

SECTION X

U.S.S. TANG (SS306)

Loss in Action

Formosa Strait
24 October 1944

Class SS285

Builder U.S. Navy Yard, Mare Island

Commissioned November 1943

Length (Overall) 311 ft. 8 in.

Beam (Extreme)..... 27 ft. 3-1/4 in.

Submergence Depth (Designed Maximum) (Axis)..... 400 ft.

Displacements

 Standard 1525 tons

 Emergency Diving Trim..... 1956 tons

 Submerged..... 2408 tons

Draft (Mean, Emergency Diving Trim)..... 16 ft. 2 in.

Type of Propulsion..... Diesel Electric Reduction Drive

Main Engines (4) Fairbanks-Morse 38-D-8-1/8

Main Motors (4) and Generators (4)..... Elliott Co.

References:

- (a) C.O. TANG conf. ltr. SS306/A-16-3 of 10 September 1945
(Report of War Patrol Number Five and Loss of Vessel).
- (b) BuMed conf. ltr. BLK:II, Serial No. 0356 of 29 July 1946
(Submarine Escape in World War II).
- (c) Interviews with Various TANG Survivors by Cdr. I. F. Duff,
(MC), USNR.

Photograph No. 10-1 (Torpedoing of U-977 - Associated Press) and 10-2.

PLATE X

10-1. On 24 October 1944, during her fifth war patrol, TANG was sunk in Formosa Strait as a result of the malfunctioning of one of her own torpedoes which made a circular run and returned to strike the hull abreast the after torpedo room.¹ The resulting detonation caused the ship to plunge by the stern within a few seconds.

10-2. This report is based on the information contained in the references. The first portion of reference (a) is a narrative of TANG's fifth war patrol up to the time of her loss and was written from memory by the Commanding Officer upon his release from a Japanese prisoner of war camp at the end of the war, approximately one year after the action took place. The second portion of reference (a) is a reconstruction of the events which occurred in TANG after the torpedo struck. Since the Commanding Officer was washed off the bridge when the ship sank, this portion is based on the stories of the eight other survivors as related to him at the first opportunity after their capture by the Japanese; five of the eight having gone down with the boat and later making individual underwater escapes from the forward torpedo room. This reference, although understandably not as complete as formal war damage reports covering actions in which a submarine returns to base and damage can be thoroughly investigated, is an excellent presentation of the available data and is the only account in U.S. Naval history of the events inside a war-damaged U.S. submarine during and after its sinking. References (b) and (c) cover the escape problem facing the men trapped within the boat and the procedure used by those few who made successful escapes. These latter two references are based upon personal written and oral accounts of the survivors as related to representatives of the Bureau of Medicine and Surgery. The photograph of the torpedoing of U-977 is included to illustrate the magnitude of TANG's disaster. The PLATE was prepared by the Bureau.

10-3. The fifth war patrol of TANG was conducted in the Formosa Strait. This area was assigned in order that TANG would be in a position to intercept any Japanese shipping which might retire from Formosa as a result of the carrier strikes against that Island by the Third Fleet on 12 through 14 October 1944, and also to intercept any enemy reinforcements which might pass through Formosa Strait in support of the Philippine campaign which commenced with the Leyte Island landing on 20 October 1944.

10-4. After normal refit at the Submarine Base, Pearl Harbor, TANG departed for Formosa Strait via Midway on 24 September 1944 and reached her patrol area on 10 October. On 11 October TANG sank one large and one medium-sized cargo ship off the west coast of Formosa, the first by a dawn torpedo attack while submerged and the second by a night torpedo attack while surfaced. On 12 through 14 October, the period of the Third Fleet air strikes against Formosa, numerous searches were conducted along likely enemy shipping retirement lanes

¹ There is evidence to indicate that the loss of TULLIBEE (SS284) on 26 March 1944 was similarly caused by a circular run of her own torpedo. See Appendix II.

