The Search for The USS "THRESHER", April to September, 1963

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In mid-April, 1963 I was aboard the Research Vessel Robert D. Conrad in the Caribbean Sea preparing to launch a network of deep-anchored current meter buoys in a line south of Puerto Rico. The cruise which began in Bermuda the week before was my first as chief scientist on the new navy-built vessel which had been commissioned only a few months earlier. In many ways, the ship was a great improvement over the smaller R/V Vema, Lamont's first ship. By comparison, it seemed luxurious with ample lab and deck space, air conditioning, and a large crane to handle heavy gear. But to many, the icing on the cake was the anti-roll system which greatly reduced the ship's rolling motion, providing more peaceful working conditions.

We had reached the central part of the Venezuelan Basin and were getting ready to set our first buoy when an urgent radiogram was received from Doc Ewing saying that the ship must cancel all work and proceed at top speed to the home port of Piermont. The message explained that the nuclear submarine USS Thresher went down with all hands a week earlier (April 10, 1963) while on sea trials, after leaving Portsmouth Naval Shipyard. Our ship was requested by the Navy to assist in the search operations.

As we ran north in rough seas at a full speed, which was barely over ten knots, more information on the disaster came by radio. The Thresher, our navy's most modern, fastest, quietist, and most powerful nuclear attack submarine had sunk while on a deep dive test in 8,400 feet of water. Its location was 200 miles east of Cape Cod, on the continental slope. As we learned more about the search operation already begun, it was quite apparent that the deep-anchored buoy equipment and radar transponders intended for our work in the Caribbean would be especially useful in the work ahead.

R/V Conrad arrived at Piermont on 26 April and, after a frenzied night of loading additional gear and instruments, left for sea the next day. Joe Worzel joined the ship as Chief Scientist and I was named Co-Chief for the upcoming cruise. The new gear brought aboard included various deep sea cameras, two loran navigation systems, and a half-built deep-towed magnetometer, the first of its kind. The other half consisted of boxes of electronic components which would be put together at sea. As the ship moved down the Hudson River, a Decca company engineer was continuing to install navigation equipment. He was told that he would be put ashore on the pilot boat as we left the Port of New York. However, in the rush of departure this arrangement was overlooked and the ship was many miles to the northeast before the poor chap discovered he had been Shanghaied. He spent the next month with us in borrowed clothes and gave us valuable help with electronic problems.

We reached the 100-square-mile search area on the 28th to find some dozen US Navy ships and research vessels scanning the depths with echo sounders, attempting to carry out a fine-grain bathymetric survey. The navy command ship designated specific areas for each ship to search and collected and plotted each ship's echo-sounder records daily.

Two major problems were soon apparent in the navy's effort to locate the Thresher in what was arguably the deepest search operation ever attempted up to that time. Firstly, it was questionable whether the main under way search tool, the wide beam 12 kilohertz navy echo-sounder, could obtain a return signal from a 30 foot diameter submarine at a depth of 8400 feet. Some experts believed that if the submarine were intact, it might show up as a very faint echo. However, the sea floor in this area of the continental slope was a jumble of mounds and slumps producing powerful reflections and side echoes which made it impossible to distinguish smaller features. The second problem was navigation. The most useful parabolic shore-based navigation aids were Decca Navigator and Loran-C lines whose readings were recorded at frequent intervals by all of the search vessels. Ideally, navigation fixes using these lines were assumed to be plus/minus a few hundred yards, the worst drift occurring after sunset. A contributing problem was the presence of the Labrador Current of up to four knots which made it impossible for a ship to keep its course along a particular loran or Decca line.

After three weeks, this first phase survey was in complete chaos. The lines of bathymetry from the different ships were impossible to correlate owing to poor navigation control considered accurate only within 2000 yards. At this point the navy opted for a "cluster" approach with vessels assigned to make crossings over possible target features. If a cluster of target echoes developed within a 500 yard area it was listed as a "possible" hull position. By the middle of May this method had produced 90 possible Thresher hull positions. Aboard RV Conrad, we concluded there was little chance that echo sounding would reveal the submarine hull, whether intact or crushed. However, we were grateful for the time these exercises provided to complete the construction and testing of our deep-towed magnetometer and its towing package.

