

SECTION XI

U.S.S. BERGALL (SS320)

Mine Damage

Gulf of Siam

13 June 1945

Class.....SS285
Builder Electric Boat Co., Groton, Conn.
Commissioned..... 12 June 1944
Length (Overall) 311 ft. 9 in.
Beam (Extreme)..... 27 ft. 3 in.
Submergence Depth (Designed Maximum)(Axis)..... 400 ft.
Displacements
 Standard..... 1525 tons
 Emergency Diving Trim..... 2050 tons
 Submerged..... 2415 tons
Draft (Mean, Emergency Diving Trim).....16 ft. 10 in.
Type of Propulsion..... Diesel Electric Reduction Drive
Main Engines (4) General Motors 16-278A
Main Motors (4) and Generators (4) General Electric Co.

Reference:

- (a) C.O. BERGALL conf. ltr. SS320/A16-3/A9, Serial No. 0267
of 17 June 1945 (Report of War Patrol Number Five).

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11-1. While conducting a surface search for a Japanese convoy in the Gulf of Siam on the night of 13 June 1945, during her fifth war patrol, BERGALL sustained damage to propulsion machinery as the result of an underwater detonation which occurred close aboard on her port quarter. The detonation is believed to have been caused by actuation of a proximity-fuzed mine. Propulsion power was temporarily lost and both reduction gears were damaged, although not seriously enough to render the machinery plant inoperative. As a result of the ensuing high noise level in both reduction gears, BERGALL was forced to terminate her patrol. This case is primarily of interest in that it is one of the few war damage experiences which illustrates the effect of a close underwater detonation on the Diesel propulsion plant of a U.S. submarine while running surfaced.¹ In addition, it is one of the many cases which demonstrates the susceptibility of reduction gears to damage. This report is based on the information contained in the reference.

11-2. After a two-week refit by the U.S. Navy Submarine Repair Unit No. 137, BERGALL departed Freemantle, West Australia, on 12 May 1945 for her fifth war patrol. On 21 May she arrived on station in her assigned area in the waters of the Gulf of Siam. Although BERGALL covered her area thoroughly, only two contacts worthy of attack were made. The first was on 30 May when two Japanese tugs and five barges were sunk by the combined use of 20mm, 40mm and 5-inch/25 cal. gunfire at a range of about 600 yards.

11-3. The second contact was made during daylight on 12 June when a slow convoy of two small tankers and one small cargo ship, escorted by one surface vessel and one aircraft, was sighted close inshore and proceeding north. BERGALL commenced a submerged approach but range could not be closed to less than 5000 yards due to the shallow waters in which the enemy ships were operating. It was therefore decided to refrain from attacking at that time but to attempt to regain contact with the convoy after dark for a possible night surface attack.

11-4. BERGALL surfaced at 2010 that night and headed north, searching for the enemy convoy along the coast and in likely anchorage areas. Contact had not yet been regained, however, when at 0110 on 13 June, while investigating the bight in the Gulf of Siam near Kaw Luem, lat. 11° 45' N., long. 90° 50' E., a heavy detonation occurred close aboard BERGALL's port side abreast the maneuvering room. At this moment, BERGALL had just completed her search of the bay and was reversing course with left full rudder. The ship was making about 13 or 14 knots with two engines on propulsion, the shore line was less than two miles distant and the water depth was but 42 feet.

11-5. It is quite likely that the detonation was caused by a proximity-fuzed mine, inadvertently actuated by BERGALL, for this particular area had been previously mined by U.S. and British aircraft operating from bases in Asia. A subsequent check of BERGALL's track disclosed that she had run three miles inside the limits of the minefield. Seventh Fleet Submarines had not at this time been notified of the presence of Allied mines in this area. The field contained both acoustic and magnetic-

¹One other such case is that of FLYING FISH (SS229) on 24 May 1944 as the result of a premature detonation of one of her own torpedoes. See brief in Appendix I.

induction ground mines of various types, with explosive charges ranging from 490 pounds to 700 pounds TPX.¹

