



## Staff News...

**T**he *Monitor* National Marine Sanctuary is pleased to announce that Michelle E. Fox is the new National Submerged Cultural Resources Outreach and Education Coordinator, located at the Sanctuary office in Newport News, Virginia. Michelle joins our staff after many years in Washington, DC where she worked first on Capitol Hill in the U.S. Senate and later for NOAA's Office of Legislative Affairs. As we say at the *Monitor* NMS, Welcome Aboard.

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## How the Engine Was Raised

**T**he *Monitor's* engine could not be raised directly to the surface for two reasons: (1) because the engine is heavy, yet fragile, it took several weeks to properly rig it for recovery; and (2) connecting the engine directly to a cable on the surface would have subjected it to the stresses of the sea motion of the barge and crane. Therefore, an Engine Recovery Structure (ERS) was placed over the *Monitor's* engine room to support the lift. The ERS consisted of a bridge frame that spans the wreck, a moveable spreader, and an engine lifting frame (ELF) suspended from the spreader (Figure 1).

The spreader was moved until the ELF was suspended directly over the engine. Then, after the hull plating was removed, steel cables were connected between the engine and the ELF. Once the frame of the engine was

supported in this manner, dozens of additional straps were added to ensure that all components of the engine would be supported for the lift (Figure 2). This process was lengthy, since the engine first had to be excavated from an encapsulating layer of corroded metal and coal.

Once rigging was complete, the entire engine unit was raised two feet using hydraulic rams mounted on the spreader. All rigging

was inspected, and heavy-duty cargo nets were slung beneath the engine and secured to the ELF. The engine was then raised another four feet and reinspected.

After a final check on the weather, which was very good, steel lifting cables were attached to the ERS and the entire structure, weighing an estimated 120 tons, was raised to the surface and placed on a waiting barge (Figure 3).

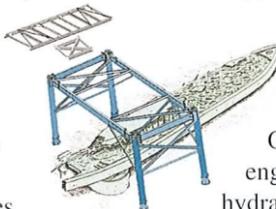


Figure 1

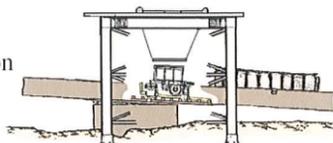


Figure 2



Figure 3

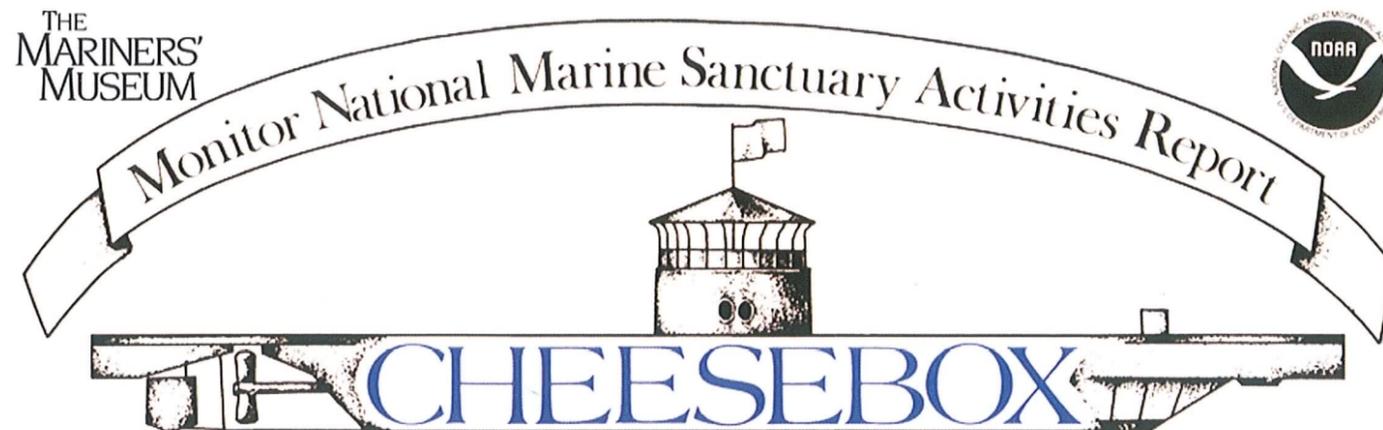


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## Monitor 2001: Recovering the Steam Engine

**B**eginning in late April and ending in mid-August, *Monitor 2001* was one of the most complex archaeological recovery projects ever conducted in the world. At long last, on August 10, 2001 the engine of the USS *Monitor* was presented by the National Oceanic and Atmospheric Administration (NOAA) to The Mariners' Museum for conservation and exhibition.

The 2001 field season to recover the *Monitor's* steam engine and a section of her hull consisted of five expeditions to the *Monitor* National Marine Sanctuary, conducted in three phases. Each phase involved personnel from NOAA, the U.S. Navy, The Mariners' Museum and several other organizations.

### Phase I - Preparation of the Site

In March and April, 2001, personnel from NOAA and the U.S. Navy conducted survey and installation dives to prepare the site for the recovery mission. In March, NOAA divers recorded videotape and measurements to assist Navy divers in their site work the following month as they repaired and installed lifting equipment.