~~CONFIDENTIAL~~

to the China coast but no contacts were established. From 14 to 22 October, although several enemy ships were sighted, range to the targets could not be sufficiently closed and consequently no attacks were made. Shortly after midnight on 22 October, radar contact was established with a heavily escorted enemy convoy composed of three large tankers, a large cargo ship, and a medium-sized transport. All ships were heavily loaded and were apparently bound for support of the Philippine campaign. TANG executed a spectacular close range night surface attack, sinking all five ships of the convoy within ten minutes of firing her first torpedo and then cleared the area at full speed, leaving the escorts apparently engaged in a gun duel with one another.

10-5. Following the action of 23 October, TANG proceeded north of Formosa Strait for deeper water and then headed toward the shallow protected waters along the China coast on the theory that, due to her recent successes, all subsequent Japanese shipping passing through the Strait would be routed close inshore. This belief proved correct, for in the early evening of 24 October radar contact was established with a large Japanese convoy hugging the China coast and located about midway between Foochow and Amoy. The convoy was proceeding south at a speed of about twelve knots, apparently also headed for the Philippines, and consisted of at least fourteen large, heavily-loaded ships in column escorted by at least one destroyer and twelve destroyer-escorts. Some of the escorts were to seaward of the convoy while others were on the landward side.

10-6. TANG closed for a night surface attack using radar ranges and TBT bearings, but her presence was apparently suspected for two of the seaward enemy escorts commenced to run on opposite course to the convoy column, firing sporadic and wild bursts of small and medium caliber projectiles. As TANG continued to approach, one of the enemy escorts illuminated the convoy column with a large searchlight while signalling and this had the favorable effect of increasing target ship visibility. Three of the leading ships, a large transport, a medium-sized transport and a large tanker, were selected as the initial targets and, at ranges varying from 900 to 1400 yards, TANG fired three slow deliberate salvos of two torpedoes each per ship. In spite of the enemy having had apparent early knowledge of TANG's presence, no evasive tactics were employed by any of the ships up to this time. All torpedoes ran true to their targets, sinking the three ships almost immediately. Meanwhile, TANG paralleled the convoy to search out the next two targets. A tanker and a transport were selected for stern torpedo attack and three torpedoes were fired at ranges between 600 and 700 yards. The escorts had now stopped their warning tactics and were directing close salvos at TANG. Just after firing at the transport, a destroyer crossed close to the stern of that ship and headed directly for TANG. The first torpedo hit the tanker, which was apparently loaded with gasoline, and a tremendous explosion resulted. The second torpedo was observed to hit the transport and an instant later the destroyer blew up, either intercepting the third torpedo or cross fire from two enemy escorts which were bearing down on TANG's beam. Only the transport remained afloat and she was apparently stopped dead in the water.

10-7. TANG cleared the immediate area at flank speed, still on the surface and untouched by the enemy gunfire. When 10,000 yards distant from the enemy escorts, a halt was made to survey the situation and to recheck the last two torpedoes remaining on board. About one hour was spent on this work, the torpedoes being partially withdrawn from their tubes, batteries ventilated, gyros inspected and the steering mechanism observed to be operating freely. The two torpedoes were then reloaded in forward tubes Nos. 3 and 4 and TANG commenced a cautious approach to again attack the crippled transport, which was now observed to be lower in the water but definitely not sinking. Since two enemy escorts were patrolling to seaward of the transport, TANG made a wide sweep and came in very slowly to escape detection by sonic listening gear. Upon reaching a favorable position, the twenty-third torpedo was fired at the transport from a range of about 900 yards. Ship speed at this time was about six knots and the heading was coned for zero gyro angle setting on the torpedoes.

10-8. When the phosphorescent wake of the twenty-third torpedo was observed heading true for its intended point of aim on the target transport, the twenty-fourth and last torpedo was fired. This torpedo assumed an erratic course immediately upon leaving its tube and curved sharply to the left in a tight turning circle, broaching during the first part of its turn and porpoising during the remainder.¹ Due to the phosphorescence of its wake, the torpedo was observed through 180 degrees of its turn. As soon as the erratic behavior was noted, which was almost immediately after the torpedo was fired, TANG went to emergency speed and partially executed a fishtail maneuver in a futile effort to clear the turning circle. This resulted only in the torpedo striking the boat farther aft than would have been the case had no evasive action been taken. The twenty-fourth torpedo, as were all those carried by TANG on this patrol, was an electric-driven Mk. 18, Mod. 1, fitted with a Mk. 18, Mod. 1 warhead containing 570 pounds of TPX (equivalent in damaging effect to approximately 850 pounds of TNT).

