Monitor National Marine Sanctuary Activities Report

CHEESEBOX

Vol. 2, No. 2

Monitor '83

On August 21, 1983, a team of scientists aboard the R/V **Johnson** arrived on station in the **Monitor** National Marine Sanctuary to initiate the first phase of archaeological and engineering research designed to culminate in stabilization of the wreck structure and recovery, preservation, and display of as much of the **Monitor** as is technologically and fiscally feasible. Plans for the five-day expedition were formulated by the National Oceanic and Atmospheric Administration, East Carolina University, and Harbor Branch Foundation following recommendations by the Technical Advisory Committee to adopt recovery of the **Monitor** as a major goal in the **Monitor** National Marine Sanctuary Management Plan. Their November 9, 1982, resolution was stated as follows:

> *In keeping with the primary goals of protection and preservation of the* **Monitor** *and all its associated records, documents and archaeological collections and to insure that the public of this and future generations have maximum access to the USS* **Monitor**, *including its artifacts and other data, the* **Monitor** *Technical Advisory Committee of the* **Monitor** *National Marine Sanctuary resolves and recommends to NOAA that a major goal in the management plan for the sanctuary be the recovery of the vessel from the wreck site and its removal to an appropriate location for study, conservation, and display.*

While myriad questions remain, the answers to which are prerequisite to making final decisions regarding recovery, conservation, and display of the remains of the USS **Monitor**, research in the ten years since the vessel was discovered has identified a number of specific data requirements that are critical to additional planning and assessment of recovery feasibility. In addition, both an engineering study carried out by Dr. Bruce Muga of Duke University and an assessment of the **Monitor**'s rate of deterioration prepared by Mr. Edward M. Miller of General Physics Corporation have identified signs that the turret in its present location under the port quarter of the vessel's hull has created considerable stress, which ultimately threatens the structural integrity of the after hull. Miller's study concludes by emphasizing "concern about the structural collapse of the vessel" and suggests "adding... support members under the hull structure...

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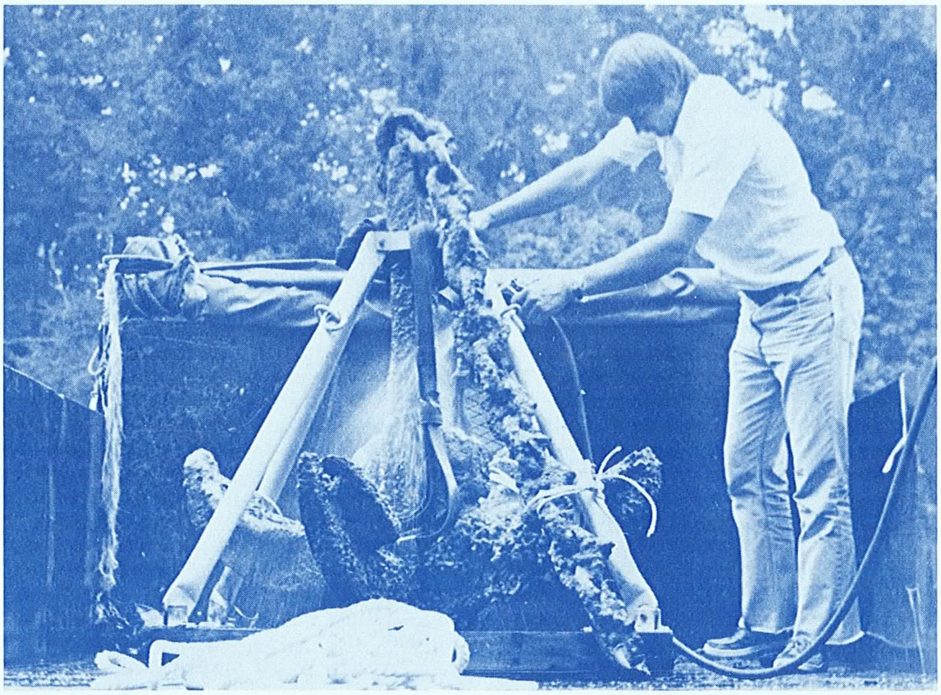

Gordon Watts, Chief Archaeologist for the expedition, hoses the anchor after it is unwrapped upon arrival at East Carolina University. (Photograph by Stuart Morgan)

Conservation of the Anchor and Chain

(Recovered from the wreck of the USS **Monitor**, August, '83)

The **Monitor** anchor, when recovered with a little over 5 feet of chain, weighed 1450 pounds and was completely covered with a marine encrustation between 5 and 15 millimeters thick, consisting of sand, shells, some coral and barnicles. To this, cemented by the iron oxide/calcareous cement of the encrustation, were several small pieces of hard coal, probably from the bunkers of the **Monitor**.

The encrustation was broken in two places: where the chain was severed in order to free the anchor from the rest of the wreck; and where the chain was joined to the anchor at the top of the anchor shaft. This short length of chain was left attached in order that we might obtain a sample of the chain along with any specialized ground tackle hardware such as swivels and shackles that might be attached.

The first indication we had of the physical condition of the anchor came when the crew of the R/V **Johnson** severed the chain prior to attempting to raise it. The tool selected for the job was a type of arc-oxygen torch known as a Broco torch. It is a very effective tool for cutting steel under water and the divers, in anticipation of this task, had practiced cutting pieces of scrap steel since, due to the versatility of modern steels, wrought iron is not only seldom used, it is difficult to obtain. Based upon their experience they expected to use one, or possibly two cutting rods. It took thirteen. The chain, at least, was apparently still sound.

Upon recovery, the anchor and chain were completely wrapped in cotton rags and a perforated garden hose was taped in place over this so that the anchor and chain could be constantly bathed with water inside their moisture retaining wrap. It was then wrapped over the cloth and hose with sheet polyethylene, sealed with duct tape and placed in a specially constructed frame to cushion it and keep it secured while being transported to the conservation facilities at East Carolina University in Greenville, North Carolina.

Once the anchor was aboard and secure,

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Readers are encouraged to comment on ***Cheesebox.*** All comments will be acknowledged and none will be published without the written consent of the author. Correspondence should be addressed to Ms. Hill at the University. We hope that you enjoy this issue and look forward to hearing from you.

Monitor '83

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(to) relieve the stresses concentrated at the turret." The study recommends assessing "the feasibility of the removal of the turret. . .to relieve the remaining ship structure from the calculated stress loadings which are causing the major longitudinal strength member, the port armor belt, to approach its plastic limit to prevent eventual structural collapse of the hull of the **Monitor.**" An engineering assessment prepared by Dr. Bruce Muga of Duke University concurs with the need to relieve this stress and calculates that removal of the turret and construction of a system of support for the hull is realistic and feasible.

Because of the stress created by the present location of the turret and the fact that the turret represents a feature associated with, yet separate and distinct from, the hull of the **Monitor,** its recovery, conservation, and display have been identified as immediate goals for on-site research. Stabilizing the hull section will provide assurance that the portion of the wreck that remains structurally intact will not collapse. Second, recovery of the turret will provide an opportunity to return the most unusual feature of Ericsson's warship to the American public. Recovery, conservation, and display of the turret will provide insight critical into the development and assessment of plans for the more complex and expensive recovery, conservation, and display of the **Monitor**'s hull.

While recovery of the turret and stabilization of the hull of the **Monitor** are the major objectives of current research, the final decision to implement plans for either operation must be made by NOAA on the basis of additional information both from the wreck and from technological and fiscal evaluations of the final proposal. The August 1983, investigation of the **Monitor** represented the first phase of a four-phase assessment designed to generate all prerequisite engineering, archaeological, historical, technological, conservation, and fiscal data in time to formulate review and approve plans for possible future recovery. At each stage of the proposed work, continued research will be evaluated in light of new data and the subsequent phase planned or the recovery option abandoned.

Objectives for this first stage of the proposed research included six primary tasks:

Document Wreck and Project Activities

Perhaps the most valuable products of on-site investigation in the USS **Monitor** National Marine Sanctuary have been the video tape records of the wreck site and research. These records have provided a frame of reference for archaeologists, engineers, historians, and others interested in the nature and condition of the site. In addition, video records have provided the first public assess to the Monitor in over a century.

To take advantage of a recently obtained broadcast-quality color underwater video camera and recorder installed on the **Johnson-Sea-Link I** (JSL-I) was the first research priority. The broadcast-quality color video equipment would provide the first opportunity to secure a comprehensive color record of the shipwreck and document on-site research activities. That record would be of considerable value in planning additional research and answering engineering and historical questions. The video tape records could also provide material that would permit assembly of a program to present the **Monitor** and on-site research to the American public.

Define Turret/Hull Association

In order to establish the nature of the present turret/armor belt relationship, project plans included estensive documentation of both structures, an engineering assessment of their relationship and testing to determine presence of corrosive welding. Plans for documentation of the turret/armor belt relationship included both color video and 35mm color photography. The attitude of the turret and armor belt was to be established using an inclinometer and traditional underwater archaeological three-dimensional surveying techniques that employ triangulation. The engineering assessment of the relationship of the two features would be performed by both submersible and lockout observation by engineers.

Define Sediment in Vicinity of Turret

In order to formulate plans for and assess the feasibility of stabilizing the hull of the **Monitor** and recovering portions of the remains, it is essential to develop a definition of the nature of bottom sediments in the vicinity of the turret and port-quarter armor belt. Such a definition is a prerequisite to evaluating the resistance to vertical and horizontal movement of the turret and construction of supports to stabilize the hull.

A penetrometer, specially designed for use in granular materials, would be employed to determine the amount of pressure needed to achieve specific penetration distance and assess sediment strength characteristics. At locations identified by an on-site reference grid associated with datum casings established north of the wreck in 1979, divers planned to probe the sediment and record resistance penetration. At four locations adjacent to the armor belt and north of the turret, sediment profiles would be taken. Using a coring device, diving scientists would sink 3-inch PVC casings into the sediment at locations identified by the on-site reference grid. Core samples would be identified by location and sealed for transportation to the surface. Both penetrometer testing and core sampling would be documented using both color video and 35mm photography.

A test excavation would be conducted at the base of and adjacent to the turret. The purpose of the excavation would be to generate sediment data and determine the precise nature and condition of rifle screen, stanchions, and other features attached to the turret. The precise location of the 3-foot-by-5-foot test excavation would be determined following a thorough reconnaissance of the area by an archaeologist at the beginning of the mission.

