

## **COLLISION SUMMARY**

On the afternoon of 9 February 2001, USS GREENEVILLE (SSN 772) collided with the Japanese Motor Vessel EHIME MARU off the coast of Oahu, Hawaii. At the time of the collision, GREENEVILLE was performing an emergency surfacing maneuver for civilian guests onboard for a seven-hour Distinguished Visitor (DV) cruise. As it rose to the surface, GREENEVILLE struck EHIME MARU's aft port quarter, causing the ship to sink in less than 10 minutes. Of 35 Japanese crew, instructors and students embarked, 26 were rescued; 9 remain unaccounted for.

Four groups performed independent reconstructions of GREENEVILLE's and EHIME MARU's tracks. Commander Submarine Force, U.S. Pacific Fleet (COMSUBPAC) N70 and N72 divisions completed two separate and independent reconstructions. A third was done by Submarine Development Squadron TWELVE in Groton, Connecticut. The National Transportation Safety Board performed a fourth. The reconstructions are virtually identical in all material ways and accurately reflect the tracks of the two vessels from 1230 until the collision at 1343 on 9 February.

The evidence before the Court of Inquiry eliminated any fault and neglect on the part of EHIME MARU's captain and crew as the cause of the collision. The evidence also eliminated any equipment or system failure onboard EHIME MARU or GREENEVILLE as directly contributing to the accident. Finally, the evidence demonstrated that the three civilian guests who participated in the emergency surfacing maneuver – one at the helm, one at the Emergency Main Ballast Tank (EMBT) actuator valves, and one at the diving alarm - were properly supervised and assisted at all times by GREENEVILLE watchstanders and did not cause the collision.

This summary specifically focuses on only the collision. Reference should be made to the full report for a discussion of COMSUBPAC's implementation of the DV Embarkation Program, the propriety of GREENEVILLE's assigned operations area (OPAREA), and whether the SUBPAC Chief of Staff, as senior officer onboard GREENEVILLE on 9 February, was in a position to intervene and prevent the chain of events leading to the collision.

### **Key Events Leading to the Collision**

On 9 February, 2001 USS GREENEVILLE was operating south of Oahu conducting a Distinguished Visitor Cruise.

At about 1306 on 9 February, the XO informed the CO that the ship needed to start afternoon ship demonstrations for embarked civilian guests. GREENEVILLE was

approximately 12-13 miles from "Papa Hotel," a point in the ocean at the entrance to Pearl Harbor where GREENEVILLE was scheduled to be at 1400. Already over 30 minutes behind the schedule posted in the Plan of the Day (POD), the ship had less than an hour to get to "Papa Hotel." In response, the CO took several actions that created an artificial urgency in the Control Room that directly contributed to the collision.

First, he ordered a chemistry sample secured before analysis was complete. With the ship behind schedule, the CO ordered the OOD to secure the sample in order to ready GREENEVILLE for "angles" (i.e., up-and-down movement in the water column to demonstrate the submarine's ability to rapidly change depth) and high-speed maneuvers.

Second, as the ship neared completion of the angles demonstration, the XO again reminded the CO of the time and distance to "Papa Hotel." "I know what I'm doing," the CO replied. Shortly after high-speed maneuvers, the CO told the OOD, "I want you to prepare for and be at periscope depth in five minutes." The CO testified that he gave the order as a training goal to a methodical and inexperienced OOD. He admitted, however, that this was an impossible task, even for an experienced OOD. By CO GREENEVILLE Standing Order 6, it would take at least eight minutes for the OOD to prepare for and get to periscope depth. That Standing Order required OOD's to hold a periscope brief with watchstanders, conduct two good target motion analysis (TMA) legs of about three minutes each on each surface contact, provide the necessary report and obtain the CO's permission to proceed to periscope depth, and make the ascent.