The final task in completing the magnetometer towing system was to provide a non-magnetic cable connection between the sensing coil and the electronics package, a distance of a couple of hundred feet. We tested all the stainless steel wire rope aboard and were discouraged to find it all magnetic. Then I remembered the bronze wire rope safety railing on the ship's 0-1 deck. It nearly broke the captain's heart to see it stripped off his new ship but it was just what the magnetometer package needed.

Phase three, during the last two weeks in May, gave emphasis to the special capabilities of the research vessels , Conrad, Atlantis II, and Gillis. Aboard Conrad we used a newly made wide-angle underwater camera, tested the magnetometer system and dredged the bottom with an enlarged scallop dredge. By luck, the dredge paid off the first day it was used. On May 26 we dredged an area where photographs had shown small pieces of debris on the sea floor which could have been trash dumped by the search vessels or perhaps material from the Thresher. At our second dredge station we collected twelve packets of "O" rings in sealed envelopes with U. S. Navy serial numbers similar to those carried aboard Thresher. This first proof of a Thresher debris field created a frenzy of activity aboard Conrad with round-the-clock bottom photography and deep magnetometer towing.

Finding the debris field also reopened the question of whether or not the submarine's hull broke apart upon impact on the ocean floor. At a Task Group conference that I attended at Woods Hole, a naval architect gave the startling estimate that the Thresher could have reached a free-fall speed of over one hundred miles per hour. Navy experts wanted to confirm this figure through tow tank tests but such data would take several months to obtain. Instead, they proposed to sink an old WW II diesel submarine at the search site and measure its terminal velocity. At this point I made a brash proposal to carry out a new type of terminal velocity drop test of a model and give the results within one week. The chief naval officer authorized me to return to Lamont and carry out the test ASAP. The results, described in the caption of figure 1, proved the naval architect's estimate was correct . The sinking of the diesel sub was cancelled and I returned to the Conrad.

Knowing that we were close to the Thresher wreckage we anchored two taut-line radar transponder buoys (figure 2) to control our navigation. They were placed three and one half miles apart on a north-south line, a couple of miles east of the target area. Using these stable beacons we had, for the first time, a range-range navigation system whose accuracy was limited only by minor errors of radar ranging and the small circle of excursion of the buoys above their anchors. Finally, we could plot our position within about one ship's length. Now the largest error in fixing the location of a feature photographed on the sea floor or detected with the magnetometer was the uncertainty in distance and direction of the instrument at the end of ten thousand feet of cable deployed behind the ship.

On June 15 the Lamont wide-angle camera photographed a large compressed air bottle (figure 3) from the Thresher and large pieces of steel plate. Three days later Conrad's proton precession magnetometer (figure 4), towed a few hundred feet above the sea floor, showed a 100 gamma anomaly (figure 5) which was registered on three separate passes and clearly indicated the main hull of the submarine.

The navy authorities, satisfied that the remains of the Thresher had now been located, called in the bathyscaph Trieste which was waiting in Boston. Conrad's final task late in June was to place a marker buoy over the Thresher location with a bottom pinger to guide the Trieste. From 24 June until 8 September the bathyscaph made ten dives photographing and recovering small objects along a debris field which ended in a mass of heavy steel wreckage described as, "looking like a junkyard."

During the following year, a U. S. Navy Court of Inquiry met to determine the cause of the Thresher's tragic loss and to make recommendations to prevent such losses in the future. Their findings, published in 1964, indicated that the probable cause of the sinking was a salt-water system failure in the engine room (while at maximum depth) which shorted electrical circuits causing loss of propulsion. The main ballast was blown but could not compensate for the loss of buoyancy and the vessel continued sinking. Shortly thereafter she exceeded her collapse depth and plunged to the bottom.

The court issued sweeping recommendations for changes and improvements in management, design, quality assurance and inspection procedures in the construction and maintenance of submarines. Following the Thresher disaster, submarine testing and construction standards were raised from the level of those used for conventional surface ships to those comparable to nuclear propulsion systems and NASA's space vehicles.

The lessons learned from the Thresher disaster fostered such changes in the construction of US Navy submarines that the lives of those who continue to sail them are now far safer than ever before. Under these policies, our nuclear submarine fleet, the most advanced and best maintained in the world, has completed millions of miles of underwater missions in all the world's oceans for the past 37 years without a single loss.

(Graphics are separate.)