When the location for testing had been determined, the grid frame would be set up over the 3-foot-by-five-foot test site to control excavation and document its progress. Once its position had been tied to the provenance stations and an elevation transferred, the grid would be used to reference all data collected. Excavation would be carried out by hand, with a 4-inch induction dredge powered by a pump on the submersible utilized to dispose of silt and overburden. As the excavation progressed, exposed artifacts would be mapped *in situ* using a camera. Critical elevations would be made using a modified bubble level, and the excavator's observations would be recorded on tape during each dive. Once the necessary provenance data had been recorded, exposed artifacts would be removed, tagged, and placed in containers on the bottom pending transportation to the surface. At this point, the excavation, documentation, and recovery process would begin again and proceed systematically until the base of the turret was exposed.

By closely scheduling the excavation around a photograph, excavate, photograph, recover, and photograph sequence, it would be possible to assure maximum efficiency and recording accuracy. Sequencing each dive in this manner would permit photographs of material exposed by excavation to be developed and checked prior to the removal of artifacts. In the event that there were problems in documentation, additional photographs would be the first priority of the next dive. This system and closed circuit television monitoring of the excavation in progress would permit each member of the excavation team to maintain a constant awareness of all on-site progress and increase the efficiency of orientation sessions between dives.

In addition to recording on-site observations on tape, the excavation team would log significant details on submersible writing slates. During decompression, information from each slate would be transferred to a permanent log containing records of all significant observations. Rough transcripts of the site tapes would be prepared prior to each individual's next dive to reduce the possibility of errors. Maps of the excavation and a catalog of recovered materials would be updated on a daily basis.

Upon completion of the excavation, photographs of the exposed turret features would be made to record details. Although 1979 excavations confirmed a high-energy bottom, making backfilling unnecessary, the excavation would be backfilled as required to protect exposed, but unrecovered, material.

Sample Recovery

During the 1979 investigation of the

Monitor, two ruptures in the deck of the vessel were observed forward of the amidships bulkhead. The first was located in the wardroom and the second was found adjacent to the port armor belt immediately forward of the amidships bulkhead. At both locations nonstructural material associated with the ship was found to be washing out of the wreck and into the sediment below. Additional nonstructural material from the interior of the wreck was observed to exist outside the confines of the hull. Additional samples of material would be recovered adjacent to the port armor belt to facilitate identification of patterns for distribution of material outside the confines of the wreck.

All samples would be documented and plotted *in situ* and individually tagged for identification prior to being placed in containers for recovery. Each 5-gallon container would be placed in a specially designed recovery basket for transportation to the surface by submersible or lift bag. Once aboard the research vessel, each sample would be photographed, cataloged and repacked, under the supervision of a conservator, for transportation to the conservation laboratory.

Structural Testing

A number of structural tests have been identified as essential in assessing the present structural conditions of the USS **Monitor**. All are related to determining the structural integrity of the wreck. During the project, efforts would be made to conduct limited structural tests as time and conditions permit. At the site of ruptures in the deck and deteriorated plating on the bottom of the armor belt, an increment borer would be used to secure samples of structural wood. Each sample would be documented and its location identified. A limited section of the turret base would be exposed to determine the composition and condition of the floor and if possible the locations of access hatches. This activity would be documented with both color video and 35mm photography and the exposed area would be re-covered for protection prior to departure from the site.

An effort would be made to assess the condition of fastenings associated with the armor belt and deck armor by mechanical cleaning and 35mm photographic documentation. Cleaning would be limited to one or two selected fasteners to be identified during the engineering assessment of the wreck. Exposed fasterners would be re-covered using either plastic or cement designed to solidify in water. At the location of exposed fasteners and in other areas identified during the engineering reconnaissance, electrical conductivity of the structure would be measured using a submersible potentiometer. This nondestructive testing would be documented using 35mm photography.

Locate and Recover Anchor

To date the largest artifact recovered from the wreckage of the USS **Monitor** is an iron hull plate sample recovered in August 1977. While this provided the first insight into the condition of the wreck structure, the plate had been disturbed in 1973 when an oceanographic camera fouled the wreck. During the incident, portions of the calcarious crust which had formed on the plate were dislodged, altering its condition and rate of deterioration. Because of the surface-area-to-weight ratio, the plate

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Conservation of the Anchor and Chain *(Continued from page 1)*

the ship preceeded to the port of Beaufort, North Carolina, where the anchor in its frame was transferred to a truck which took it to East Carolina University followed by a van load of anxious observers.

Upon arrival at the campus it was taken to the conservation facility, the wrappings were removed, it was rinsed, cleaned of some of the larger lumps of shell and coral adhering to the encrustation, examined and placed in its tank to begin electrolytic reduction. Examination of the anchor and chain revealed that our earlier indications of condition were essentially correct. The depth of corrosion where the chain had been severed and where the encrustation had broken at the juncture of chain and anchor was less than 5 millimeters. Based on this it was estimated that the depth of corrosion anywhere on the anchor would be less than 10-12 millimeters. The corroded material was black, soft, slightly granular and appeared not to have "grown" beyond the original dimensions of the artifact. This condition is not uncommon on ferrous material recovered from marine situations. It typically consists of a form of ferrous oxide, called magnetite with significant chloride and sulfide content. Ferrous compounds may be reduced to elemental iron by controlled electrolytic reduction; so this was what we had both hoped and expected to find.

Even though the corrosion-affected area is quite thin, it occupies the most important area of the artifact: the original surface. Therefore the conservation problem is to preserve the surface of the anchor in place so that the anchor can safely exist in a dry condition and at temperatures that people find acceptable for themselves.

The conservation of the anchor and chain is divided into three phases:

1. Reduction
2. Salt removal
3. Coating and protection

The object of the reduction phase of the conservation is, *in so far as possible*, to reduce the ferrous corrosion products from their oxidized state to iron to preserve intact the surface of the artifact. This is done by adjusting the electrode potential of the anchor so that hydrogen (H) ions are formed within the corrosion layers and react with the corrosion compounds. This must be done at a very low current density since evolution of hydrogen above the rate that reduction occurs results in the formation of hydrogen gas bubbles (H_2) which not only do not participate in the reduction reaction but can cause mechanical perturbation of the surface. This tends to cause surface removal rather than reduction.

In the case of the **Monitor** anchor this is being done within its coating of marine encrustation at an initial current density of ca. .0003 amps/cm^2 of surface area at about 11.7 volts. The encrustation is porous and will permit ions to flow through it and by remaining in place on the anchor, will protect the surface from damage and, more importantly, will protect the surface ferrous corrosion products from coming in contact with oxygen that would further oxidize the surface causing, perhaps, more damage to it than did 120 years of submergence.

The encrustation will be removed as the rate of reduction slows and hydrogen bubbles gradually form between it and the surface of the anchor. This will create a cleavage plane along the encrustation/anchor interface and will allow the encrustation to be removed with minimal damage to the surface. What we actually have to accomplish this is a small direct current power supply regulated at 4.5 amperes and stainless steel anodes suspended near the anchor in 750 gallons of 2% sodium hydroxide (NaOH) solution in a large painted steel tank.

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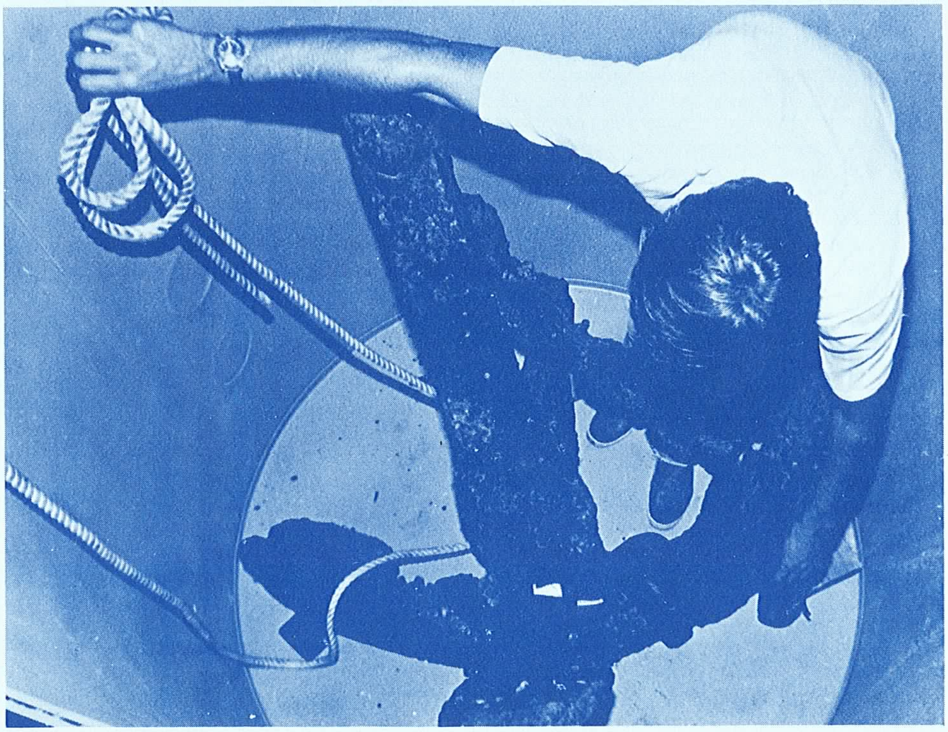

The *Monitor*'s anchor being positioned in the storage tank prior to the initiation of conservation procedures. (Photograph by Stuart Morgan)

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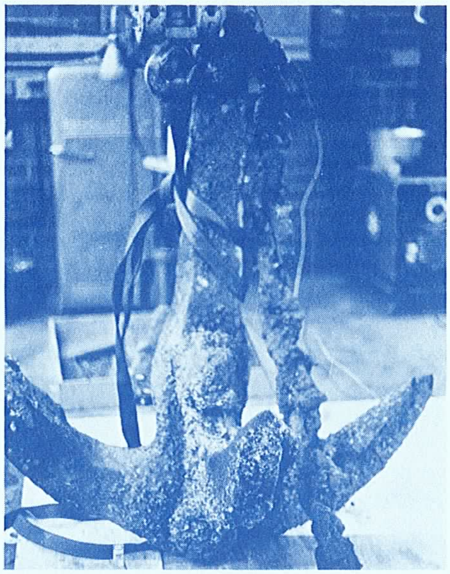
provided somewhat limited insight into the present condition and conservation problems associated with heavy objects such as the turret and ordnance.