11-6. The impact of the detonation jarred the entire ship. Personnel were knocked off their feet, tossed out of bunks, and in the maneuvering room were thrown up against the overhead. Lighting failed in the maneuvering and after torpedo rooms. The overspeed trips operated on Nos. 2 and 3 main Diesel engines, which were on propulsion, and No. 1 main Diesel engine, which was charging the batteries, causing all three engines to stop and thereby cutting off power to the main propulsion motors. The loss of load on Nos. 1, 2 and 3 generators and the jarring of the contactors for these generators in the main control cubicle caused severe arcing across the contactor tips and ignition of the leads. Severe arcing also occurred across the closed motor bus tie contactor tips in the control cubicle. Inspection disclosed that these contactor surfaces were extensively burned. The No. 4 generator reverse current relay was found to have been rendered inoperative.

11-7. Propulsion was quickly shifted to the forward and after batteries, enabling the ship to get underway again within a few minutes after the detonation. Loud knocking was heard in the port reduction gear and to a lesser extent in the starboard gear. The port shaft was secured immediately to prevent possible additional damage to the port reduction gear and BERGALL proceeded to clear the area on the starboard shaft only. No enemy interference was encountered.

11-8. As stated above, when the detonation occurred, BERGALL was reversing course with full left rudder. The steering system was in power operation. Electrical power to the steering motor was lost at once due to fuzes in the motor control panel jarring out of their holders. This occurred in spite of the fact that these holders were of the improved high impact design. The casing on the lower after bearing of the port tiller ram was torn loose although the bearing itself appeared undamaged. The rudder jammed hard against its stops but after shifting to hand operation at the change valve in the control room, steering control was regained in time to steady on the desired escape course. No difficulty was experienced with the rudder in hand operation. The rudder angle indicator transmitter worm wheel was jarred out of mesh with its rack on the tiller ram and remained out of commission until repaired several hours later. In the intervening period, rudder angles were determined by the after torpedo room rudder angle indicator and relayed to the control room and bridge by sound powered telephone.

¹ The records of this minefield indicate that it contained a total of 6 acoustic and 28 magnetic-induction type mines. All were aircraft laid ground mines. Types and numbers of these mines were as follows:

- 6 - U.S. Mk. 13, Mod. 5 (Acoustic, 490 pounds TPX)
- 6 - U.S. Mk. 26, Mod. 1 (Magnetic, 525 pounds TPX)
- 3 - U.S. Mk. 36, Mod. 1 (Magnetic, 635 pounds TPX)
- 2 - U.S. Mk. 13, Mod. 0 (Magnetic, 700 pounds TPX)
- 2 - British A-Mk. V (Magnetic, 675 pounds Minol)
- 15 - British A-Mk. VII (Magnetic, 620 pounds Minol)

11-9. Chlorine gas was reported in the forward battery compartment immediately after the detonation and this space was promptly sealed. It was found, however, that a vinegar jug in the galley had broken and the erroneous chlorine gas report originated when the vinegar fumes were carried through the supply ventilation system to the forward battery room. The compartment was therefore opened up again.

11-10. By 0130, twenty minutes after the damage occurred, two main Diesels had been started again and put on propulsion. Both batteries were secured. Normal power operation of the steering system had been regained. BERGALL headed for the mouth of the Gulf of Siam, still using the starboard shaft only. At 0445 power was put on both shafts and speed was increased to 14 knots. The port reduction gear was very noisy at this speed but the vibration was not considered dangerous.

11-11. At 0705 BERGALL submerged, stopped the port shaft and opened the port reduction gear inspection plate. No tooth damage was apparent but the after end of the port gear casing was found to have shifted $\frac{3}{16}$ of an inch outboard on the bedplates, the studs apparently having either been bent or sheared.

11-12. Since the noise level of the reduction gears was too high to permit submerged approach on escorted ships, and the lack of contacts to date in that area indicated little likelihood that an opportunity might present itself for a night surface attack during the few days remaining of her scheduled on-station period, BERGALL terminated the patrol and proceeded to Subic Bay, P. I., for further inspection and repairs.