Sonar data collected during GREENEVILLE's high-speed maneuvers was not reliable to use as a basis for contact management. On course 340° after completing maneuvers, GREENEVILLE was obliged to spend about three minutes steady on course and depth and at a speed of about 10 knots conducting TMA on its two known surface contacts (S-12 and S-13) before conducting a baffle clear. Reconstruction evidence indicated, however, that it spent no more than 20 seconds within those three parameters. Had GREENEVILLE spent a full three minutes on course 340°, at a depth of 150 feet and a speed of about 10 knots, Sonar would have recognized a high right bearing rate change (six degrees per minute increasing to 11 degrees per minute) on contact S-13 (EHIME MARU) and known that this surface ship was close. Instead, the CO, OOD, Sonar Supervisor, and FTOW all continued to believe S-12 and S-13 were distant contacts.

Unaware that EHIME MARU was a closing contact, GREENEVILLE came right from 340° to new course 120° and prepared to come to periscope depth. As the ship turned to 120°, Sonar reported a new contact, S-14, over the 27MC to the Control Room. Once reported, the contact management team was obliged to spend about three minutes on course 120° conducting a first leg of TMA on S-14. After completing a first TMA leg, Standing Order 6 required a second three-minute leg on another course. Neither the CO nor the OOD, however, heard, or if they heard, recognized Sonar's contact report as containing information on a new contact. In addition, neither the Sonar Supervisor nor the FTOW, both of whom were aware of the new contact, requested a second TMA leg. Unaware of the new contact, the CO announced to

Control Room watchstanders that he had “a good feel for the contact picture” and ordered the OOD to proceed to periscope depth on course 120°.

Ironically, had GREENEVILLE remained at PERISCOPE DEPTH on course 120° for six and a half minutes, it may have collided with EHIME MARU. Unfortunately, choosing course 120° for its second TMA leg only validated what GREENEVILLE’s contact management team already thought they knew about S-13 – that it was a distant contact. With EHIME MARU closing GREENEVILLE on a constant bearing, decreasing range collision course, there was no bearing rate change visible to Sonar that would have alerted GREENEVILLE that S-13 was closing the ship.

LTJG Coen, normally a methodical and deliberate watchstander, was not given time to develop an accurate picture of the surface contact situation. In the rush to come to periscope depth, he did not conduct the normally required periscope brief with watchstanders. By not conducting the brief, he missed a valuable opportunity to receive and critically assess important contact and sea state information normally provided by Sonar. Likewise, other personnel in the Control Room were not given time to perform their jobs properly. The Diving Officer of the Watch (DOOW) did not have time to trim the ship properly at 150 feet to support achieving the desired up angle at periscope depth. Upon hearing Sonar’s report for new contact S-14, the FTOW hurried to complete his analysis of all three surface contacts prior to coming to periscope depth, thereby overlooking an updated 4,000 yard closing solution on contact S-13 (EHIME MARU). In the critical minutes before proceeding to periscope depth, he focused entirely on new contact S-14, which he considered to be the primary contact of interest because of the single leg TMA solution. Focused on S-14, he tragically ignored the true contact of significance, S-13.

Additionally, the large number of civilians in Control created a physical barrier between watchstanders and equipment displays that hindered the normal flow of information among members of GREENEVILLE’s contact management team. It was the commanding officer’s responsibility to set the conditions for them to observe safely. Civilians gathered around the Contact Evaluation Plot (CEP) blocked access to that display. Additionally, their presence prevented movement and access between various watchstations in Control and Sonar that interfered with normal line-of-sight communications and stifled feedback. While the civilian guests conducted themselves appropriately at all times, it is apparent that GREENEVILLE watchstanders did not work around them. The responsibility for doing so, however, rested entirely with the CO, the OOD, and other members of the contact management team.

Third, the CO effectively assumed the Deck and the Conn from the OOD at the start of angles until the collision occurred. Recognizing that he had one of his most methodical and deliberate OOD’s on watch, CDR Waddle took control and directed the maneuvering of the ship in an effort to speed things up. The OOD became a relay for the CO to pass maneuvering orders to the Ship Control Party.