To provide a suitable heavy object sample for analysis and conservation, the anchor of the **Monitor** would be located and recovered along with a section of anchor chain 10 feet in length. Recovery of the anchor would not disturb the archaeological integrity of the site, as it was believed to be some distance from the wreckage. It would provide both structural deterioration and conservation data essential in developing plans for recovery and conservation of the warship's turret. Once testing and conservation had been completed, the anchor would provide a unique artifact for inclusion in displays to enhance public awareness of the **Monitor** National Marine Sanctuary and plans for continued investigation of the ironclad.

To accomplish these objectives a team of diver-scientists had joined the R/V **Johnson** in Beaufort, North Carolina, prior to departing for Cape Hatteras on August 20, 1983. John Broadwater, Virginia Historic Landmarks Commission underwater archaeologist and Director of the Yorktown Shipwreck Project, joined the project to assist in the conduct of archaeological research. Edward M. Miller, an engineer with General Physics Corporation of Columbia, Maryland, provided engineering expertise necessary to conduct the desired structural testing and documentation. Wesley K. Hall, a graduate student in the Program in Maritime History and Underwater Research, and Gordon P. Watts, Jr., codirector of that program and Director of Underwater Research at East Carolina University, brought additional archaeological experience to the project and completed the lock-out scientific team. In preparation for the mixed gas lock-out diving, each of the researchers had undergone rigorous physical examinations that would identify potential sources of problems when working under the pressure of 230 feet of sea water. In addition, the team traveled to the Harbor Branch Foundation Fort Pierce, Florida headquarters in late May to undergo four days of submersible lock-out training and equipment familiarization exercises. The training included diving physiology, safety and emergency procedures, and equipment operation. To ensure that each diver scientist would be competent and comfortable enough in diving operations to concentrate on the various research tasks, training included lock-out exercises and a chamber dive to 180 feet to simulate decompression. When the R/V **Johnson** and crew arrived in the **Monitor** National Marine Sanctuary before dawn on August 21, 1983, months of planning and preparation had come to an end.

August 21, 1983

Using Loran C, the crew of the **Johnson** quickly locates a precision depth recorder target conforming to the signature the **Monitor**'s remains are known to produce. Shortly after 0800 the JSL-I is launched to place an acoustic transmitter at the site, conduct observations, and video tape the wreck. Within the hour it is obvious that the sonar target is not the **Monitor** but a previously unknown rock outcrop and associated reef



The *Monitor*'s anchor. (Photograph by Dina Hill)

structure. After recovery of the submersible, a second target is identified by the R/V **Johnson**'s depth recorder slightly west of the initial contact.

0100: A second submersible dive quickly identifies this target as another rock outcrop and reef structure. Neither feature was known to exist in the **Monitor** National Marine Sanctuary or its immediate vicinity. After recovering the JSL-I and recording the position of the features, the Loran-C coordinates for the **Monitor** are rechecked and found to be consistent with the most current chart location of the **Monitor**'s remains.

The problem has been created by changes in the Cape Hatteras vicinity Loran C chains that have been effected since the 1979 expedition. Coordinates used in 1979 were associated with two chains that have been discontinued and replaced. Having to unexpectedly relocate the site using only depth recorders proves to be time consuming as bottom surface coverage is limited. By late afternoon new chain coordinates are secured and combined with the calculated position of the site to produce a point of origin for the search. Steaming in ever-widening circles around that point of origin produces results. Within a half-hour a third sonar target having characteristics similar to those produced by **Monitor**'s wreckage is located.

1855: Submersible launched again with less than an hour before sunset. After identifying the target on sonar, the crew heads slowly in its direction. Low light and poor visibility make navigation tedious.

1900: The submersible crew radios the location of wreckage and ten minutes later confirms its identification as **Monitor.**

In spite of low visibility, an examination of the wreckage confirms that there have been no dramatic changes since the 1979 expedition. While low light and turbidity prevent video taping the site, an effort is made to locate the anchor. From a station immediately aft of the bow where chain from the anchor well had been observed to stretch across the starboard armor belt and disappear into the sand, Tim Askew and Ed Miller again employ the JSL-I sophisticated sonar to scan the bottom south of the wreck. Historical records indicate that the anchor should lie southwest of the **Monitor**'s bow at a distance of approximately

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After the initial changes of electrolyte, which will clear the sea water from the encrustation, the chloride content of the solution will be monitored at least weekly to enable us to keep track of the progress of the reactions and to help determine optimum intervals for solution changes. As the encrustation loosens and is removed samples of the surface will be examined to determine the extent to which reduction has occurred.

The second phase; salt removal is critical because salt, predominantly ironsalt, is formed within the corrosion as a result of oxidation in salt water. This salt, if it is not removed and is exposed to oxygen either by contact with air or with oxigenated water, will oxidize iron to iron oxides and hydrochloric acid (HCl). The HCl in turn reacts with the remaining iron and oxygen to form ferric chloride and water, or ferrous chloride and hydrogen which will oxidize to ferric chloride and water, which begins the corrosion anew.

Salt removal is accomplished by electrolysis, the same mechanism as is reduction. To facilitate salt removal the current density is raised to increase the voltage drop at the surface of the artifact and cause the Cl^- negatively charged chloride ions to leave the reducing surface of the cathode/anchor under electrolytic pressure.

The electrolytic solution will be checked for chlorides weekly and will be refreshed on a schedule designed to maximize the rate of salt removal. When the solution approaches the chloride content of the Greenville, North Carolina, municipal water supply the de-ionized water will be used in the electrolyte. When chlorides stop appearing in the solution the surface of the anchor and chain will be checked, especially along weld lines and fissures to minimize chances of a hidden "salt pocket" going undetected.

In the final phase of conservation the anchor and chain will be rinsed to remove all traces of the NaOH electrolyte, coated with a tannic acid solution to stabilize the surface and dried in an oven at about 150° C. In the assumption that the National Oceanic and Atmospheric Administration intends to store and display the anchor under controlled museum conditions, a final coating of microcrystalline wax will be applied to protect against such hazards as water, fingerprints, perspiration, and being left on the loading dock during lunch.

A special shipping/storage/display container should be constructed to protect it from the abuses to which heavy artifacts are often subject since it will have a relatively fragile surface for its weight. We also plan, as treatment progresses, to unbolt the two removable flukes and to remove the chain from the anchor by unscrewing the shackle, if possible. The chain link that was cut to free the anchor will be sacrificed for metallurgical examination.

Curtiss E. Peterson
University of South Carolina

600 feet. While the project schedule calls for an extended search using a sophisticated device for subbottom object location, it is hoped that the anchor and some of the **Monitor**'s anchor chain might be visible on the bottom surface and detectable on sonar.

Within minutes the sonar identifies two targets to the south-southwest of the wreck. Maneuvering slowly across the bottom and tracking the closest target with the sonar, Askew and Miller close on the object. Disappointly it proves to be a 5-gallon can. The second target, located 150 yards south-southwest of the **Monitor**, is relocated and the search continues. In further-reduced visibility Askew and Miller examine the second target. Although fouled by modern line and heavily encrusted, two distinct flukes are visible above the bottom surface. Hard-pressed to believe that location of the anchor could be so simple after the frustrating exercise required to relocate the wreck, Askew reports the identity of the second target to the R/V **Johnson** and records details of the object on video tape before requesting clearance to surface.

2041: The JSL-I is recovered and spirits are much improved. While valuable time has been lost in relocating the wreck site, finding the anchor with sonar on the first dive eliminates the need for several dives scheduled for searching. Following recovery of the submersible the operations schedule is adjusted accordingly. Our next dive will be to video tape the wreck.

August 22, 1983

0630: After breakfast we install a pump and mount the induction dredge on JSL-I's manipulator. While the first dive is scheduled for video taping and engineering assessments, the low visibility option will be to excavate the anchor. On the bottom it is disappointing to find that sediment suspended in the water column has reduced visibility to approximately 10 feet. After a brief examination of the turret and armor belt by engineer Bruce Muga, work in the vicinity of the wreck is halted. Exercising the low-visibility option, the submersible heads for the anchor. Within minutes of initiating excavation, visibility drops to almost zero and all work has to cease. After waiting in hope that the visibility will improve, JSL-I surfaces.

1300: Following recovery we rig the dredge to be diver-operated, add a high pressure gas jet to JSL-I's manipulator, and install a vertical thruster on the submersible's bow. In the event that we cannot work at the wreck site we will have the option to lock out a diver-scientist and excavate the anchor. Within minutes of the launch it is obvious that video taping is out of the question. Visibility is still less that 10 feet at the wreck. As this is sufficient for working on the anchor, the submersible is positioned to permit the forward thruster to be used to remove the overburden. Due to the unconsolidated nature of sediment covering the anchor, the vertical thruster is extremely effective for controlled excavation. In clear view of the submersible pilot and observer the thruster can be accurately positioned and run to gently blow sand away, uncovering the anchor's stock.

Once the anchor crown has been exposed, John Broadwater is locked out of the dive compartment to attach a lifting harness carried in the submersible's forward storage basket. Working immediately forward of the JSL-I, the archaeologist quickly clears the anchor of modern line and, following a previously determined pattern, slips the nylon web harness around the flukes. After snugging the harness down across the anchor crown, Broadwater attaches a new 3000-pound lift bag. The bag is partially filled to prevent its fouling the anchor. With darkness only hours away and the seas rising, it will be best to attempt the recovery in the morning. Before returning to the dive chamber of the submersible, Broadwater identifies a link of the anchor chain for cutting and cleans the calcarious crust away with a hammer. Everything is ready for recovery.

August 23, 1983

Unfortunately the weather has deteriorated throughout the night. A quick check at the sanctuary confirms that conditions would have to moderate before the JSL-I could be launched and recovered. We wait, anchored in the lee of Cape Hatteras. After a frustrating day we check the site again in mid-afternoon. Seas are still running at 6 to 8 feet and the wind remains 20 to 25 knots, gusting to 30 knots. Captain Abney takes the R/V **Johnson** back northwest to anchor near Cape Hatteras. After supper we regroup and plan for tomorrow in hope of improving weather.