10-9. The torpedo struck TANG on her port side aft in the vicinity of either the after torpedo room or the maneuvering room, about twenty seconds after being fired. The exploder mechanism (Mk. 8) used in the Mk. 18, Mod. 1 torpedo warhead is an inertia type which fires by impact from any angle and the time delay between receiving an impact blow and detonation of the warhead is so slight that the fuzing may be considered as instantaneous. It is therefore probable that the torpedo detonated on contact with the outer hull if it struck in way of the maneuvering room or with the single hull (pressure hull) if it struck in way of the after torpedo room. The Mk. 8 exploder mechanism arms itself by an impeller driven gear train, the impeller being caused to revolve by the ahead motion of the torpedo through the water. Arming of a Mk. 18 torpedo at its rated speed of about 29 knots should normally occur in approximately 200 yards or about 12 seconds running time. Based on studies of torpedo war damage experience with surface vessels, it is estimated that the torpedo detonation probably caused complete destruction of a section of TANG's pressure hull extending

¹ A torpedo anti-circular-run device is currently being developed by the Bureau of Ordnance to prevent recurrence of such malfunctioning.

over a longitudinal distance of at least 25 feet on the port side and extending in depth almost through to the opposite side of the hull, if in fact the hull itself was not completely severed (Photo 10-1).

10-10. Sufficient information is available to permit a fairly complete description of the events which occurred in TANG following the detonation. The boat as a whole was violently whipped. One survivor (conning tower) stated: "With the explosion of the torpedo, the boat seemed to bounce up and down". Personnel as far forward as the control room sustained broken limbs and other injuries. Pipe lines fractured, deck plates lifted up and lightly attached fittings and loose gear were flung about. The propulsion plant was destroyed instantly and men watching the pitometer log in the forward torpedo room noted that the boat lost all forward motion within a few seconds. The after torpedo room, maneuvering room, after engine room, and probably all adjacent tanks flooded rapidly. The watertight door in the after bulkhead of the forward engine room was closed with difficulty against the intruding water from the after engine room, but not until the forward engine room had been half flooded. There were no survivors from the three after compartments. The ship apparently settled slowly for a few seconds and then plunged rapidly by the stern. Reference (a) states that "TANG sank by the stern much as you would drop a pendulum suspended in a horizontal position". Three of the nine officers and men on the bridge were thrown clear or were washed over the side as the boat sank and managed to stay afloat until rescued by the Japanese about eight hours later. Nothing is known of the fate of the other six men on the bridge. No lookouts survived and it is possible that they may have been unable to extricate themselves from or were injured by the periscope shear guard rails and were carried down with the ship. Communications were maintained between the conning tower and bridge until the ship plunged but there was insufficient time to carry out an order to close the upper conning tower hatch. Water poured through this open hatch and completely flooded the conning tower within a matter of seconds after it went below the surface of the water. One officer subsequently made a successful underwater "free" escape from within the flooded conning tower and it is known that one man was thrown through the lower conning tower hatch into the control room by the shock of the detonation, breaking his arm in doing so. Personnel in the control room succeeded in closing the lower conning tower hatch to prevent the inrush of water into the lower compartment. The hatch had been damaged, however, and leaked badly, causing the control room and pump room to flood slowly.

10-11. Although TANG's stern plunged to the bottom, the buoyant force of the intact amidships and forward compartments and tanks was such that the bow remained on the surface, the boat assuming a "spar buoy" position with an up angle of approximately 40 degrees. The officer who escaped from within the conning tower stated that upon reaching the surface he observed about 25 feet of the bow projecting above water. Within the ship, all loose gear fell to the after ends of each compartment and all hands held onto anything they could grasp. Some lost their footing and were thrown aft.

