Servicing NOAA Buoys on the Central California Coast

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NOAA environmental and oceanographic data buoys provide an invaluable source of data for monitoring weather and wave conditions in the coastal and offshore waters of the United States. The U.S. Coast Guard, in close cooperation with the National Data Buoy Center (NDBC) at Stennis Space Center in Mississippi, maintains responsibility for the servicing of these buoys. In early September 2002, I had an opportunity to ride along on a buoy-servicing trip to see first-hand how the Coast Guard and NDBC accomplish this mission.

San Francisco Bay with the Golden Gate Bridge in the distance.

Early Monday morning, September 9th, I boarded the **USCGC Aspen** (WLB-208) at Coast Guard Base San Francisco Bay, located at Yerba Buena Island in San Francisco Bay. Built by Marinette Marine Corp. in Marinette, Wisconsin, and commissioned on September 28th, 2001, the **Aspen** is one of the Coast Guard's newest cutters. Following a transit down the St. Lawrence River, down the east coast and through the Panama Canal, the **Aspen** arrived at it's new home port on December 18th, 2001. Also aboard on this trip were Chief Warrant Officer (CWO3) John Ward (a Coast Guard liaison officer assigned to NDBC), John Blackmon, and Dave Parrett (SAIC technicians; SAIC is the primary contractor under NOAA responsible for buoy maintenance services).

The U.S. Coast Guard has responsibility for maintaining aids to navigation in coastal and inland waterways throughout the United States. Although not considered "aids to navigation," the servicing of NOAA's environmental data buoys is included in this mission (in close coordination with NDBC). Although a relatively small part of the Coast Guard's overall buoy maintenance mission, it is a vital one. On this trip, the **Aspen** would service three NOAA data buoys off the central California coast, along with two navigational buoys. The three NOAA buoys scheduled for service included Half Moon Bay Buoy (# 46012), Monterey Bay Buoy (# 46042), and Cape San Martin Buoy (# 46028).

Not all buoy servicing missions are alike. In some cases, new buoys are deployed for the first time, while others are re-deployed after having broken their mooring and gone adrift. In both cases, the deployment involves putting a large concrete sinker on the ocean bottom, which serves to anchor the buoy in position. For this trip, each buoy would be replaced on-site with a completely re-conditioned buoy, with one day scheduled for each.

The servicing operation actually begins at NDBC's facility at Stennis Space Center, which schedules periodic (emergency in some cases) data buoy servicing missions with the Coast Guard. It is here that buoys previously delivered from other servicing missions are overhauled, outfitted, and tested. The re-conditioned buoys are then carried across country by flatbed truck to the port, lifted on board Coast Guard buoy tenders by crane and secured to the deck. The **Aspen**, with a beam of 46 feet, can carry three of the 3-meter

discus buoys (side by side) to be serviced on this trip. Once on-site at each location, the buoy in the water would be hauled aboard and replaced with a re-conditioned buoy. Although each of these buoys was of the same basic design, each was unique due to some slight (but significant) differences in instrumentation and configuration. Each was therefore designated to replace a specific buoy. In fact, each of the "new" buoys already had it's number painted on before it arrived at the port (e.g. the "old" buoy # 46012 would be replaced by the "new" # 46012).

The first of the NOAA buoys on the schedule was # 46012, located just off the California coast about half way between San Francisco and Monterey Bay. Weather conditions on this day were nearly ideal, with a clear blue sky, northwest winds at 5-10 knots, and a 3-4 foot swell with periods of 17-20 seconds. Weather and sea conditions are absolutely critical to buoy maintenance operations. If the seas become too rough, conditions can quickly turn unsafe for the deck crew. These buoys weigh between 3,500 and 4,000 pounds and provide more than sufficient force (in motion) to cause serious injury.

The **Aspen** proceeded to the buoy's location, guided by its sophisticated "Integrated Ship Control System," which brings together (and displays information from) the cutter's satellite navigation system, radar, and electronic nautical charts. This information is integrated with the maneuvering system, consisting of variable pitch props, rudders, and two thrusters (bow and stern), allowing for very precise navigation and maneuvering.

The NDBC technicians had reason to believe this particular buoy may have had some saltwater intrusion, which can result in a dangerous build up of hydrogen gas (due to interaction of the saltwater with the batteries). Hydrogen is a highly explosive gas, and bringing the buoy on board could have exposed the crew and technicians to an unacceptable risk. For just such an occasion, the SAIC technicians were equipped with sensitive "sniffing" gear. The **Aspen's** crew lowered a small boat and took the two technicians out to the buoy to check for the possible presence of hydrogen. In this case, no dangerous emissions were detected and the buoy was deemed "safe" for taking aboard.

3-meter discus buoys in a diagonal position along the deck with the Aspen's crane poised overhead.

The **Aspen** then slowly and carefully maneuvered toward the buoy, bringing it closely alongside. The **Aspen** (and other similar Coast Guard cutters) uses a very precise maneuvering system for just such occasions. The ship's bow and stern thrusters can be manually driven or, using an integrated computer, provide specific maneuvering instructions to be immediately carried out. The ship can be moved in very small increments in all directions until the buoy is in an optimum position for working.

