costly venture. The NAVFAC EXWC Dive Locker and Engineering Technicians from the NAVFAC EXWC Expeditionary Programs Division (EX300) have developed and demonstrated a technique to accomplish this through the use of divers and small

boats, executing these repairs at a cost of approximately \$5,000/day.

DESCRIPTION

The overall process is illustrated in figure 1. It should be noted that an inspection dive is required prior to maintenance actions to determine the extent of the deteriorated sections and pre-cut the new chain to size (it is advisable to mark the limits of the thrash zone section with large, white zip ties). The process consists of: (1) pulling tension to slack the thrash zone section; (2) divers cut out the thrash zone section with u/w cutting torches; (3) divers install new section utilizing chain-joining links (CJL); and (4) release tension and retrograde the project site.

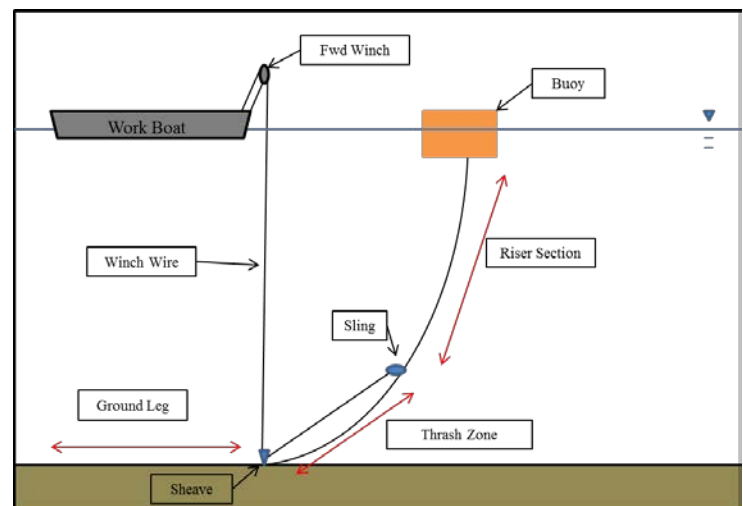


Figure 1: Rigging Schematic

The process requires a work boat with a submerged lift capability of approximately 500 – 1,000lbs and enough deck space to conduct surface supplied diving operations (SSDS). NAVFAC EXWC Dive Locker has previously developed a small boat which is 32' long with a forward A-Frame w/1,000 lb. submerged

lift capacity. A similar version of this prototype is now being incorporated into the Underwater Construction Team's (UCT) Table of Allowance (TOA). In addition to the work boat, another small boat is needed to house a topside welding unit to power the u/w cutting torches.

The operations begin by mooring both the workboat the small boat up to the buoy that will have its mooring chain replaced. Once in a secure mooring, the new section of chain is first lowered to the bottom using the forward A-Frame and a tool basket is then lowered using a forward capstan. Once tools & materials are safely on bottom, divers are deployed. The process on bottom is as follows: (1) attach choker sling with sheave a few links below the lower-most deteriorated link; (2) attach a choker sling a few links above the upper-most deteriorated section; (3) run the winch wire from the A-Frame through the sheave and attach to the upper sling; (4) pull tension from the winch until enough slack is obtained on the thrash zone; (5) attach a large pendant (2" Amsteel line w/spliced eyes was used) from an anchor shackle above the thrash zone section to a pelican shackle below the thrash zone section; (6) release tension from winch and verify pendant is secure; (7) lower u/w cutting tools and cut out the deteriorated sections (figure 2); (8) install new section of chain w/CJLs at either end; (9) remove the pendant using quick release on the pelican shackle; (10) retrograde the project site.



Figure 2: Diver cuts out deteriorated mooring chain.

BENEFITS

NAVFAC EXWC Dive Locker and EX300 successfully replaced 21 moorings on the PSBs at Naval Base Coronado (North Island) and Naval Base Point Loma. This took place over 20 work days during September 2013 and February 2014. The estimated savings over utilizing the crane barge is estimated at \$200,000.

RECOMMENDATIONS

This process for conducting the necessary maintenance on the mooring chains is a low cost and safe alternative to a crane barge when operational risk management (ORM) has concluded the water depths and environmental conditions do not pose a serious risk to the divers or the mooring system. It can be readily executed by the NAVFAC EXWC Dive Locker and the UCTs upon receipt of their new work boat with certain limitations which are:

- Water depths are less than 100 fsw
- Mooring chain is 2" or less

It should also be noted that current is a major limiting factor due to the strain it puts on the mooring chains. Work should be scheduled at slack tide as even modest currents can drastically increase the difficulty of accomplishing the tasks safely and effectively.

REFERENCES

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