10-12. The men in the forward torpedo room, about ten in number, had secured their compartment shortly after the detonation occurred

and after vainly attempting to contact other compartments by phone came to the conclusion that the after part of the ship was destroyed. They discussed the possibility of escaping at once through the empty forward torpedo tubes but decided against that course because they could hear depth charges and feared the bow would be shelled.¹

10-13. Personnel in the control room had also secured their compartment immediately after the detonation but possessed somewhat more complete information as to the extent of damage. Their prompt execution of damage control measures had established boundaries sufficient to prevent further rapid intake of water and they realized that some of the men trapped within the boat might be able to escape through the one remaining intact escape trunk in the forward torpedo room. To prevent the possibility of damage to the exposed bow by enemy action, and to facilitate escape operations by removing the excessive up angle, it was decided to sink the bow and level off. Therefore, about fifteen minutes after the initial damage occurred, TANG was deliberately bottomed by flooding the No. 2 group of main ballast tanks. Hydraulic power not being available, flooding of these tanks was accomplished by manual operation of the vent valves in the overhead of the control room.

10-14. Meanwhile, classified publications were being destroyed by burning, at first in the control room and later in the forward battery compartment when the water level in the control room made it necessary to evacuate and seal that space. The survivors from the control room and forward battery compartment, about fifteen men in all, then proceeded to the forward torpedo room, carrying their injured in blankets. When the door to the forward torpedo room was opened, the difference in air pressure between the two compartments due to leaking air systems amidships was such that those men near the door were literally blown into the torpedo room.

10-15. About one-half hour later, the survivors from the forward engine room and after battery compartment decided to attempt to reach the forward torpedo room. This group consisted of about twenty men, two of whom were injured. They discovered by peering through the

¹ Based on the reports that TANG assumed a 40 degree up angle with about 25 feet of the bow exposed, the outer doors of the torpedo tubes would have been slightly below the surface of the water at this time and escape through the tubes would therefore have been difficult, if not impossible. There are two instances, however, where such escapes have been accomplished from U.S. submarines. (1) S-5 sank in 194 feet of water off the Delaware Capes on 1 September 1920, due to internal flooding through maloperation of the induction valve. The crew managed to blow the stern to the surface and with great effort cut a small hole in the shell above the waterline. All hands were released about 51 hours later when an escape access was cut in the exposed stern by the crew of the steamship GENERAL GOETHALS. (2) On 7 December 1921, S-48 sank in 67 feet of water while on trials off Bridgeport, Connecticut. The engine room, motor room and steering room were flooded due to neglecting to replace a manhole cover on No.5 port ballast tank. The bow was blown to the surface and all 41 men aboard escaped through a torpedo tube.

eye-port in the watertight door to the control room that water in that space had already flooded above the door level. On testing the bulkhead flappers in the ventilation piping they found the water not yet at this height. They therefore opened the bulkhead door, letting the water race through, and then proceeded to the forward torpedo room. When these men first attempted to open the door to the torpedo room, two men in the torpedo room tried to get them to crack the door slowly so as to gradually equalize the large difference in air pressure between the two compartments. The men in the forward battery compartment, however, did not understand the signals and thought they were being deliberately kept out. They forced the door open and, being accelerated by the air pressure, it struck and severely injured one of the men in the forward torpedo room who had been trying to signal to them.

