the time head of the Navy's nuclear propulsion program, told Congress, "When fact, supposition and speculation, which have been used interchangeably, are properly separated, you will find that the known facts are so meager it is almost impossible to tell what was happening aboard Thresher."

Report's 'conclusion' unlikely

Thus, the "conclusion" that a silver-braze joint failure had caused the loss of the Thresher is highly unlikely and — at best — tenuous. In retrospect, three facts provide a more reasonable if not conclusive account of the cause of the disaster:

First, almost immediately after losing Thresher, Rickover at once sought to reduce the time lag after a scram to restart the reactor, according to Rear Adm. Ralph James, chief of the Bureau of Ships, in a 1963 interview. Reportedly, this effort included Rickover convening a meeting in Washington of his staff and available nuclear submarine engineers to work on this matter.

Second, according to then-Cmdr. Axene, the first CO of the Thresher, he would have reported a reactor scram as a "minor difficulty." He would not have used that term for a flooding casualty, "even through a small-diameter pipe."

Third, and in several respects most significant, the Navy's seafloor sound surveillance system had acoustically detected several sources from the Thresher in the submarine's final moments. At the time SOSUS was highly classified and was not discussed in open session of the court of inquiry or in the congressional hearings.

The submarine's main coolant pumps were initially detected by SOSUS on April 10 at 8:45 a.m., as the submarine was approaching a depth of 1,000 feet. SOSUS data indicated that at 9:11 a.m., after two minutes of line frequency instability, the nonvital electrical bus failed while the reactor MCPs were operating in "fast" mode, the normal full-power lineup for the propulsion plant.

The failure of that electrical bus caused the main coolant pumps to stop, which resulted in an immediate reactor scram — shutdown.

At 9:13 a.m. the Skylark received the message containing the words "minor difficulty." The other, garbled messages followed, indicating that the Thresher was attempting to blow ballast to reach the surface; a definite indication that she had lost propulsion.

Unable to effectively blow to the surface because of subsequently confirmed ice formation in the ballast system, the Thresher sank to her collapse depth without any prior flooding. At 9:17 a.m., the Skylark's bridge personnel heard what would be the final message, the one containing the number "900." This is accepted to have been a reference to test depth, indicating that it was being exceeded by 900 feet — the submarine had reached 2,200 feet.

'Sound of ship breaking up'

Moments later Lt. j.g. James Watson on the Skylark's bridge heard over the UQC a sound that he recalled from his World War II service: "the sound of a ship breaking up ... like a compartment collapsing." Continued calls via UQC to the Thresher brought no response. A short time later the Skylark began dropping small signal grenades, a pre-arrangement with the Thresher to immediately surface in the event that communications were lost. Hecker and his crew aboard the submarine rescue ship could do nothing more.

The Thresher collapse event signal was detected by multiple SOSUS arrays as an extremely high-amplitude event at ranges as great as 1,300 nautical miles. The characteristics of that acoustic event confirmed that the Thresher's pressure hull collapsed or "imploded" at 09:18:24 at a depth of about 2,400 feet (i.e., more than 400 feet below her predicted collapse depth).

The Thresher's pressure hull and all sea-connected piping systems had survived well beyond their design specifications. The analysis of the SOSUS detection of the collapse event — the bubble-pulse frequency — also indicated that the pressure hull and all internal compartments were destroyed in about one-tenth of a second, significantly less than the minimum time required for perception of the event by the men on board.

Measurements made during the instrumented sinking of the discarded diesel-electric submarine Sterlet in 1969 are consistent with the conclusion that the water-ram produced by the initial breaching of the Thresher's pressure hull at 2,400 feet entered the pressure hull with a velocity of about 2,600 mph. That force would have ripped asunder the pressure hull longitudinally and vertically, as verified by photographs of the Thresher wreckage.

Beyond reasonable doubt

Thus, beyond reasonable doubt, the available evidence defines the initial Thresher casualty as an electrical bus failure, which shut down the submarine's main coolant pumps causing the instant reactor scram. Unable to rapidly restart the reactor to regain propulsion, and unable to blow ballast, the Thresher slowly sank toward the ocean floor — a depth of 8,400 feet — with 129 men on board.

The loss of the Thresher was a reminder that the seas are deep, cold and dark, and while man has mastered them with his submarines, those who go down to the sea in undersea craft must be ever vigilant. But when tragedy occurs, it is vital to determine and understand the truth. □