Fourth, the CO did not discuss the surface picture with his contact management team. Specifically, he did not verify a common understanding of contacts with the OOD, Sonar Supervisor, and the FTOW from the time he first entered the Control Room at 1314 to the time of the collision. His own situational awareness of contacts was based on two brief walk-throughs of Sonar and a single review of Fire Control displays. Confident he knew the contacts, and pressed for time, he failed to use the team to build his understanding of the surface picture. He effectively denied himself essential backup from watchstanders who had critically important contact information to provide. Further, he denied himself the opportunity to assess the situational awareness of the team, which would have revealed confusion and lack of reliable contact solutions.

Similarly, when new contact S-14 was identified and reported to the CONN over the 27MC, no one on the contact management team requested a second TMA leg be performed. As previously noted, two good TMA legs are required to generate a good solution (bearing, range, course and speed) on a contact. S-14 was first reported as a new contact when GREENEVILLE conducted a baffle clear, changing course from 340° to 120°. Prior to coming to periscope depth on 120°, either the OOD or CO should have ordered a second TMA leg for S-14. It appears, however, that neither of them heard the contact report, or, if they did, they failed to identify S-14 as a new contact. Additionally, the Sonar Supervisor or the FTOW, both of whom knew of the new contact, should have requested a second TMA leg, thereby providing critical backup to the OOD and CO. Based on inaccurate information, and without team support, CDR Waddle stated he had “a good feel about the contact situation” and ordered LTJG Coen to proceed to periscope depth on course 120°, unaware that it was a collision course with EHIME MARU.

When the FTOW heard the CO say he had a good feel for the contact picture, he assumed the CO was referring to all surface contacts, including S-14. When the CO ordered the OOD to come to periscope depth, the FTOW immediately focused his attention on S-14. He had fire control solutions of 19,000 and 16,000 yards, respectively, on S-12 and S-13. He considered S-14 his principal contact of interest because the fire control system’s initial solution of 8,000 yards was based on a single leg of data that yielded a solution of significant uncertainty. Pressed for time and concerned about working S-14’s solution, the FTOW quickly updated his contact solutions for S-12 and S-13. Without reviewing those updates, he immediately switched to his fire control “time/bearing” display, looking for any significant changes in bearing rate that would alert him that S-14 was close. Focused on the “time/bearing” display and preoccupied with S-14 during the ascent to periscope depth, the FTOW failed to detect and report the new 4,000-yard closing solution he had entered for S-13.

Fifth, while at periscope depth, the CO interrupted the OOD’s periscope search and performed his own visual search. Behind schedule and confident all contacts were distant, CDR Waddle took the periscope and conducted a non-standard, abbreviated search that failed to account for safety of own ship and surface vessels.

It was only after the periscope searches by the OOD and CO that the FTOW cycled back through all his displays and saw the 4,000-yard closing solution on S-13. By that time, the FTOW had heard the OOD state "I hold no close contacts" and the CO declare "I hold no visual contacts" after completing their periscope searches. The CO had just ordered an Emergency Deep and GREENEVILLE was on its way down to 400 feet. Believing his solution to be wrong because the OOD and CO held no visual contacts, the FTOW testified he out spotted S-13's range from 4,000 to 9,000 yards to reflect his estimate of the distance to the visual horizon. The FTOW's action of out spotting the range to 9,000 yards resulted in a non-sensible speed solution of 99 knots. The FTOW then inappropriately entered this solution into the fire control system without any rational analysis.

Shortly after the periscope searches, the CO ordered "Emergency Deep," an evasive maneuver intended to prevent collision while at periscope depth. The GREENEVILLE proceeded to 400 feet, executed a turn, which was not complete, and conducted an emergency main ballast tank blow. The ship surfaced underneath the EHIME MARU, causing major flooding on that ship which rapidly sunk.

CDR Waddle created an artificial sense of urgency that contributed to the collision with EHIME MARU. Behind schedule, he convinced himself that, by personally conducting ship maneuvers, he could rapidly complete all events and minimize a late return to Pearl Harbor. He injected himself into virtually every action - effectively assuming the Deck and Conn, cutting TMA legs short and conducting a non-standard, abbreviated periscope search - to save time. In doing so, he marginalized key contact management personnel and cut corners on prescribed operational and safety procedures. Speeding up ship maneuvers requires more, not less, backup from the crew to conduct those evolutions safely and efficiently.