10-16. All of those men who had survived the initial damage, a total of about forty-five, were now in the forward torpedo room. When the last group arrived, about one hour after TANG first plunged, it was learned that the boat was flooded to the forward engine room. The general feeling of the men at this time seems to have been one of mixed optimism and confidence in their ability to eventually escape combined with excitement and lack of direction. From the last radar bearing, they knew they were only a few miles offshore and it was therefore felt that the chances of reaching land after ascending to the surface were quite favorable. They also had a fairly accurate estimate of the depth of the water from the angle the boat assumed when the stern sank and also from previous chart and fathometer soundings. Submarine escape devices, or "lungs" were passed to all hands and instructions on how to use them were reviewed. Over half the men seemed to possess but little familiarity with the operation of the "lung" equipment. The limited number of available life jackets were distributed and those without were instructed to use their "lungs" as such when they reached the surface. The atmosphere within the forward torpedo room at this time was fairly good, although some smoke and fumes had been introduced from the burning of the classified material. Heat and humidity were increasing and the higher than normal air pressure due to accumulated air leakage caused some discomfort, but adverse physiological effects were not yet pronounced. Although the ship's service lighting system had failed a few minutes after the detonation, the emergency lighting system was functioning properly.

10-17. Preparations for escape were halted when, at about this time, several depth charges were dropped close enough to shake the boat considerably although no further damage was sustained. The enemy remained in close proximity for the next several hours and during this period all activity in TANG came to a standstill. Meanwhile, a fire, reported by reference (a) to have been of electrical origin, started in the forward battery compartment and became quite intense.

10-18. When the enemy vessels apparently had finally departed, it was decided to first attempt to blow tanks and flooded compartments to see if the boat could be surfaced, and thereby render it much easier and quicker for all hands to escape. A small party of men was

assembled to proceed to the control room on this mission but when they started to open the watertight door to the forward battery compartment, large quantities of acrid black smoke from the fire in that space blew into the torpedo room. Although the door had been cracked for only a second or two and then closed at once, fumes and smoke completely filled the compartment. Visibility was reduced to the extent that the lights could be but dimly discerned. Some of the men began to gag and suffered considerable distress almost immediately. The smoke was reported as having an odor similar to that of burning rubber. It is quite likely that the batteries themselves may have been on fire since it was stated that the disconnect switch for the forward battery had not been opened and numerous short circuits are known to have existed. When irritation from the smoke became severe, many men used their "lungs" as respirators, apparently with considerable success. The men were now trapped by the forward battery compartment fire and since self-salvage efforts, at least to the extent of once again raising the bow to the surface, could not be made, there remained no alternative but to attempt individual escapes.

10-19. The first escape attempt was made shortly after daylight. A party of one officer and three men equipped with "lungs" entered the escape trunk, flooded it and opened the side door. It had been arranged that the last man to escape was to notify the men below by tapping just before he left the trunk so that the door could then be closed and the trunk drained down to make ready for the next party. However, due to difference of opinion as to how the trunk operated and difficulty in rigging the ascending line and escape buoy, an inordinately long period of time was consumed. The officer left the trunk before the ascending line and buoy had been streamed and was never seen again. The remaining three men finally completed rigging the escape line but by this time approximately forty minutes had elapsed and the personnel below in the torpedo room, having received no signals from the escape party, closed the trunk door by the remote operating gear and drained the trunk down, thus preventing the escape of the men within.

10-20. A second party of three men and two officers then entered the trunk and rigged for escape. Three of this group left the trunk, one of whom reached the surface alive and survived. The other two who left the trunk were not seen again. After another forty minutes or so, again having received no signals from the escape party but hearing moans from within the trunk, personnel below in the torpedo room closed the escape door, drained the trunk and found the remaining two members of the party, both officers, still in the trunk. One was in a semi-conscious condition, presumably due to inability to withstand the high partial pressures and increased carbon dioxide content of the atmosphere within the trunk. The other officer had become fouled in the unused portion of the ascending line which, after having been cut inboard of the point of attachment of the buoy line outside the trunk, was withdrawn into the trunk and apparently loosely piled underfoot. However, it was the belief of the men below that the line which fouled the officer was the buoy ascending line itself and that the buoy had been cut free outside the door.