11-13. With the exception of one sheared holding-down bolt outboard and aft on No. 4 main engine, and the operation under impact of the overspeed trips for Nos. 1, 2 and 3 main engines, no damage occurred to the Diesel engines proper and they performed satisfactorily until the next Navy Yard routine overhaul. The bushing on the engine air starting lever twisted loose, however, resulting in considerable loss of air (500-pound) from the air starting flasks. There was no other reported damage to equipment or systems in either of the two engine rooms. No damage occurred forward of the engine rooms with the one exception of bent slip rings on the S_J radar antenna.

11-14. In the maneuvering room, no damage occurred to the main control cubicle other than that mentioned in paragraph 11-6 above. Various minor derangements were found in this space, however, such as sheared studs, fractured welds on brackets, displacement of sheet metal bulkheads, etc.

11-15. In the motor room, a considerable leak developed around the port stern tube packing. Adapters on the lubricating oil lines were cracked at the forward bearings for main motors Nos. 1, 2 and 3 and at the after bearing of main motor No. 4. The bearing caps on Nos. 3 and 4 main motor bearings were found to have been loosened.

11-16. The dog operating mechanism of the upper hatch for the after torpedo room access trunk spun open and it is interesting to note that the holding turnbuckles, which had been installed during the previous refit, were all that prevented this hatch from opening.

11-17. Considerable damage occurred to the operating gear of the after torpedo tubes. The emergency poppet valve for tube No. 9 jammed in the open position. The torpedo tube blow and vent manifold was jarred loose and the studs holding the vent-closing valves of the poppet system for tubes Nos. 7, 8 and 9 to the underside of the blow and vent manifold were sheared. The stop bolt rods on the four after torpedo tubes were distorted, resulting in minor leakage into the boat through the packing glands at the after trim tank bulkhead. Later inspection disclosed that three of the four after torpedo tubes were distorted to the extent that the torpedoes within had to be removed by chainfall and re-loads could not be made. Both the hydrogen burning panel and the Mk. 18 torpedo charging panels were torn loose from their mountings. The track locking mechanism on one torpedo handling skid was broken. One Mk. 27 torpedo was thrown up from its stowage rack and struck the bunk above, causing a slight dent in the case of the TPX-loaded warhead.

11-18. BERGALL arrived at Subic Bay on 17 June 1945. Since investigation of the damages indicated that complete repairs were beyond the capacity of local forces, the ship was ordered to the Navy Yard, Portsmouth, N. H., where she arrived on 5 August. There complete war damage repairs together with routine overhaul and outstanding alterations were accomplished, the major item of work being repairs to the main reduction gears. Both of these gears were removed from the ship for complete inspection. On the port reduction gear, the noisiest one, it was found that the outboard pinion had been driven into the bull gear by the shock of the mine detonation. The gear assembly was considered mechanically satisfactory for it had been used during the entire 10,000-mile run to the U.S. east coast from the Philippines. However, although all points of observable impact were stoned, the high noise level in this gear could not be reduced to meet satisfactory operational requirements. It was then sent to the manufacturer for reconditioning and a new port reduction gear assembly was installed in the ship. The starboard reduction gear was found to be only slightly damaged and was returned to the ship after repairs by the Navy Yard. All work was completed and BERGALL was returned to service on 19 November 1945, about five months after the initial damage was incurred.

11-19. That BERGALL did not sustain more severe damage from the detonation was due to the fact that the mine was actuated while still at an estimated distance of between 90 and 120 feet from the hull, well outside the serious damaging-range of the mines known to have been in this field. Since both acoustic and magnetic proximity-fuzed mines are known to have been present in BERGALL's vicinity, it is not possible to determine which type of mine caused the damage.