### **Analysis**

There were two fundamental causes of the collision. First was the inadequate acoustic and visual search conducted by USS GREENEVILLE in preparation for periscope depth operations on 9 February.

Sonar data collected during GREENEVILLE's high-speed maneuvers was not reliable to use as a basis for contact management. GREENEVILLE was obliged to spend about three minutes steady on course and depth and at a speed of about 10 knots conducting TMA on its two known surface contacts (S-12 and S-13) before conducting a baffle clear in preparation for periscope depth operations prior to surfacing. Reconstruction evidence indicated, however, that it spent no more than 20 seconds within those three parameters. Had GREENEVILLE spent a full three minutes on course 340°, at a depth of 150 feet and a speed of about 10 knots, Sonar would have recognized a high right bearing rate change (six degrees per minute increasing to 11 degrees per minute) on contact S-13 (EHIME MARU) and known that this surface ship was close. Instead, the CO, OOD, Sonar Supervisor, and FTOW all continued to believe S-12 and S-13 were distant contacts.

Unaware that EHIME MARU was a closing contact, GREENEVILLE came right from 340° to new course 120° and prepared to come to periscope depth. As the ship turned to 120°, Sonar reported a new contact, S-14, over the 27MC to the Control Room. Once reported, the contact management team was obliged to spend about three minutes on course 120° conducting a first leg of TMA on S-14. After completing a first TMA leg, Standing Order 6 required a second three-minute leg on another course.

Choosing course 120° for its second TMA leg only validated what GREENEVILLE's contact management team already thought they knew about S-13 – that it was a distant contact. With EHIME MARU closing GREENEVILLE on a constant bearing, decreasing range collision course, there was no bearing rate change visible to Sonar that would have alerted GREENEVILLE that S-13 was closing the ship.

The CO did not conduct an adequate visual search at periscope. Once GREENEVILLE arrived at periscope depth, the OOD conducted three 360° sweeps, approximately eight seconds per sweep, in low power for surface contacts at a depth of 60 feet. His initial surface search met the requirements of NWP 3-13.10 (Submarine Electronic/Optic Sensor Employment Manual) and CO GREENEVILLE Standing Order 6. As the OOD began his aerial search, the CO interrupted him and took the periscope, preventing the OOD from completing the entire continuous search pattern. The CO performed a 360° horizon search in low power at a depth of 60 feet. Watchstanders looking at the PERIVIS display during the OOD's and CO's search at 60 feet observed wave hits on the periscope headwindow. Ordering the ship up to 58 feet for a higher look, the CO started a high power sector search starting at 340° and continuing right to 120°. During this search, he paused to look down bearings where he thought S-12 and S-13 would be. He did not ask for, nor did he receive, a cued search on specific fire control contact bearings from the FTOW.

The CO's search was not conducted in accordance with NWP 3-13.10 guidance or his own Standing Order 6. That guidance provides that a continuous visual search at periscope depth requires a 360° horizon search in low power with successive 90-degree quadrant searches in high power. It also states that each step in the process should be done slowly, taking approximately 45 seconds per sweep. All totaled, a proper periscope search when first coming to the surface should take more than three and a half minutes to conduct. Analysis of the Sonar Data Logger revealed that GREENEVILLE spent only 66 seconds at periscope depth, which was the total time the OOD and CO spent on their respective searches. The CO spent about 16 seconds conducting his higher look through the periscope.

Further, given existing weather, visibility and sea conditions, and the overarching need for safety, the CO should have come shallower, or even broached the ship to get as much periscope out of the water as possible. His "higher look" at 58 feet was simply not high enough or long enough given the sea state.

The second cause of the collision was inadequate contact management by the submarine's contact management team.