August 24, 1983

Again the primary objective will be to video tape the wreckage. However, as visibility has been consistently low, we also prepare to lock-our Craig Caddigan of Harbor Branch. If low visibility precludes video taping, Craig will cut one link of the anchor chain, using a torch especially adapted for use on the submersible, and finish filling the lift bag.

0808: The JSL-I is launched. Within minutes it is obvious that lower water column conditions have not improved. As anticipated, visibility is only 5 to 8 feet on the bottom and video taping of the wreck is out of the question. Once the submersible is positioned up-current of the anchor, Craig locks out and attaches a 37 khz pinger to the lifting harness. After driving a 6-foot fiberglass rod into the sediment to identify the end of the anchor chain, Craig cuts a line approximately 5 feet from the anchor. With everything cleared, Craig begins to fill the lift bag with compressed air. Filling continues for ever-lengthening minutes as conversations turn to overcoming suction created by the sediment. Finally Askew radios that the bag and anchor have left the bottom.

Having received confirmation that the anchor has left the bottom, the R/V **Johnson** moves in for recovery. All aboard scan the surface for evidence of the lift bag. After an agonizing two minutes it is obvious that something has gone wrong. The anchor never arrives at the surface.

After recovering JSL-I so that Craig can be transferred to the **Johnson**'s chamber for decompression, we review the video tape of recovery activities. Everything has gone according to plan. This leaves a number of possibilities: the lift bag and anchor are fouled: perhaps the bag has "burped," spilling its air and sending the anchor back to the bottom. The most unlikely and still disturbing of all possibilities is that the bag and anchor are only slightly buoyant and drifting in the water column. The attached pinger is transmitting so relocation will not be difficult.

1430: Once the submersible's batteries have been recharged, JSL is launched to track the pinger and relocate the lift bag and anchor. Visibility on the bottom is less than 5 feet and it is virtually impossible to see the bottom from the submersible sphere, a distance of only 3 feet. After 45 minutes of tracking, the pinger is located. To our dismay it is lying on the bottom, no longer attached to the anchor recovery harness. We recover the pinger and assess the situation. The only option is to relocate the anchor and lift bag using the sonar. With enthusiasm at low ebb, we identify two targets southwest of the **Monitor** and head slowly in their direction. Visibility is additionally reduced by the afternoon sun and we travel across the bottom with pains-taking deliberation, eyes straining to penetrate the murkey water. Finally, after more than 30 minutes, we close on the first target. It is almost under the submersible before we can identify it as the lift bag. Visibility is so poor that we use the closed-circuit television to examine the bag. With the camera's high resolution we can see that the entire top of the bag has blown out. Beyond, the bag we are relieved to find the **Monitor**'s anchor sitting upright on the bottom.

After video taping the bag and anchor we return to the surface to examine recovery options. This late in the day, with seas already marginal, visibility barely acceptable, and the submersible's batteries low, we decide against recovery. Too many considerations are too close to the threshold where safe operations are over-extended. The decision is depressing but prudent.

2100: At anchor near Cape Hatteras, we rig the JSL for recovery. Hopefully we can use the submersible's manipulator arm to attach and fill new lift bags. If we can conduct the recovery remotely, our schedule can be organized to permit Ed Miller's engineering assessment on the same dive. With good visibility the afternoon dive could be devoted to video documentation. Our plans are all contingent upon good weather, however, and the forcast is not promising.

August 25, 1983

0730: Before we arrive on station it is apparent that the seas have not moderated. Winds are a constant 20 to 25 knots. After riding out the morning in hopes of some indication of change, we secure our equipment and head for Beaufort. Fortunately, the **Johnson** will be operating in the vicinity of Cape Hatteras for another week. If weather improves, we may be able to return to the sanctuary just long enough to recover the anchor.

August 29, 1983

Up early after a mad scramble to Cape Hatteras following Jeff Prentice's Sunday morning call confirming improved weather. Courtesy of the U.S. Coast Guard we head eastward to rendezvous with the R/V **Johnson** in the USS **Monitor** National Marine Sanctuary. When we arrive on-site the JSL has already been launched and is proceeding toward the anchor with Tim Askew, Don Liberatore, Rich Morris, and Craig Caddigan aboard. The recovery plan calls for attaching two lift bags to the harness. With both filled to capacity, they will provide 3000 pounds of lift. In the event that these operations cannot be carried out using the JSL's manipulator, Craig is prepared to lock out to attach and fill the bag manually.

Once positioned adjacent to the anchor, the lift bags are removed from the JSL's forward

(Continued on page 6)

The John Ericsson Society
(April - August 1983)

Richard Sandstrom, dressed as John Ericsson, riding on *Monitor* float for July 4 parade in Manhattan.

July 4th American —Scandinavian Salute

The 1983 American - Scandinavian Harbor Festival culminated in a rousing 4th of July parade in New York City and featured a colorful float of the U.S.S. **Monitor**. The John Ericsson Society (JES) and the American Society of Swedish Engineers chose Ericsson's **Monitor** to represent their organizations and co-sponsored the project. John Wennstrom was JES Committee Chairman for the float project, and Alzar Templeton was Artistic Advisor. A vigorous fund raising campaign was coordinated by Treasurer Arthur Peterson. Michael Lydon created banners which were carried in the parade by members of both societies. The float was constructed by the Bond Float Company of New Jersey.

John Ericsson was portrayed by JES member Richard Sandstrom, who rode on the float throughout the parade. The parade began in lower Manhattan and marched up Broadway to the reviewing stands in front of City Hall. The parade lasted three hours and highlighted Scandinavian - Americans. Despite broiling mid-summer temperatures, the turnout was excellent.

John Ericsson's 180th Birthday Celebrated In New York City

On July 29, 1983, members of the John Ericsson Society (JES), the American Society of Swedish Engineers, friends, guests, and state and local officials gathered to celebrate the birthday of **Monitor** inventor John Ericsson. The celebration was held at the site of the Ericsson memorial in Battery Park, lower Manhattan.

Fred Ekvall, Vice President of the JES, acted as Master of Ceremonies for the event which began with the laying of a wreath on Ericsson's statue. Arnold Abrahamson and Richard Sandstrom carried the Swedish and American flags. Gunnar Melin led the group in singing the American and Swedish national anthems, with musical accompaniment by Walter Eriksson. Paster Evert Olson of the Church of Sweden gave the invocation.

A proclamation from Governor Mario Cuomo, honoring Ericsson's achievements, was presented by Assemblyman Joseph Ferris. A second proclamation from Mayor Ed Koch, declaring July 29th "John Ericsson Day in New York City," was read by Majority Leader of the New York City Council, Thomas Cuite. A third proclamation from Borough President of Brooklyn, Howard Golden, was read by Fred Ekvall. He noted that Brooklyn was the site of the construction of the **Monitor**.

Following the proclamations, JES Director of Research, Alazar Templeton, spoke at length on Ericsson's creativity and his numerous accomplishments; she emphasized the role of the ironclad **Monitor** in preserving the Union. She also gave a report on the August 1983 plans for the NOAA-ECU archaeological expedition to the **Monitor** National Marine Sanctuary.

Greetings from the Swedish Government and an address on the life and achievements of John Ericsson were then given by Deputy Consul General Hans Anderson.

Dynamic vocal and musical presentations were given, between the speeches, by Gunnar Melin and accordianist Walter Eriksson.

Following the ceremonies, most of the participants gathered at the Seaman's Institute for lunch and a continuation of the convivial celebration.

John Ericsson Memorial, Battery Park, New York City.

Monitor Places First In Islip Tricentennial

Islip Township, Long Island, New York, was one of the first communities to be founded in North America. Islip was granted a charter in 1683 and marked its tricentennial celebration in May 1983.

A week of festivities was climaxed by a grand parade on Sunday, May 22. Included were numerous marching units, floats, fire engines, military vehicles and a plethora of colorful personalities. Leading the parade were the following dignitaries: Maud S. Sherman, James Poro, Sr., The Honorable Alexander W. Kramer, Robert David Lion Gardener, Charles B. Webster and Richard Johnson.

The parade was highlighted by a float of the U.S.S. **Monitor**, designed and built by Gunnar Lundstedt, a patriarch of the town of Islip, the John Ericsson Society and White Cap Seafood Co. As founder of White Cap, Gunnar has been its president for 45 years and proudly notes that it is the oldest corporation with that same officer in New York state. He and his brother John are co-owners of White Cap Seafood. Gunnar is also currently a vice president of the John Ericsson Society (NYC) and a member of the Islip Chamber of Commerce.

Gunnar chose John Ericsson's **Monitor** as the subject for his float to reflect both his Swedish ancestry and American heritage. He built the float in his backyard and worked continuously on the project for two months. Construction was delayed several times by rainy weekends. At 3:30 a.m. Sunday morning before the parade, Gunnar was still adding finishing touches.

The float measured 22 feet in length with the hull of the **Monitor** constructed from a real wooden (open) boat. Gunnar made the turret from a halved steel drum. With a lathe he hollowed out the centers of two wooden table legs to create the cannons. He chose a bright alumninum paint for the **Monitor**'s turret and upper hull and a copper color for the lower hull. Sandra Sarro and Claudia Esposito provided artistic assistance in painting the float; they also made the accompanying placards, including a description of the historic battle of the ironclads. Michael Cherveny, another local enthusiast, helped attach the float to a flatbed trailer in preparation for the parade.

A colorful array of flags and pennants for the float were rounded up and prepared by Jean Svedin and her granddaughter, Stacey Robbins and friends Holly and Melinda Blam.

Riding on the **Monitor**'s deck were crewmen Gunnar and John Lundstedt. Stacey Robbins and Holly Blam, both of Swedish descent, rode on the forefront of the float, proudly displaying the American and Swedish flags. Peter Svedin and Michael Cherveny drove the truck which transported the float. Gunnar's sheperd dog, Bubu, pursued the float throughout its journey across town; at times he darted in front of the truck and float, wanting very much to join the **Monitor**'s "crew." He was thwarted by the booming of the **Monitor**'s cannons, as Gunnar fired a series of blanks at intervals. After considerable persistence, however, Bubu acquired a front seat with the drivers of the truck.

