



H.L. Hunley Project Update

Period: August 2016-January 2017

Conservation Team Report

- Finished conservation of ruler HL-2784. The final step will be the consolidation of the sections and the reconstruction of the artifact.
- Finished the conservation of approximately 40 rubber gaskets: HL-3422, HL-3447, HL-3399, HL-3525, HL-3440 (A- B), HL-3504, HL-3537, HL-0967, HL-3503, HL-0921, HL-0922, HL-3455, HL-3453, HL-3470, HL-3466, HL-3467, HL-3478, HL-3481, HL-3465, HL-3559, HL-3547, HL-3554, HL-3475, HL-3496, HL-0896, HL-3495, HL-3401, HL-3487, HL-1992, HL-3653, HL-3500, HL-3453, HL-3779, HL-3506, HL-3508, HL-3433, HL-3542, HL-3510, HL-3498, HL-0633
- Continue with conservation of large rope fragments HL-3143. To date, 10 of these fragments where cleaned and consolidated.
- Continue conservation of cotton rope HL-3787 from forward pump piston
- Plate CT2 (snorkel box) is currently under electrolysis
- Conservation and desalination of forward pumps parts and ballast tank connecting pipes continue
- The sodium hydroxide solution of the Hunley tank was neutralized and new solution prepared. This conservation teamwork took about a week to be completed.

H.L. Hunley hull:

- The deconcretion of the interior of the submarine is continuing. Major features such as the crank and operational features within Grid 1 to include forward bulkhead have been completed. Current ongoing tasks include deconcretion of the flywheel and aft bulkhead. "Probelines" facilitating the measurement of concretion thickness within Grid 1 on plate boundaries prior to full deconcretion have been completed, and measurements carried out.
- In October 2016, the recirculation system had to be repaired due to the Hurricane, which impacted the deconcretion activities but not the Hull treatment.
- Weekly monitoring of the cathodic protection of the submarine.

Other activities:

- X-rays of artifacts.
- XRF analysis of artifacts for material identification.
- Monthly chloride monitoring of iron alloys artifacts.

Outreach:

- One conservation intern from Externado Universidad in Colombia started in December.
- Gave project update to Hunley volunteers in February 2016 and November 2016
- Participated and prepared the lab for the Hunley member's tours
- Gave a talk at the Rotary Club of Mount Pleasant about the Hunley project
- Hunley VIP tour for people from Oceaneering

- Filmed a video and photo shoot for museum furniture maker Patterson-Pope. The video and photos highlights the storage rooms and the costume made furniture for the Hunley collection.

Archaeology Team Report

Hull Component Documentation and Analysis

- Interior Deconcretion: WLCC conservators continued to make progress with the deconcretion of the interior of the submarine. The focus remained on the components of the crew compartment and the captain's station. All seven sections of the hand crank were completed, revealing indications of leather and textile around the handle portions. This material was sampled for further analysis. In addition, the work in Dixon's area (Grid 1) involved the deconcretion of: 1.) the forward bulkhead, 2.) the steering rod, 3.) the dive plane handle and counterweight. Additional deconcretion continued on the flywheel at the aft portion of the crew compartment, as well as the interior hull accessible through the aft stern hole.
 - Progress on the interior deconcretion was hampered by technical problems related to weather effects on the pumping system for the solution storage tanks.
- Documentation All of these areas of deconcretion were documented and studied by the archaeological team. This documentation included notes, sketches, photography, and 3D photogrammetry. The concretion that was removed is also being screened and examined for small artifacts and samples, and will be x-rayed for additional clues.
 - The deconcretion of the crank handles revealed the presence of a tooth (HL3791) belonging to crewman DD (Frank Collins). Forensic analysis of his remains following excavation revealed that he was missing four teeth due to post-mortem disarticulation. This tooth was determined to be one of those missing artifacts.