During morning preparations for getting underway, LT Sloan, the Navigator and the on-coming OOD, discovered that the Analog-Video Signal Display Unit (AVSDU) in the Control Room was out of commission. The AVSDU is a remote display of sonar data used by the OOD to conduct contact analysis. Its loss degraded the ability of the OOD to maintain situational awareness of contacts from the Control Room. Safety and prudent seamanship dictated that the ship compensate for its loss. After informing Sonar that the AVSDU was out of commission, LT Sloan promptly notified the CO. CDR Waddle did not take any additional measures to compensate for loss of the AVSDU other than to visit Sonar briefly on two occasions to maintain his own estimate of the surface picture. He expected his OODs would know to do the same. Neither he nor anyone else took action to ensure appropriate compensatory measures were instituted and passed down to subsequent watchstanders.

LT Sloan was the Contact Coordinator during GREENEVILLE's morning surface transit to her assigned OPAREA. While conducting a visual search through the periscope, he noted a hazy, off-white sky on the horizon that made it difficult to pick out a light hulled contact. He failed, however, to pass on this information to his relief, LTJG Coen. Had he done so, LTJG Coen and CDR Waddle may have done a more careful, deliberate periscope search and detected EHIME MARU's white hull and superstructure against the horizon.

Prior to angles, the OOD knew the ship was scheduled to come to periscope depth and conduct an emergency surfacing maneuver later that afternoon. He failed, however, to drive the ship aggressively to develop good TMA solutions on contacts S-12 and S-13. Although occupied with civilians visiting Control, he still had time and opportunity to develop a more complete understanding of the contact picture. Additionally, the Sonar Supervisor and FTOW failed to backup the OOD by recommending course and speed changes to the CONN that would produce good TMA solutions. As a result, the early afternoon solutions incorrectly identified S-13 as a distant and opening vice distant and closing contact.

The CO, in an effort to speed things up and believing he had a complete and accurate contact picture, did not follow Naval Warfare Publication (NWP) guidance and his own Standing Orders on 9 February.

After completing high-speed maneuvers at 1331, the CO failed to ensure an adequate first leg of TMA was completed on course 340°. Analysis of GREENEVILLE's Sonar Data Logger revealed the ship spent no more than 20 seconds in the "window" of parameters (i.e., steady on course and depth with speed about 10 knots) necessary to obtain good contact solutions. This is far short of the three minute standard set out in NWP 3-21.51.1 (Submarine Target Motion Analysis (TMA) Techniques) and CO GREENEVILLE Standing Order 6 (Periscope Depth Operations).

When the CO directed the OOD to be at periscope depth in five minutes, no one thought to question whether he had given the OOD an impossible task. When the CO stated “I have a good feel for the contact picture” before ordering the ship to periscope depth, no one questioned his situational awareness of the new contact. When the CO declared “I hold no visual contacts” after completing his periscope search, the FTOW simply out-spotted his 4,000 yard range solution on contact S-13, believing the system solution was wrong because CDR Waddle hadn’t seen any surface contacts through the periscope. The SUBPAC Chief of Staff and XO harbored concerns that the CO was moving quickly, but never questioned him about it, believing CDR Waddle to be in control of events. On 9 February, no one thought to critically question the CO’s judgment. CDR Waddle was driving the ship and didn’t need their help. The CO’s self-assured statements and the team’s confidence in his abilities negated their watchfulness and denied the CO critically important backup.

The presence of civilian guests onboard GREENEVILLE, while not directly contributing to the collision on 9 February, indirectly affected the performance of key watchstanders in the Control Room.

### **Conclusion**

The reason for these two causes is clear and is discussed in the key events. The CO created an artificial sense of urgency in preparation for surfacing when prudent seamanship, the safety of his ship and good judgement dictated otherwise.

The CO’s informality and urgency throughout the day developed into a situation in which he lost all backup from his crew. Focused on driving the ship and narrating the afternoon’s evolutions over the 1MC to his guests, the CO missed important Sonar and Fire Control information on contacts that could have prevented the collision. Behind schedule yet confident he could personally demonstrate all planned evolutions for his guests, the CO cut corners on safety and established standard operating procedures and collided with EHIME MARU.