The work was slow and difficult; the unpredictable seas, strong currents, and constant threat of storms made underwater tasks difficult at best. Because of the *Monitor's* depth (240 feet), Navy divers could only remain on the wreck for approximately 30 minutes, after which they had to spend nearly three hours decompressing to avoid the painful condition known as "the bends." In spite of these difficult conditions, Phase I was completed on May 30, 2001, paving the



Monitor Collection, NOAA

*The Monitor's 35-ton engine is lifted from the Atlantic for the first time in 140 years*

way for Phase II, the recovery of the *Monitor's* steam engine.

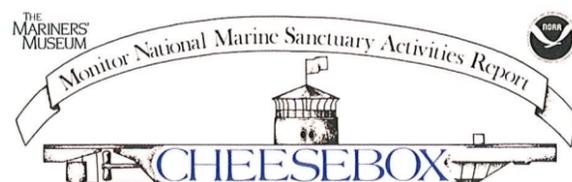
### Phase II - Recovering the Engine

The real test of planning by NOAA and the Navy came during Phase II. Nearly four weeks of mobilization during Phase I preceded the 28-day effort to raise the *Monitor's* engine. This phase began with the arrival of the 500-foot-long Derrick Barge *Wotan* at the wreck site in mid-June. The barge was equipped with a 300-ton derrick crane, accommodations for 104 personnel, and equipment to support two simultaneous dive operations. The barge was positioned over the wreck and held in place by eight large anchors,

each on a cable that could be adjusted so divers could be lowered to specific locations on the wreck.

Phase II employed divers from 26 separate Navy units and brought the latest technology to the mission. Navy divers employed conventional surface-supplied diving and, in addition, conducted proof of concept dives using a commercial saturation diving system that greatly increased dive time. The primary goal was recovery of the *Monitor's* steam engine. Navy divers worked around the clock for four weeks to remove lower hull plating, free the engine from a cement-like encrustation of corrosion

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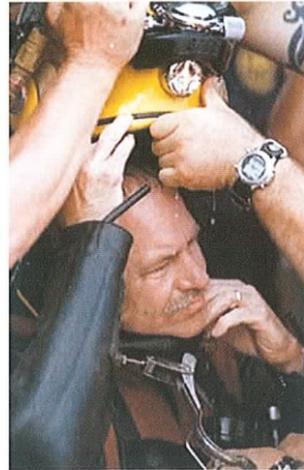




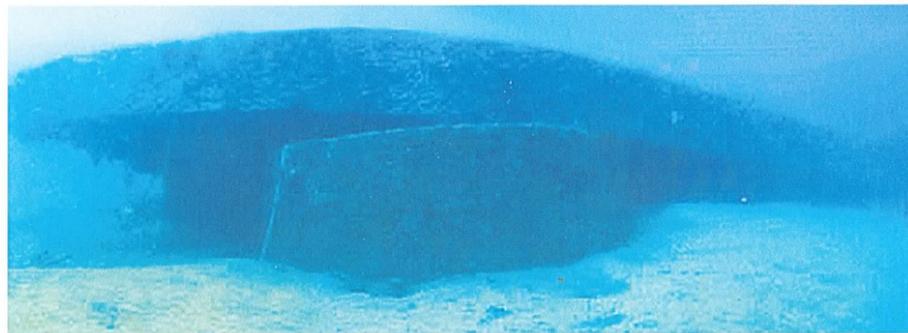
## Scenes from *Monitor* Expedition 2001



A team of Navy divers and NOAA archaeologists recover the steam engine of the USS Monitor.



CAPT. Chris Murray takes his MK-21 dive helmet off after completing the in-water phase of his dive.

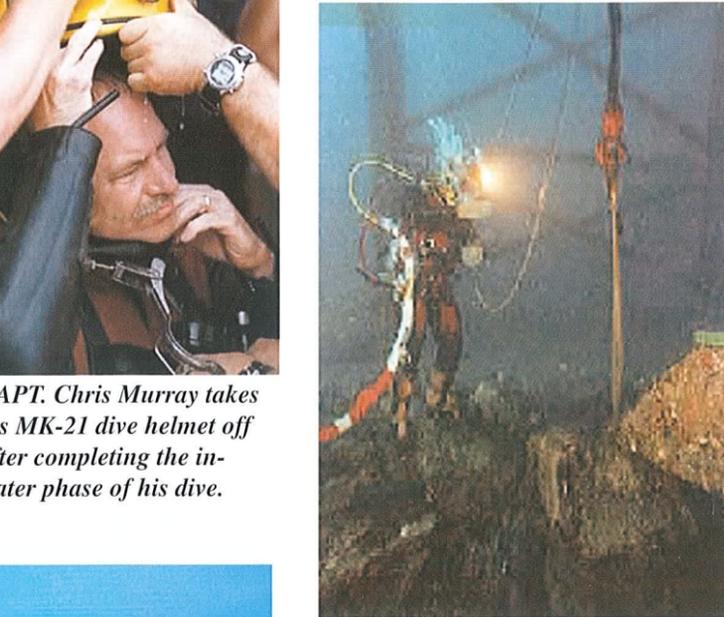


A Navy diver walks across the Monitor's hull as he rigs the engine for lifting.