Following the parade, Gunnar's efforts were well rewarded; his **Monitor** float received first prize. He was presented a flag by the Islip Chamber of Commerce and a handsome trophy with the inscription: "Islip Hamlet Tricentennary Celebration, 1683 - 1983, Best Original Float, First Place."

When asked about his plans for the float after the parade, Gunnar replied that he planned to keep it as a souvenir—possibly to commemorate some future event!

Alazar Templeton
Director of Research
John Ericsson Society, NYC

Monitor '83 *(Continued from page 5)*

storage basket. Large hooks make attachment of both lift bags relatively straightforward and simple. A high-pressure gas hose attached to the manipulator is inserted into the bag and compressed air is released by controls inside the submersible sphere. Without complication the lift bags and anchor clear the bottom at 0947. A short 20 seconds later, the yellow bags break the surface 300 yards off the **Johnson**'s starboard bow. As the **Johnson** maneuvers to bring the bags alongside, we make final preparations on the foredeck. While a diver attaches a line to the harness, we secure the pillory especially designed to hold the anchor during its voyage to Beaufort and transportation to conservation facilities at East Carolina University in Greenville, Once the anchor has been winched alongside, a cable from the forward crane is attached. One hundred twenty-one years after being ordered released by Captain Bankhead to bring the **Monitor**'s bow into southwest seas, the anchor is hoisted aboard the R/V **Johnson**. Recovery has gone without complication.

Following a short but enthusiastic celebration, we photograph the anchor and begin to wet-pack it for the remainder of the voyage. First layer after layer of absorbent cotton rags are applied. Particular care is taken to see that the entire surface is covered. The rags will retain water, keeping the anchor constantly wet until it can be placed in a tank for conservation. A 50-foot section of sprinkler hose is wound around the chain, shank, and flukes. Connected to the R/V **Johnson**'s salt water system, it will ensure that any water draining from the cotton rags will be replenished. Finally the anchor and chain are lashed to the pillory and wrapped in plastic as an additional precaution against deterioration caused by premature drying. Lashed to the **Johnson**'s foredeck hatch, the **Monitor**'s anchor will ride securely until the R/V **Johnson** reaches Beaufort on September 1. As we return to Cape Hatteras aboard the Coast Guard vessel, talk turns to plans for future operations. While the anchor will provide valuable insight into the **Monitor**'s construction and present condition, our highest priority objectives remain unrealized because of weather and poor visibility. Always a potential source of problems, the Cape Hatteras environment has disrupted our research schedule. The only alternative is to return and try again.

Gordon P. Watts, Jr.
East Carolina University

Monitor Project's Who's Who

A four-member scientific team, supported by divers from Harbor Branch Foundation, participated in an expedition to the **Monitor** National Marine Sanctuary from August 21-25, 1983. Drawn together for the five-day project at least partly through their common interest in the historic Civil War wreck located beneath 36 fathoms of water in the Atlantic Ocean were the members of that scientific party: Gorden P. Watts, chief archaeologist; John D. Broadwater, senior archaeologist; Wes Hall, archaeologist; and Ed Miller, engineer.

Watts currently directs underwater research for East Carolina University's graduate Program in Maritime History and Underwater Research in Greenville, North Carolina, while Broadwater, adjunct professor for the same program, works as an underwater archaeologist with the Virginia Historic Landmarks Commission in Yorktown, Virginia. Thirty-year-old Hall, the team's youngest participant, is a second-year graduate student in the two-year ECU program, and Miller presently serves as senior engineer with General Physics Corporation in Columbia, Maryland.

Although they shared a common interest in this year's scientific investigation of the USS **Monitor**, their individual backgrounds differ widely. Watts received A.B. and M.A. degrees in history from ECU in 1968 and 1976 respectively while Broadwater, who received a B.S. in electrical engineering from the University of Kentucky in Lexington in 1966, now pursues an M.A. in American Studies at the College of William and Mary in Williamsburg, Virginia. Miller meanwhile, received a B.S. in Engineering and International Relations from the U.S. Naval Academy in 1974, and Hall received a B.A. in Anthropology from the University of Arkansas in 1977.

Of the four, two have published books concerning the famous Civil War ironclad. Watts, with 15 years experience as an underwater archaeologist, authored *Investigating the Remains of the U.S.S.**Monitor**: A Final Report on 1979 Site Testing in the **Monitor** Marine Sanctuary*. In addition, he wrote his master's thesis on "**Monitor** of a New Iron age: The Construction of the U.S.S. **Monitor**" and was one of the principal investigators on the **Eastward** cruise that located the wreck of the **Monitor**.

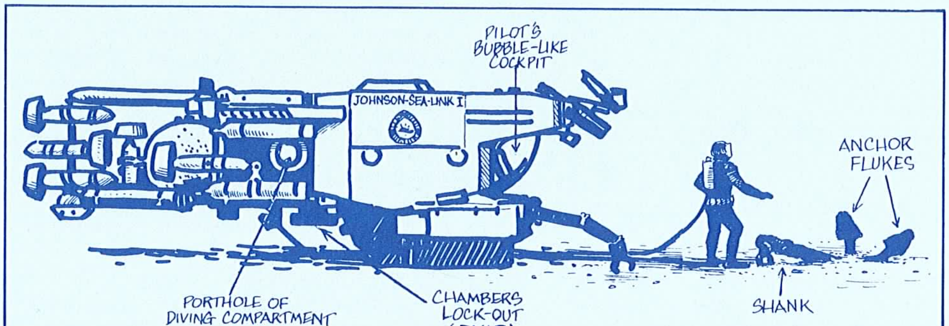
Miller first became interested in the **Monitor** as a midshipman at the U.S. Naval Academy. In fact, while at the academy he was deeply involved in ***Project Cheesebox***, a multidisciplinary research project to study the history of the **Monitor** and attempt to locate its remains. Upon graduation in 1974, he was temporarily assigned as project officer of ***Cheesebox*** at the Naval Historical Center. ***Project Cheesebox*** involved midshipmen, historians, researchers, and technical experts who studied the historic ironclad's last hours and assisted in determining the wreck location. The project resulted in a three volume publication. Miller's book, *U.S.S. **Monitor**: The Ship That Launched a Modern Navy*, is an extension of that project. The book was published in 1978 while Miller served as assistant engineer and saturation diving officer aboard one of the Navy's newest catamaran-hulled submarine rescue vessels, the USS **Ortolan**.

Broadwater has most recently published "Development of a Preservation Plan for Virginia's Submerged Cultural Resources" (1982), "Virginia's Underwater Archaeology Program" (1982), and "The Confederate Ironclad CSS **Virginia**: Myths and Facts" (1982). He participated in the search for the **Monitor** in 1973, assessment of the wreck site in 1974, and the 1979 expedition. In addition, Broadwater has participated in a number of underwater archaeological research surveys and excavations over the past thirteen years. Since 1978, he has served as project director for Yorktown's Shipwreck Project.

Wes Hall is experienced in both historic and prehistoric archaeology. Before entering ECU's program last fall, he supervised and/or participated in numerous terrestrial and underwater archeaological surveys and excavations, primarily throughout the southeastern United States. He is scheduled to complete his course work in the spring.

Stuart Morgan
East Carolina University

(**Editor's Note:** As of December 5, 1983, Edward Miller accepted a position as Project Manager with the Sanctuary Programs Division of NOAA.)



Artist's illustration of underwater archaeologist near anchor: From a description of John Broadwater's activities at the anchor's location ECU artist Roger Kammerer illustrates the archaeologist advancing towards the anchor. Exiting the JSL's dive chamber around 4:30 P.M. Monday, the project's second day, Broadwater is depicted advancing from the submersible's port side towards the anchor, located about 5 feet in front of the vessel's bubble-like cockpit. The anchor, with two flukes exposed about a foot from the ocean's floor, can be seen with about 5 feet of its chain trailing into the sediment to the bow anchor well of the *Monitor*. The anchor's shank, with part of its chain exposed, points toward the submersible's cockpit.

U.S.S. MONITOR:
The Ship That Launched A Modern Navy

There are many "famous" ships. Some are famous because they just happened to be the lead-ship of a class or because they were used as a flagship by some Admiral at a famous battle or other noteworthy event — the **Olympia** and **Missouri** for instance. Some are famous by reason of a particular incident which had special political implications. The frigate **San Jaucinto** of the Trent Affair is an example, or the **Maine**, or the **Pueblo**. Some are famous by reason of long and consistently successful careers and because they happened to survive. The **Constitution** — "Old Ironsides" — and the **Constellation** are such, as is the **Texas**. But for every one of these there were many other ships which could just as well have become famous or been "saved" and, with the hyperbole of the local tourist bureau, been memorialized.

Some ships owe their fame to the fact that they sank in cold and inaccessible waters and lay there "in bond", relatively undisturbed until the archaeologists "discovered" them. The Swedish warship, **Wasa**, is one such, as is the gondola, **Philadelphia**, recovered some years ago from the bottom of Lake Champlain and now on display at the Smithsonian Institution; or brig, **Defence**, which still lies in shallow water in Penobscot Bay, Maine. Certainly, the **Defence**, which hid from the victorious British Forces after fleeing the disastrous battle off Castine in August 1779, and was shortly blown up by her crew, has no claim to fame other than as a "survivor."

Then there are some, but very few, ships which can lay claim to fame in their very own right. Such ships are destined early-on to be saved, to be memorialized. And if sunk, they become the object of research, intensive sleuthing, and, with luck, eventual location. Columbus' **Santa Maria** fits this description. Though many have researched her records and searched the coast of Hispaniola where she reportedly sank on Christmas Day, 1492, she remains to be found.

So far as U.S. Naval history is concerned, there are two ships which, in their own right and quite without regard to being a flagship or some political *cause celebre*, have to be considered truly famous. Of these two ships, it can honestly be said that they launched a "new" navy and tolled the end of the old. These two are, of course, **Monitor**, "The Ship That Launched A Modern Navy", and **Nautilus**, the ship which launched the nuclear navy. Some might claim a similar distinction for **Langley**, the converted collier, which was the harbinger of the aircraft carrier, but, there is something quite different between a truly new ship as leader, as compared to a ship which is the conversion of a near-redundant hull to new use.

Monitor, even more than **Nautilus**, can lay claim to being *really* famous for she meets the other critieria of fame also. She paricipated in the famous seas battle with C.S.S. **Virginia**, formerly the U.S.S. **Merrimac**, in Hampton Roads — and, if she did not win, at least she saved the day. She was a national morale builder and political darling, as well as a technological leader.