10-21. The difficulties encountered in these first two escape attempts combined with the presence of the smoke and progressive deterioration of the atmosphere within the torpedo room had by this time noticeably lowered the morale and physical condition of all hands. All former enthusiasm now died down and many of the men did not care whether they escaped or not. One of the survivors stated: "The constantly increasing pressure, smoke, and heat seemed to affect everyone's thinking". Another survivor stated: "Difference of opinion among the first men attempting escapes wasted valuable minutes. The men weren't sure of escape procedure and were afraid they would make a mistake that would be fatal to the men below. Escape procedure is very simple on paper but somewhat different where everyone's life depends on it. One of the major difficulties encountered was the lack of proper means of communication between the men in the trunk and the men below. We didn't know what was going on or what troubles they had". One of the officers who was in the second party to enter the trunk but was unable to escape and returned below, was apparently one of the few men aboard who had made a one hundred foot training escape. He is reported to have stated that although he personally did not care to attempt to escape again, there was no reason why all of the others should not be able to escape.

10-22. A third party, consisting of four men, then entered the escape trunk. They carried with them a lifering and line with the idea of streaming it for use as a new ascending line since, as previously stated, it was their belief that the original escape buoy had been cut adrift by the second escape party. After flooding the trunk and opening the door, it was found that there was no oxygen available at the trunk manifold with which to initially charge their "lungs". Although aware that the "lungs" could be blown up with their own breath sufficiently to permit safe ascent, only one of the four elected to do so. It took about fifteen minutes to rig the trunk, including preparing the lifering as a buoy, and by this time the one man intending to escape, although having no difficulty with breathing through his "lung", had become very exhausted and dizzy. He had planned to let the lifering go up to the surface and then to ascend the line attached to the lifering as in the standard escape buoy rig but, being on the verge of passing out, he simply stepped out of the trunk, holding the lifering in his arms, and started rapidly toward the surface. One of the men who remained in the trunk tried to slow down this fast ascent by jerking on the line as it payed out but this caused the escaping man to lose use of his "lung" after going up about twenty feet. From that point up he made a "free" escape by allowing the constantly expanding air in his lungs to vent through his open mouth, reaching the surface alive and in sufficiently good condition to remain afloat until rescued. The men remaining in the trunk then drained the space and obtained more oxygen for the "lung manifold from the torpedo room. Two of these men were so completely discouraged that they refused to

obtained more oxygen for the "lung" manifold from the torpedo room. Two of these men were so completely discouraged that they refused to try again. The one and only man who escaped on this third attempt was familiar with the escape procedure through adequate previous training. He stated, "I felt at ease using the "lung" and knew it would work after I tested it under the water before leaving the trunk. I had made a one hundred-foot escape before".

10-23. After another forty-five minutes or so, three men from a fourth escape party reached the surface alive using "lungs" and, although exhausted, managed to stay afloat. Approximately one hour later, three others from the fifth and last known escape attempt reached the surface but were in weakened condition, apparently unable to breathe, and died shortly afterwards. At least one of the men is believed to have died as a result of air embolism.

10-24. Of the thirteen men who are known to have left the submarine via the escape trunk, only eight are known to have reached the surface and of these eight only five were in sufficiently good condition to cling to the buoy until rescued. Some of the men who were not seen again after leaving the trunk may have reached the surface alive but perhaps did not use the ascending line and were carried by currents to points out of sight of the group at the escape buoy and subsequently drowned. Conditions inside the trunk when being flooded by the various escape parties were no doubt partially responsible for the low percentage of successful escapes. One survivor reported "The compression of the air as the water flooded the trunk caused a great amount of heat. When the water was above the door, it left a very small air space and everyone had difficulty in getting their breath. The pressure made the voices very high and almost inaudible. All these combined to create a certain amount of panic in everyone".

10-25. The exact fate of the thirty odd men who remained in the forward torpedo room is not known although it is quite apparent that the viability of the atmosphere in the forward torpedo room was probably soon reduced below the point at which life could be sustained. The deleterious effects on all hands of the smoke introduced from the forward battery compartment was considered by the survivors to have been one of the greatest factors in delaying and hindering the escape attempts. One survivor stated "This smoke did more to kill the men who didn't get out than any other thing". Another stated "The smoke undoubtedly killed every man in the compartment not long after the Japs picked us up. Some men were nearly unconscious when I left. The smoke made you cough and the coughing caused more irritation in your lungs and throat". Heat and humidity reached high levels and air pressure kept increasing due to leakage through forward battery compartment drains into the No. 1 sanitary tank and thence into the forward torpedo room through the lavatory drain. The leakage occurred in spite of check valves in the lavatory line and use of wooden plugs provided in the depth charge kit. In addition to causing considerable discomfort in itself, the increase in air pressure in the forward torpedo room also accelerated the physiological effects of the smoke and whatever other noxious or toxic gases that may have been present, such as carbon monoxide.