The turret, seen here beneath a portion of the hull and armor belt, lies 240 feet below the surface.



Navy diver being "hatted up" for a dive to the Monitor. The camera and light mounted on the diver's helmet allows topside supervisors to see what the diver is seeing.



Images courtesy of U.S. Navy and NOAA



NOAA research divers explore the Monitor's turret. These free-swimming divers have good mobility and can hover or swim over the wreck.



## 2001 Expedition Paves Way for 2002

(continued from page 1)

products and coal, and attach the engine to lifting cables. Because the engine has been weakened by almost a century and a half of corrosion, all of its components had to be secured by dozens of cables and straps to a specially designed engine lifting frame (see diagram on page 4).

Once the engine was securely rigged, it was slowly lifted and raised clear of the hull. On July 16, 2001, for the first time in nearly 140 years, the Monitor's 35-ton steam engine appeared above the surface of the Atlantic Ocean. The engine was placed on a waiting barge and transported to a waiting Newport News Shipbuilding drydock.

Soon thereafter, the engine, with a section of the lower hull still attached, was transported to The Mariners' Museum, where it currently lies in a 93,000 gallon steel tank. The Museum plans to allow visitors to watch the conservation process, which could take five to ten years to complete.

### Phase III - Preparing for 2002

Phase III of the Monitor 2001 Expedition continued into August. On July 17, 2001, a team of NOAA divers began surveying the engine room while Navy

divers began removing a portion of the Monitor's armor belt.

### Monitor 2002 - Turret Recovery

Monitor Expedition 2002 is the last planned large-scale recovery mission in the implementation of a long-range preservation plan for this deteriorating warship. The primary partners with NOAA in this summer's Expedition are the Navy's Naval Sea Systems Command (NAVSEA), Mobile Diving and Salvage Unit Two (MDSU TWO), and The Mariners' Museum. Additional assistance will be provided by East Carolina University, the National Undersea Research Center at the University of North Carolina at Wilmington, Northrup Grumman Newport News, and the U.S. Coast Guard.

Monitor Expedition 2002 is the most complex and difficult of the recovery expeditions. The Monitor's world-famous revolving gun turret, with its two large cannons inside, is estimated to weigh nearly 150 tons. That weight, plus the weight of the unique steel lifting frame, means the final lift weight will exceed 200 tons.

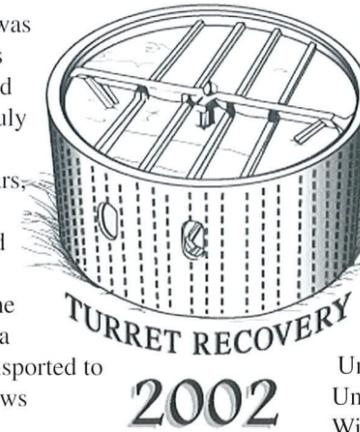
To gain access to the Monitor's turret for excavation and recovery, a portion of the Ship's remaining hull structure must be removed. The deck area over the turret

is covered with tons of debris and the likelihood of significant artifacts being found in this area is high.

Diving and recovery operations, like last year, will take place on the Derrick Barge *Wotan*. The more than 100 Navy personnel involved will conduct surface-supplied and saturation diving around the clock, seven days a week. An ROV will provide topside NOAA and Navy personnel with the means to observe and direct on-site tasks.

Once recovered, the turret will be transported by barge to The Mariners' Museum, where it will be conserved and placed on exhibit. In the meantime, the turret will be accessible to Museum visitors who will be able to see the turret undergoing a conservation process that could take between five and ten years.

A \$6.5M grant to NAVSEA from the Department of Defense Legacy Resource Management Fund makes the Expedition possible. NOAA is providing \$600,000 in additional funding.



Follow Monitor Expedition 2002

<http://monitor.noaa.gov>



## From the Pilot House

This issue of *Cheesebox* contains big news. As you will see in our lead story, last year's engine recovery was highly successful and the Monitor's engine now sits in a conservation tank at The Mariners' Museum. The really big news is that by the time you receive this issue, mobilization will have begun for this year's turret recovery expedition. Monitor Expedition 2002 is an incredibly complex operation, involving over a hundred engineers, riggers, divers and archaeologists. Michelle Fox, our new Outreach and Education Coordinator, will coordinate shore support and Web update activities, while Jeff Johnston, Tane Casserley and I will form the core of the NOAA Archaeology

Team on the barge. We are very excited about the expedition and I hope you will follow the action, beginning in mid-June, at <http://monitor.noaa.gov>.

This fall we plan to give *Cheesebox* a new look; we will also expand our Web coverage of our research and education activities. Please let us know—by mail or through our Web site—what additional information you'd like to see. And while you're at it, keep your fingers crossed that the weather cooperates with the expedition!

John Broadwater, Manager