Research Projects and Collaborations

- Explosion Simulation Study: The results of the collaborative study between the WLCC, the Naval Surface Warfare Center, Carderock Division (NSWCCD), and the University of Michigan on the effects of the torpedo detonation were presented at the Society of Naval Architects and Marine Engineers (SNAME) Maritime Conference, October 23-28, 2016. These results were delivered by Matthew D. Collette (University of Michigan) and Ken Nahshon (NSWCCD) in their paper "Investigating the Loss of H.L. Hunley" and will be published in the forthcoming conference proceedings.
 - Study conclusions: The detonation of the Hunley's spar torpedo would not have been sufficiently powerful to damage the hull plates or structure of the submarine. The explosion would also not have directly injured the crew. The only direct effects on the submarine would have been a slight heaving motion of a few inches from the force displacement wave propagating through the ocean water.
- Diatom Study: Dr. Scott Hippensteel of UNC Charlotte completed his study of the adipocere bone marrow from the crewman BB of the *H.L. Hunley* for the presence of diatoms. Diatoms in the bone marrow could indicate a drowning scenario for the crew from water in the lungs. The final results and report on the study were submitted to the WLCC November 21, 2016.
 - Study conclusions: No diatoms were found in the preserved adipocere bone marrow from crewman BB. This does to preclude drowning, but there is evidence to prove that individual BB died in a drowning scenario.

3D Documentation and Metrology

- Structured-Light Scanning, July-August (Breuckmann OptoTOP-HE):
 - Forward pump HL1994, post-deconcretion: HL3786 outflow pipe, HL3750 inflow valve housing, piston body, HL3766 outflow check valve, HL3755 inflow check valve, HL3768-71, piston head components.
 - Ballast pipe sections of HL2146: S6262B, S6266, S7608, S6264.
 - Spar HL0556, center pipe section
- Photogrammetry Documentation and Modeling, July-August (Agisoft Photoscan, Nikon D60):
 - HL1994 forward pump (post-deconcretion) to examine possible cracks in the cast iron.
 - Crew compartment grids 2-7 for comparison with interior scan data.
 - Crew compartment grid 1 (Captain's area) for modeling and artifact distribution.
- 3D Processing and Site Plan Modeling (Polyworks and Rhinoceros)
 - Final modeling of all ballast pipe components and valves and reconstruction in site plan.
 - Alignment of interior scan and photogrammetry data.
 - Modeling of HL1994 forward pump components and reconstruction in site plan.

Reports and Publications

- Michael Scafuri submitted a PAPER “The Hunley Revealed: Documentation, Deconcretion, and Recent Developments in the Investigation of the *H.L. Hunley* Submarine,” for publication in the *International Journal of Nautical Archaeology (IJNA)* on the archaeological documentation of the exterior deconcretion, 2014-2015.
- Johanna Rivera-Diaz and Michael P. Scafuri submitted a PAPER “The Sea, the Sub, and Maritime Collaboration: How conservators and archaeologists worked together to recover and conserve the *H.L. Hunley* submarine, for publication in the proceedings of the University of Pennsylvania Museum Symposium *Engaging Conservation: Collaboration Across Disciplines*, October 6-8, 2016.
- Emily Schwalbe and Michael Scafuri produced a draft REPORT on “The Ballast and Pump System of the H.L. Hunley.” The report is to analyze the design and operation of the water ballast system for the submarine.
- Michael Scafuri submitted an ABSTRACT “The integration of Photogrammetry and Structured-Light Data in the Modeling and Analysis of an American Civil War Submarine.” For presentation at the for CAA 2017 conference, March 14-16, 2017 in Atlanta, Ga.

Grants

- Brent Fortenberry and Michael Scafuri submitted a grant application to the NPS Maritime Heritage Program. The grant is seeking funding for new 3D technology and to support an additional full-time person to assist with the completion of the archaeological work on the H.L. Hunley.

Education, Public Outreach, and Media

- FOTH Members Tours (October 21, 22): Developed a tour presentation for the FOTH members, including the production of a poster highlighting the interior features and recent deconcretion of the crew compartment.
- WLCC presentation and lecture to FOTH volunteers and tour guides on the latest archaeological findings, research, and conservation relating to the *H.L. Hunley* (November 7).
- FieldTrip ZOOM online lecture to 6-8th grade classrooms on the H.L. Hunley.