Finally, **Monitor** meets the final criteria for fame — namely, she sank and was swallowed in the mystery of the sea for over 100 years, long enough to become 200-proof from the standpoint of the archeologists as well as the historians.

These were the elements of her fame that led to a series of expeditions, starting shortly after World War II, to find her. It was this fame and the raw challenge of finding her which led then-Midshipman First Class Edward Miller and seven of his classmates to embark on an academic project in their First Class year at the Naval Academy and which eventually led to the location of **Monitor**. This, in turn has led to an additional element of fame for the little "Cheesebox-on-a-Raft — she was designated by Congress as the very first National Marine Sanctuary.

U.S.S. ***Monitor****: The Ship That Launched A Modern Navy* by Edward M. Miller, is the beautifully written story of **Monitor** from the genesis, years before the Civil War, of the idea of such a warship by her famous designer-builder, John Ericsson; through the politics of her construction; the tension and heroics of her engagement with **Virginia** on Sunday, March 9, 1862; and on through her sinking off Cape Hatteras in the early morning hours of December 31, 1862, while being towed to further duty at Beaufort, North Carolina, by the paddle wheel steamer **Rhode Island**. Finally, this story of **Monitor** has something which no previous naval history has given us — namely, the story of how Captain Ernest Peterkin, USNR, of the Naval Research Laboratory and others, as a hobby sleuthed the trail which was to lead to her location. But the unique and prideful substory here is how eight midshipmen, working on a First Class project, catalyzed the joint effort of the Navy's technical branch; the Historian of the Navy, Vice Admiral Edwin Hooper, USN, (who had earlier been Commander Service Force Pacific and in charge of Ship Salvage and Underwater Search); the oceanographer of the Navy; the Supervisor of Salvage of the Navy; and the civilian oceanographic and oceaneering community — How ***Project Cheesebox*** led to the mounting of an expedition which very professionally searched for and found **Monitor**.

This book, viewed as a direct result of the eight-man ***Project Cheesebox*** at the Naval Academy in 1973-74 is truly a landmark. The first four chapters, from the training and eventual immigration to the United States of Swedish inventor-engineer, John Ericsson, through the famous battle with C.S.S. **Virginia** in Hampton Roads has, of course, been written in greater or lesser scope in all U.S. Naval histories. The treatment here, which stems from the very comprehensive researching by the ***Project Cheesebox*** team is, however, far more complete and authoritative. The book is as earlier noted, beautifully written and appropriately augmented by sketches, drawings, photographs, copies of logs and chartlets.

Then come the final two — of six — chapters. These will not be found in any previous story of **Monitor**. To tell the thrilling and tragic tale of the mid-winter tow South, the ferocious storm off Cape Hatteras, the abandoning and sinking of **Monitor** and the efforts of pulling boats from **Rhode Island**, Ed Miller and his classmates researched the National and Naval Archives, the newspapers and other periodicals of the time, and numerous personal letters of survivors and rescuers. Shipwreck stories are always thrillers. This is a great one; a true one. Chapter Five, "The Loss of U.S.S. **Monitor**", I predict, will find its way into some later day anthology of shipwrecks and sea disasters.

Finally Chapter Six, "The Search for the **Monitor**", provides us an accurate, if slightly anticlimactical, summary of all the known previous projects to search for **Monitor**. This reviewer says "accurate" on the basis of having himself been involved in several of the earlier attempts while coming up the ladder and eventually as Navy Supervisor of Salvage. Author Miller is too polite to this reviewer, however, for he could have reported, but did not, that I was especially unbelieving and pessimistic at the conference in the Naval Research Laboratory which preceded the successful expedition aboard **Alcoa Seaprobe** which found and positively photographed **Monitor.** I thought at the time that the evidence they had was inconclusive. Happily, I was as wrong as could be.

We all like to join a winning team and read of a winning effort. Lieutenant Ed. Miller's *U.S.S.* ***Monitor****: The Ship That Launched A Modern Navy* is the story of a winning effort in more ways than one. President Lincoln and his cabinet took a gamble in authorizing the **Monitor** to be built. They won. The ahead-thinking Naval constructors, along with Ericsson, were winners, too, in promoting the technological advances which were embodied in **Monitor**. And the Navy as a whole won and followed the **Monitor** into the modern era of steam-propelled, iron and steel ship with revolving turrets. Finally, this book is the story of a winning effort by eight midshipmen, Naval Academy Class of '74, and their academic advisors and shipmates and mentors from the technical side of the Navy in winning the Great **Monitor** Sweepstakes!

In the full spectrum of the mine countermeasures business, there are three phases: search, classification, and rendering safe. In the business of ship salvage and, particularly as it relates to the salvage of submarines or aircraft crashed in the sea and H-bombs lost off the coast of Spain, there are also three phases: search, identify and recover or salve. Similarly, in the business of underwater archaeology there are three phases: research and search, confirm or identify; and recover and conserve. The larger **Monitor** Project is now down to the last phase — recover and conserve. It remains to be seen whether funding will be provided for the application of existing technology to recover or salvage **Monitor**. Such a project would be technologically quite difficult and quite expensive, but the salvage part of it is, nonetheless, state-of-the-art.

On the other hand, the technology of conservation of **Monitor** hull and machinery, once returned to the surface, is not yet developed. Nor is there a resolution of the political and entreprenuerial aspects as just how and where she would be displayed. The State of North

Carolina, off whose shores she rests, wants her; as does the city of Norfolk on whose doorstep she fought her famous battle. Lieutenant Miller alludes to these problems in the Epilogue of his book. Further, he is in the midst of them as a member of the **Monitor** Technical Advisory Committee. It is quite possible that one day in the future it will fall to him to write a Chapter 7 — "The Recovery of the **Monitor**." To those of us who carried nickles to school in the 1930's to "save Old Ironsides", this seems quite possible. In the meantime, *U.S.S.* **Monitor**: *The Ship That Launched A Modern Navy,* stands as a remarkably thorough history of the little Cheesebox-on-a-Raft from the time she was conceived, down to the underwater surveys of her present location 220 feet beneath the seas off Cape Hatteras.

Capt. W.F. Searle, USN (Retired)

(**Editors Note:** Captain Searle held the Office of Supervisor of Salvage, U.S. Navy, from 1964 to 1969. Since retiring he has established a world-wide practice as a salvage consultant and has served the United Nations in a consulting capacity relative to the clearance of ports in Bangladesh and the Suez Canal. With his colleagues LCDR Herman Kunz, USN (Retired) and Professor David Wyman of Maine Maritime Academy, he searched for and located the wreck of the Revoluntionary War brig ***Defence***. He is a member of the ***Monitor*** Technical Advisory Committee.)

Monitor's Commanding Officers to be Researched

A collection of biographical sketches of the U.S.S. **Monitor**'s commanding officers is currently being compiled under contract to the North Carolina Division of Archives and History. The **Monitor** had six commanding officers during her brief existence. John Worden was the first, followed by Samuel D. Greene, Thomas O. Selfridge, Jr., William Jeffers, Thomas H. Stevens, and John Bankhead. Jeffers and Worden served in the Mexican War, while Stevens spent the war years as naval storekeeper in Honolulu in the Hawaiian Islands. Selfridge and Greene were both Naval Academy graduates. Selfridge graduated first in his class in 1854 and was the first officer of the Academy. Greene graduated in 1859, seventh in a class of twenty which included Alfred T. Mahan.

John Lorrimer Worden, one of the *Monitor's* commanding officers.

During the Civil War all but Greene commanded various war ships including the **Monitor**. Greene spent the war years as executive officer of the **Monitor**, the **Florida**, and finally the **Iroquois**. In addition to the **Monitor**, Worden and Stevens would command other monitors during the war. Worden commanded the **Montauk** in the South Atlantic Blockading Squadron where he was involved in a number of engagements, including the destruction of the Confederate cruiser **Nashville** near Savannah, Georgia.

Of all the **Monitor** commanders, Stevens had the most distinguished war career. He commanded the gunboat **Ottawa** in the capture of Port Royal and later was in charge of the expedition up the St. John's River that resulted in the occupation of Jacksonville, Florida. After briefly commanding the **Monitor**, he transferred to the **Sonoma**, which was involved

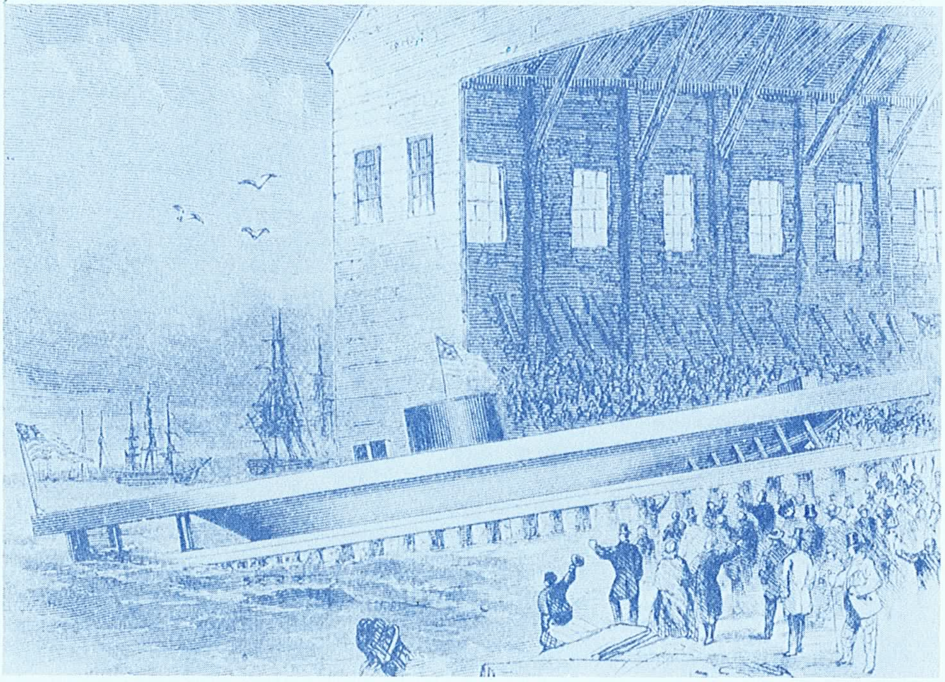
(Continued on page 11)

Who Built the Monitor?