In preparation for this day's operation, the deck crew conducted a briefing to ensure all parties involved intimately knew their specific roles and responsibilities. For this operation, there were eight crew members working on deck, led by a senior petty officer. A safety observer was also present, watching every step from above. On the bridge, Lieutenant Commander Adam Shaw, **Aspen's** Commanding Officer, had overall control of the entire operation, with safety being his primary

consideration. The operation would not commence until the Captain decided conditions were safe and the crew was completely ready.

Once the buoy was safely alongside, the deck crew attached a line to prepare it for lifting (not always easy, given less favorable weather conditions). Once the line was in place, the crane hook was securely attached to one of the lifting points on the base of the buoy. Using the **Aspen's** 20-ton hydraulic crane (with a 60-foot boom), lifting began almost immediately, but proceeded slowly and carefully. Rather than hoisting the buoy high up, then rotating the crane to lower it on deck, the buoy was slowly dragged aboard, using the crane in combination with a horizontal cable ("crossdeck") pulled by a separate winch. This procedure minimizes the risk of the buoy swinging and potentially injuring crew members. After the buoy was safely secured on deck, the anchor chain (still attached to a 6,000 pound sinker on the bottom, 259 feet below) was slowly pulled on deck. To prevent the chain from being pulled back into the water and to protect the deck crew, it was secured on deck with a special "chain stop." The crew then proceeded to scrape the buoy's hull of its abundant accumulation of sea life, which had made this particular buoy its home for the past year. Finally, the chain was disconnected from the bottom, inspected for abrasions and other weak points, and subsequently reconnected to the "new" buoy # 46012.

The next phase of the operation involved attaching the crane's hook to the new buoy, releasing the chains securing it on deck, lifting it, and

Operation in action: replacing 3-meter buoy off the coast of California.

finally putting it in the water. This phase of the operation is easier said than done. With two other buoys on deck to the side and (now) another buoy in the center of the deck (i.e. the "old" # 46012, just out of the water), this would prove to be a delicate maneuver. The buoy would have to be carefully lifted and rotated such that it's sensitive environmental instrumentation (on the top of the buoy) would not impact any obstacles, either on the ship or the other buoys on deck, thus risking damage. Damage to its instrumentation would have meant certain delay, and (if serious), could even have resulted in a long postponement of this particular buoy's replacement.

After careful planning and discussion by the deck crew, the new buoy was slowly lifted and, using the "crossdeck" cable to control its horizontal movement, was then rotated over the side and slowly lowered into the water. Then, with the crew safely out of the way, the buoy's anchor chain was released from the chain stop and the "new" NOAA data buoy # 46012 was free from the **Aspen** and ready to begin its job of gathering and transmitting vital data. For about the next three hours, NDBC monitored the buoy's environmental and oceanographic data, transmitted via satellite. The data was compared to data on-site ("ground truth") and, with no significant discrepancies, the operation was deemed a success. The **Aspen** then proceeded on to its next operation.

Over the next two days, the **Aspen's** crew repeated this operation, replacing NOAA data buoys off Monterey Bay (# 46042) and Cape San Martin (# 46028). While similar in most respects, there were a few significant differences. As mentioned previously, no two buoy servicing operations are alike. Weather

conditions are never the same and, at times, the configuration of the buoy requires adjustments to handling procedures. Additionally, the buoy's location in itself is significant.

The next day, the **Aspen** proceeded to buoy # 46042, west of Monterey Bay. While again sunny with excellent visibility, the winds were slightly stronger and the seas slightly higher. Additionally, this buoy was located in much deeper water - nearly 7,000 feet. As part of it's design, each buoy is given a certain amount of "room to roam." Due to constantly changing winds and currents, buoys must have a certain amount of slack in the mooring chain so that it is free to move about (within limits). The precise term is "watch circle radius." In the case of the first buoy worked on this trip (# 46012 off Half Moon Bay), the water depth was "only" 259 feet, with a corresponding watch circle radius of about 130 yards, meaning it had freedom of movement within a circle of that size. In the case of the much deeper water at buoy # 46042, however, the watch circle radius increased to more than 1,700 yards. When strong currents are present, the ship may have to "chase" the buoy, making its capture more difficult.

3-meter buoy on station. The vertical bars around the deck of the buoy are called “seal cages” and are placed on buoys to prevent seals from climbing aboard, thus avoiding possible harm to the seal while preventing damage to the buoy.

Buoy # 46042 also had a different mooring chain configuration, including an attached device known as a "flounder plate." NDBC was evaluating the wave data on buoys with and without this device attached.

Buoy # 46028 off Cape San Martin, replaced on the third day of the voyage, also had a directional capability, but had no "flounder plate" attached to it.

Maintaining coastal aids to navigation (and NOAA data buoys) along the California coast is the Aspen's primary mission, but it is certainly not its only mission. The **Aspen** also performs vital search and rescue, law enforcement, and pollution control missions as well. I genuinely appreciate having had the opportunity to experience life aboard the **Aspen** for a few days, and to watch her very professional crew in action.

U.S. Coast Guard Cutter Aspen