10-26. Increase in CO₂ content was reported as not being too noticeable because of the amount of smoke in the air although this component must have been present early in dangerous quantity. Though use of CO₂ absorbent was considered, it had not been employed up to the time the last survivor escaped since the large number of men in the compartment left but little area to spread the chemical. Lack of use of CO₂ absorbent was a serious error for calculations indicate that, with 45 men in the forward torpedo room, a 3 per cent CO₂ concentration would have been reached in only four hours. The effect on personnel of excessive CO₂ was also enhanced by the rise in air pressure known to have occurred in the compartment.¹ CO₂ poisoning is believed to have been the most important single factor causing the early debilitation of the crew and alone could have been responsible. Oxygen was bled into the compartment several times to revitalize the air and seemed to relieve the general feeling of suffocation.

10-27. When the fourth and last successful escape party entered the escape trunk, the fire in the forward battery compartment was reported to have reached such intensity that paint on the forward side of the torpedo room bulkhead had melted and was running down. Considerable pressure had built up in the forward battery compartment and apparently the bulkhead door was not sufficiently tight to prevent acrid smoke from seeping by the gasket. Reference (a) advances the theory that this door gasket may have blown out, either due to pressure or an ensuing battery explosion and that the remaining personnel were thereby asphyxiated. Aside from from this conjecture, however, the members of the fourth escape party believed that at the time they entered the escape trunk the breathing conditions in the torpedo room had deteriorated to such an extent, due to increased air pressure, lack of oxygen, high carbon dioxide content and the presence of fumes and smoke, that all remaining personnel would probably have been rendered unconscious or dead within a very few hours.

10-28. All of the total of nine men who survived, five from the escape trunk, three from the bridge and one from the conning tower, were picked up during the day by one of the Japanese escorts. One consolation to the survivors was the sight of the bow of their last transport target projecting out of the water a thousand or so yards away.

10-29. The unaided "free" escape of the only survivor from within the conning tower is interesting. As the stern plunged toward the bottom and the conning tower flooded rapidly through the open upper hatch, this officer held onto the No. 2 periscope tube for support. He at first obtained air by pressing his mouth up into the periscope stuffing box structural housing recess at the top of the conning tower, where a small bubble of air had been entrapped, and then swam underwater to the forward end of the conning tower where, due to the extreme up angle of the boat, a fairly large bubble had pocketed between the forward bulkhead and the conning tower hatch. Figuring that he might be able to reach another air bubble topside, he then swam up through the conning tower hatch and found an air pocket trapped under the pilothouse

¹ See paragraph 22-15.

front and the officer-of-the-deck's bridge platform. After pausing momentarily in this bubble, and knowing that it was perfectly feasible to make an ascent without the aid of a "lung", the officer began to swim up as rapidly as he could, expelling air all at one time when part way up, and burst out on the surface just as he thought he would have to inhale some salt water. The bridge deck at this time was about fifty feet below the surface. Of the other eight men in the conning tower, one fell into the control room through the open lower hatch, as stated previously, and a second man is known to have also reached the air bubble trapped under the pilothouse but did not reach the surface. The remaining six men were either rendered unconscious by the initial detonation or were drowned when the conning tower flooded.