A number of our readers have written to ask for information concerning where the **Monitor** was built and by whom. As you will see, that is not an easy question to answer. Many of the requests for information were associated with efforts to establish whether an ancestor was involved in the construction; others were prompted by a desire for a more complete history of the vessel. We felt that all of our readers would find it of interest to know just how many iron works, foundries, and forges participated in building the **Monitor**. And if you find that great-granddad did indeed play a role, we would like to hear from you.

The companies that created the **Monitor** were as follows:

- Delamater Iron Works, New York City, constructed the engines and boilers. This company was located at the foot of West 13th Street on the Hudson River.
- Novelty Iron Works, New York City, constructed the turret. It was located on the East River, at the foot of East 12th Street.
- Holdane and Company, New York City, was one of four iron works that manufactured iron plates for the **Monitor**. The company was located at 84-86 Washington Street.
- Continental Iron Works, Greenpoint, Brooklyn, Long Island, was responsible for construction of the hull and for general assembly of the vessel. Thomas F. Rowland was the proprietor of Continental.
- Clute Brothers and Company, Schenectady, New York, constructed a donkey engine for operating the turret.



When launched on January 30, 1862, the *Monitor* represented the collective labors of no less than nine foundries.

- Albany Iron Works of Troy, New York, manufactured iron plates. The manager of this plant was John F. Winslow. Rensselaer Iron Works, also of Troy, manufactured iron plates, iron bars, and rivets.
- Niagra Steam Forge of Buffalo manufactured the two port stoppers for the gun ports when **Monitor**'s guns were not in use.
- H. Abbott and Son, Baltimore, Maryland, manufactured iron plates and bars. Historical sources indicate that this was the only plant in the country capable of rolling armor plate one inch thick.

Dina B. Hill East Carolina University

Aboard The **Monitor** (In Miniature)

My greatest interest is in the design and construction of the **Monitor**, and I have created detailed exterior and interior cutaway models of this unique ironclad, each nearly four feet in length (Figure 1). The models were built to a scale of one quarter inch to one foot.

Since John Ericsson destroyed nearly all existing plans and drawings of the **Monitor**, I found it necessary to research a large number of sources to construct these models. Sources include Civil War newspapers, engravings, lithographs, documents, and personal accounts by **Monitor** crewmen. The letters of **Monitor** Paymaster William F. Keeler to his wife, Anna, were especially helpful. Other important sources include a set of drawings featured in *Model Craftsman*, February 1937, and blueprints by S.B. Besse from The Mariners Museum, Hampton Virginia. Over two thousand hours were required in the construction of these two models. Basic construction materials were wood, metal and plastic.

The USS **Monitor** contained some forty patentable inventions, many which actually never were patented. One of these was the ship's unique anchor well (Figure 1). The anchor was protected in a covered cylindrical hole in the bow, and it could be raised and lowered without exposure to enemy fire.

Behind the pilot house and below the main deck were berths of officers and men (Figure 2). The captain's cabin (Figure 3) was on the front port side of the berth deck. It was ten feet square, and adjoining it on the starboard side was his stateroom of equal size. Immediately behind were eight staterooms for the other officers, four on each side of the wardroom. These staterooms were six by eight feet, with bunks resting against the outside walls.

Storage closets were set in the walls above and under the beds. Each stateroom had several shelves with patterns cut into them, into which were set a washbasin, water pitcher, tumbler, soap dish, night jar and other utensils (Figure 3). They were made of white stoneware with **Monitor** inscribed on many of them in gilt lettering. A gilt framed mirror hung over each set of shelves. The woodwork was polished black walnut.

There was a grill in the floor of each stateroom to admit fresh air from the circulating system. Light was admitted into each room through a glass disc set overhead, which could be opened to admit air when the sea was calm. But rarely was the sea calm! Paymaster Keeler wrote that when he glanced up, he often saw fish swimming overhead, within the glass disc. Keeler also wrote that due to extremely crowded quarters, he had to keep his books on the bed during the day; he then placed them on the floor at night when he slept.

There were accommodations for only half the crew since at all times half were on and half off duty. The men slept in hammocks suspended from the upper deck by brass rings. Part of the berth deck was directly under the turret, and because of the extremely low freeboard of the vessel (eighteen inches), the sea often washed in under the turret and swept the men right out of their hammocks.

The officers ate their meals in the central wardroom. Their table had leaves which could be added or removed according to the number of guests they had for that day. Oil lamps suspended from the overhead deck and on the walls provided illumination in the wardroom. Storage lockers ran along both sides of the hull. There were provisions for the men for three weeks. The shellroom was located near the turret chamber on the port side of the vessel and the gunpowder room was directly opposite on the starboard side.

I have included a great many intricate details in the living quarters of my interior cutaway model. Every floorboard was handlaid. The woodwork is primarily balsa and pine. There are several bookshelves in the cutaway model; the books were made from small pieces of balsa, cut to scale, sandwiched between two layers of cardstock, and the labels were all hand-lettered. The open log in the wardroom was constructed similarly; the pages were individually made and hand scripted. I created the mirrors from balsa with wire grillwork and added aluminum foil for the reflective surfaces. Most of the washbasins and bowls were made from halved cherry pits. The water glasses were made from tiny sections of glass capillary tubing. Capillary tubing was also used to create the candles, which were then inserted into plastic beads; the beads were glued to modified cast metal parts. The miniature oil painting in Captain Worden's cabin was handpainted and framed. The wine bottles were created from dowling and plastic and also hand labeled. The cheese in the "Cheesebox" is a cross section from a twig with a wedge cut out. The fruit in the bowl in Worden's cabin was handmade with lichen added for leaves. Styrofoam was used to construct the mattresses in the officers' quarters, and cloth was added for sheets and blankets. The pillows were also created from styrofoam with soft tissue covering. The table and chairs in the wardroom were handmade from wood with red velvet upholstery created from discarded clothing.

A single bulkhead amidships (Figure 4) separated the living quarters on the **Monitor** from the engine and boiler room with an airtight seal. Coal bunkers, one hundred tons capacity, were located along both sides of the hull, aft of the bulkhead. Two Martin boilers, nine feet high, generated a steam pressure of 40 psi. The boilers were mounted in the hull side by side, and they depended on forced drafts of air brought in through two large deck openings by blowers.

The **Monitor**'s vibrating lever engine (Figure 5) generated 320 horsepower with two pistons contained in a single cylinder casing, thirty-six inches in diameter. The piston rocked back and forth, and a series of connecting rods changed the vibrating motion to rotary to turn the drive shaft. At the end of this drive shaft was a four-bladed screw propellor, nine feet in diameter. A cavity in the overhanging rear upper deck protected the propellor. Just behind it was the ship's rudder.

In the construction of my cutaway model, I used real bituminous coal, ground into fine chunks, in the bunkers. Rivets in the boilers and other machinery were made from the heads of straight pins. Many crates and boxes were made from blocks of wood with added details. Some parts, especially tools, were carefully selected to scale and purchased ready made. The ship's galley, directly under the turret, was entirely handmade as were all the pots and pans. Included is a skillet with two eggs being fried, sunny side up, for Captain Worden's breadfast.

The **Monitor**'s most unique feature (Figure 6) was her revolving gun turret. The turret had an exterior diameter of 21 feet 4 inches and an interior diameter of 20 feet with a 9 foot

All photographs for this article by Robert Templeton, from the Alazar Templeton **Monitor** Collection.

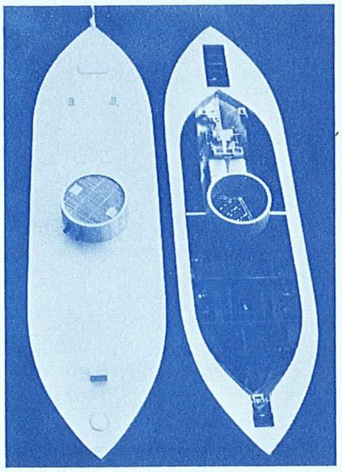


Figure 1.

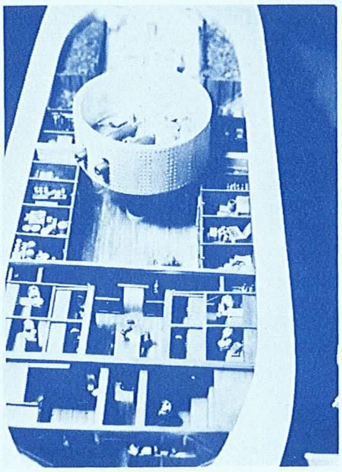


Figure 2.

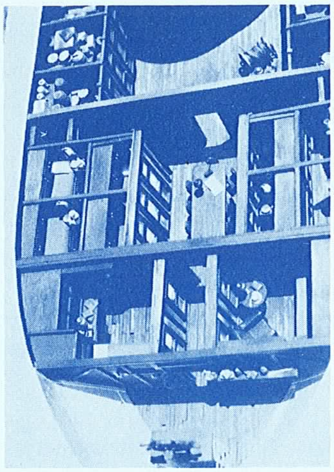


Figure 3.

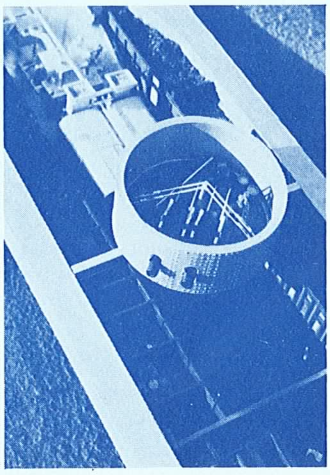


Figure 4.

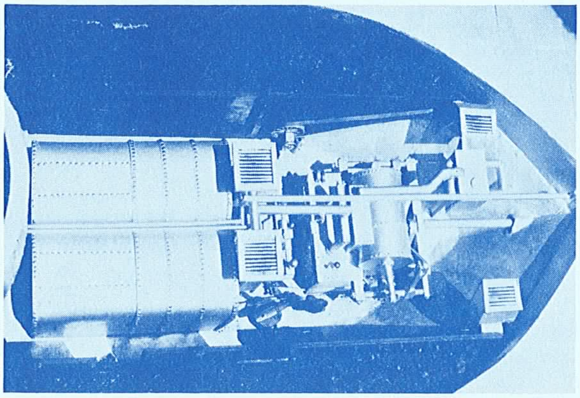


Figure 5.

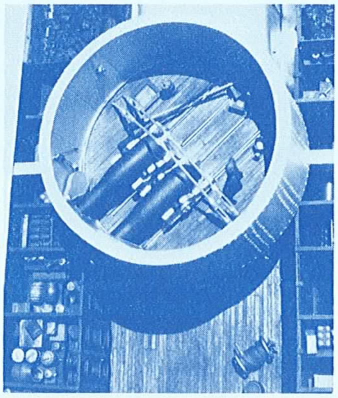


Figure 6.

height. The walls were made of eight layers of iron armor, each one inch thick, curved and bolted together. The turret was manned by nineteen officers and gunners; it mounted two eleven-inch Dahlgren guns which were run out to fire through two ports on one side. The guns fired 175 pound shot with a 15 pound powder charge. Firing time was once every eight minutes. The turret turned on a brass ring inset into the deck. A central vertical drive shaft revolved the turret and was turned by four large horizontal gears connected to a small steam engine. The men could enter or leave the turret through a hatch which had to be directly aligned with the ladder underneath. During the battle, temperatures inside the turret reached 140 degrees F.

The guns in the turrets of both **Monitor** models were turned on a lathe. The cannonballs were made from glass beads. The turret hatch was constructed from fine wire mesh and framed with balsa. The rivets in both turrets were made from the heads of straight pins, and there are more than six hundred rivets in each turret!

The overall length of the USS **Monitor** was 172 feet with an extreme beam of 41 feet 6 inches. The lower hull was 124 feet by 34 feet. The ship's draft was 10 feet, 6 inches. The deck armor consisted of iron plates, one inch thick, over 8 inches of wood planking. The **Monitor**'s side armor belt was comprised of iron plates, 5 inches thick, backed by 25 inches of wood. The ship had a designed speed of 9 knots with an actualized speed of only 6 knots; displacement was 987 tons. The design of the **Monitor** has often been considered the most revolutionary in naval history.

This is my second set of exterior and interior cutaway **Monitor** models. The first set was purchased by the Philadelphia War Museum in 1981, where they are now on display. I have made a great many improvements in the design, construction, and detail in the new models due to much additional research.

During the past seven years, **Monitor** models which I have built have been included in various exhibits and other events. My first set of models were the focal point of my year long exhibit (1979) at the U.S. Navy Memorial Museum in Washington, D.C. My models have been included in NOAA television conferences, the National **Monitor** Conference (Raleigh, North Carolina), Norfolk Harbor Festivals, exhibits at the Philadelphia Civic Center, New York Aquarium, **Monitor** Research and Recovery Foundation (Norfolk, Virginia), Buffalo Science Museum and the Houston Astrodome (Texas).

I am especially grateful to Commander Tad Damon and other staff members at the Navy Museum for many helpful suggestions in creating these new models. I also greatly appreciate advice and suggestions from Captain Ernest Peterkin, Edward Miller, August Crabtree and H. Sheperd Paine.

Alazar Templeton
Director of Research
John Ericsson Society, NYC

Commanding Officers

(Continued from page 9)

in a thirty-four hour chase of the Confederate cruiser **Florida** on the Bahama Banks. On this cruise the **Sonoma** captured five prizes off Bermuda. He then received command of the monitor **Patapsco**, which was involved in frequent actions around Charleston during the summer of 1863. On September 8, 1863, he led a night boat attack against Fort Sumter, which was repulsed with heavy casualties. He later commanded the **Oneida** and monitor **Winnebago** in the Gulf Blockading Squadron, conning the latter armored vessel in the battle of Mobile Bay.

After the war, three of them—Selfridge, Stevens, and Worden—would reach the rank of rear admiral, while Jeffers would be appointed commodore. Selfridge and Worden would command the European Squadron and Stevens would command the Pacific Squadron. Bankhead was made captain in 1866 and commanded the **Wyoming** in the East India Squadron until ill health forced his retirement. He died in 1867 while on the way home and was buried at Aden, Arabia. Greene rose to the rank of commander before committing suicide in 1884. One biographical sketch said that "The cause assigned for this act was anxiety over an article on the engagement between the **Monitor** and **Merrimac** that he was preparing for publication."

The biographical sketches will be completed during the winter of 1983 with publication scheduled for 1984.

William N. Still, Jr.
East Carolina University

List of Publications

Publications on research conducted for the U.S.S. **Monitor** National Marine Sanctuary are available to the public upon request. Please contact:

Ms. Gloria Thompson
Sanctuary Programs Division
Office of Ocean and Coastal Resource Mgmt
National Ocean Service
National Oceanic and Atmospheric Admin.
3300 Whitehaven Street, NW
Washington, D. C. 20235

OR

Ms. Diana M. Lange,
***Monitor* Sanctuary Coordinator**
Underwater Archaeology Unit
Division of Archives and History
P.O. Box 58
Kure Beach, North Carolina 28449

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☐ Hill, Dina B. (edited by) *Analysis and Preservation of Hull Plate Samples from the **Monitor***. 1981.
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☐ Watts, Gordon P. *Investigating the Remains of the U.S.S. **Monitor**: A Final Report on 1979 Site Testing in the **Monitor** National Marine Sanctuary*. 1982. (Temporarily out of print).
☐ Watts, Gordon P. and James A. Pleasants, Jr. *U.S.S. **Monitor**: A Bibliography*. 1981. ($2.00 per copy, make checks payable to: N. C. Division of Archives and History).
☐ 1983 ***Monitor*** National Marine Sanctuary Management Plan. 1983.

Thank You. . .

The 1983 **Monitor** expedition was the result of a cooperative effort involving a number of individuals, agencies, and institutions. NOAA and ECU would like to take this opportunity to express our appreciation to all those who assisted in and/or participated in the planning and conduct of this expedition.

A very special thank you goes to the team of special consultants who devoted a tremendous amount of time and energy to the project. These included Curtiss Peterson of the University of South Carolina and Kenneth Morris of Mobil Chemical Corporation, consulting conservators; Dr. Bruce Muga of Duke University, consulting engineer; and Capt. Ernest Peterkin, USNR (Ret.), consulting historical engineer. We would also like to express our appreciation to Dr. Donald Hamilton of Texas A & M University, who profided assistance in planning the conservation section of the expedition operations manual, and to Dr. Stanley Riggs of East Carolina University who assisted in formulating specifications for the sediment coring device designed for the expedition. Conduct of the project would have been extremely difficult if not impossible without the participation of two of the diver scientists: Edward Miller of General Physics Corporation and John Broadwater of the Virginia Historic Landmarks Commission. We would like to thank these two agencies for permitting their staff members to be involved in research in the **Monitor** National Marine Sanctuary. We would also like to thank Dr. Robert Jones, Director of the Johnson Science Laboratory, and the crews of the R/V **Johnson** and **Johnson Sea-Link I**, of Harbor Branch Foundation, for all of their efforts under sometimes frustrating and difficult conditions.

At ECU a number of individuals were instrumental in providing support, both moral and logistical, and we would like to acknowledge their contribution to the project. Dr. John M. Howell, Chancellor, and Dr. Angelo Volpe, Vice Chancellor for Academic Affairs, have frequently demonstrated their support for **Monitor** research during the past year and it has been much appreciated. Robert Franke, Director of Sponsored Programs, Curtis May of Grants Administration, and Rod Seymour of Purchasing worked closely with project planners and coordinators to expedite a number of items. Dr. Susan McDaniel, Associate Vice Chancellor for Academic Affairs, provided assistance in locating space for conservation of artifacts. William R. Craft, Superintendent, and Larry Snyder, Engineer, both of the Steam Plant, provided space for the anchor storage tank.

Acknowledgement must be made to Bobby Tripp of Daughtridge Oil, Greenville, for donation of the anchor storage tank and to Hardee and Cox, also of Greenville, for assistance in the fabrication of project equipment.

Special thanks go to Bill Hershman of the Sea Gull Motel for all of his efforts in coordinating accommodations for shore support personnel and members of the media. And a *very* special thanks must go to Sam Neal of Hatteras, who provided one of the vessels used to shuttle guests to the research vessel. "Cap'n Sam" rapidly became an almost indispensable member of the project team and we are most grateful for all of his assistance encouragement, and interest.

Finally, to all of our readers who sent messages of congratulations, who wrote to share your excitement about our research in the **Monitor** National Marine Sanctuary, and to all of you who were with us during the project in spirit if not in body, we thank you. This project would not be possible without all of you.

Dina B. Hill
East Carolina University

The Pilot House

The 1984 expedition was, as most of you know, affected by unfavorable weather which resulted in the completion of only one of the project objectives: recovery of the **Monitor**'s anchor. The anchor is currently undergoing conservation at East Carolina University (please see the articles related to the expedition and conservation of the anchor in this issue) and planning is underway for the next step in on-site research. More about future plans for the site in future issues.

Beginning in 1984, ***Cheesebox*** will be published three times annually: April, August, and December. Two of the issues will be as the past three have been: a combination of technical and general articles, current events, and historical notes. The August issue will be a "special" issue dedicated to one subject or one aspect of the **Monitor,** its history, or research at the site. We are excited about the prospect of producing this special issue and will provide more information about it in the April ***Cheesebox.***

We would like to encourage our readers who have ideas for articles for ***Cheesebox*** or who have historical material that they would like to donate to the **Monitor** archival collection to please contact us. We would appreciate hearing from you.

Again, the editors of ***Cheesebox*** would like to thank all of our readers who have forwarded comments, suggestions, and expressions of support for this publication. The comments continue to be very positive and we appreciate hearing from you.

Finally, we would like to express our appreciation to NOAA and particularly to Dr. Nancy Foster, Chief, Sanctuary Programs Division; Gloria Thompson, Sanctuary Specialist; and Edward Miller, **Monitor** Project Manager for all of their assistance in the compilation of this issue of ***Cheesebox.*** It is a pleasure working with all of them.

Please help us keep you better informed by keeping us notified of any change in your current address.

Program in Maritime History
and Underwater Archaeology
Department of History
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Monitor National Marine Sanctuary Activities Report
CHEESEBOX

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