10-30. It is of course obvious that had the tactical situation permitted TANG to remain in the position she assumed immediately after being torpedoed, the escape problem would have been enormously simplified. With the stern on the bottom in 180 feet of water and with the bow about 25 feet out of water, the forward escape trunk door was only 24 feet below the surface. At this shallow depth it is entirely feasible to make a "free" escape without the aid of a "lung" and without having to vent excess air through the open mouth as is mandatory when escaping from greater depths. All that is required is that the escaping man exhale slightly just prior to leaving the trunk and he can then hold his breath the rest of the way if he so prefers. However, even relatively simple escape problems become difficult when personnel have been rendered physically and mentally debilitated by long exposure to poor atmosphere. The case of HMS THETIS is an outstanding example. THETIS sank in a depth of 120 feet while on trials off Liverpool in June 1939 as a result of opening a torpedo tube breech door with the muzzle door also open. After seventeen hours the crew lightened the submarine aft sufficiently to get the stern out of water. In this position the after escape chamber was only about ten feet below the surface. By that time most of the crew had headaches and breathing was becoming increasingly difficult due to the high CO₂ content of the atmosphere. The extreme angle of the boat plus the deteriorated physical condition of the crew made movements to the after escape station very trying. Two officers successfully escaped at this time but when the chamber was drained down, water reached the main motor control equipment and started an electrical fire which further depreciated breathing conditions by adding large quantities of smoke to the atmosphere. Only two more men made an escape. The remainder were apparently physically and mentally incapable of making the escape effort even though at this time the escape chamber was still but slightly below the surface.

10-31. TANG's loss illustrates the following points:

(a) A surfaced submarine in maximum diving trim which sustains pressure hull damage of sufficient magnitude to cause immediate flooding of two or more adjacent end compartments will probably up-end

so rapidly that the crew will in all likelihood not be able to abandon ship prior to sinking.^{1,2}

(b) In the event of (a), if damage control measures are promptly executed it is probable that watertight integrity can be established at one of the escape stations plus several intermediate compartments as the boat sinks.²

(c) Assuming the boat then hits bottom in a depth suitable for escape operations, some or all of those men who manage to make their way to an escape position should, by properly carrying out the escape procedure, be able to reach the surface either with the aid of "lungs" and an ascending line or by "free" escapes.² TANG represents the only known case in the history of the U.S. Navy of individual underwater escapes from a disabled submarine in either war or peace.

(d) Wartime training methods were apparently not sufficiently rigorous to install adequate confidence in, and knowledge of, the escape procedure.

¹ On her fourth war patrol, BESUGO (SS321) secured one torpedo hit on a surfaced German submarine, U-183 (740 tons). The U-boat sank in 2 to 4 seconds. There was only one survivor and he was carried far underwater.

² While operating under Com SubsSoWesPac on her fourth war patrol, the Dutch submarine HNMS ZWAARDVISCH secured one torpedo hit in the forward torpedo room of a surfaced German supply submarine (1600 tons). The German boat is reported to have sunk in about 30 seconds. Twenty-one men escaped after the submarine reached bottom in 120 feet of water. The majority of these men made "free" escapes from the control room while only a few used breathing equipment.

Photo 10-1: TANG (SS306). View showing torpedoing of U-977 by ATULE (SS403) on 13 November 1946. Note that the pressure hull of U-977 has apparently been completely severed by the detonation and that the forward and after portions of the hull have jack-knifed. U-977 was a standard German Type VII-C design: length 220'-2"; maximum beam 20'-4"; diameter of pressure hull 15'-5"; pressure hull plating thickness .73"; and submerged displacement 880 tons. TANG's pressure hull was 16'-0" in diameter with .87" HTS plating, and was therefore of slightly greater strength than that of U-977. The torpedo used by ATULE was a Mark 14 body fitted with a Mark 16, Mod. 4 magnetic proximity-fuzed warhead containing 660 lbs. of Torpex, and is believed to have detonated almost directly underneath the keel of U-977. The charge which sank TANG was 570 pounds of Torpex, or only slightly less than that employed against U-977. This photograph demonstrates the great destructive power of torpedoes when used against unprotected ships such as submarines. The upward movement of the hull shown here would not have been nearly as pronounced in the case of TANG, however, since her displacement was almost three times that of U-977, the torpedo struck TANG aft rather than amidships, and was a contact side detonation rather than a non-contact under-the-bottom detonation.