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11-20. The sensitivities of such proximity-fuzed mines are normally set for the average acoustic or magnetic characteristics of the vessels they are intended to act against so that detonation will occur when within a range calculated to cause severe or lethal damage. It is entirely possible for such mines to be swept at relatively harmless distances when the actuating influence is considerably greater than expected. For example, in the case of acoustic mines of the sonic frequency type, such as those in this field, the frequency and intensity of sound generated by submarine Diesel propulsion plants is understood to be capable of causing detonation at a considerably greater range than surface ship steam propulsion plants.

11-21. The magnetic-induction type influence mine is fuzed to detonate when the rate of change in the surrounding magnetic field exceeds a pre-determined amount. This rate of change is proportional to the velocity of the ship with respect to the mine and, for a given relative velocity, will be greatest when the ship is turning through a north or south magnetic heading. Since BERGALL was reversing course at about 14 knots when the mine detonated, it is probable that her magnetic "influence" was at or near the maximum possible for that speed. It is understood that many U.S. magnetic ground mines are fuzed so sensitively that steel hulled minesweepers are not considered safe when passing overhead in less than 120 feet of water. It is not unusual for magnetic mines to detonate at distances of over 100 feet. BERGALL was ranged at Freemantle, Australia, in November 1944, at which time it was found that her signature was similar to that of an untreated and undegaussed submarine. The ship was again ranged at Pearl Harbor in July 1945, while en route to the United States shortly after the damage occurred, and her signature at this time was reported as being satisfactory for the Pearl Harbor area. Due to variation in the earth's magnetic field with latitude, however, this signature would have been 4 or 5 times greater than that of a degaussed submarine for the magnetic conditions existing in the Gulf of Siam where the mine was detonated. This would of course have greatly increased the likelihood of remote operation of a magnetic-induction type mine.

SECTION XII

U.S.S. GRAMPUS (SS207)

Gunfire Damage

Off Truk
17 May 1942

Class.....SS198
Builder Electric Boat Co., Groton, Conn.
Commissioned..... 23 May 1941
Length (Overall) 307 ft. 2 in.
Beam (Extreme) 27 ft 3 in.
Submergence Depth (Designed Maximum)(Axis)..... 250 ft.
Displacements
 Standard 1475 tons
 Emergency Diving Trim..... 1990 tons
 Submerged..... 2359 tons
Draft (Mean, Emergency Diving Trim)..... 16 ft. 9 in.
Type of Propulsion Diesel Electric Reduction Drive
Main Engines (4) General Motors 16-248
Main Motors (4) and Generators (4)..... General Electric Co.

References:

- (a) C.O. GRAMPUS conf. ltr. A16-3/SS207, Serial No. 04 of 17 June 1942 (Report of War Patrol Number Two).
- (b) C.O. GRAMPUS conf. ltr. L11-1/SS207, Serial No. 05 of 30 June 1942 (Report of War Damage).

Photographs Nos. 12-1 through 12-3 (furnished by C.O. GRAMPUS),

12-1. On the night of 17 May 1942, while conducting a surface patrol off Truk during her second war patrol, GRAMPUS was detected by a Japanese patrol vessel and forced to make a quick dive. While passing 30 foot depth, one shell, believed to have been a 3-inch or 4.7-inch common projectile, struck the starboard bulwark of the cigarette deck and detonated approximately three feet beyond its point of impact about two feet above the cigarette deck over the main engine air induction trunk. While no damage of a serious or military nature was caused, and GRAMPUS experienced no difficulty in subsequently evading the enemy, the action has been included in this report to illustrate the shrapnel effect of medium caliber projectiles and the obvious vulnerability of submarines to such attacks. While other U. S. submarines have been more heavily damaged by gunfire attack, this experience of GRAMPUS was chosen since it is the only such action in which photographs of the damage were available to the Bureau.

12-2. The damage report, reference (b), submitted by the Commanding Officer while the ship was undergoing repairs by OTUS (Ex-AS20) at Fremantle, W.A., is clear and comprehensive, and is therefore reproduced below in lieu of the usual narrative.

Fleet Post Office
San Francisco, California
30 June 1942

From: The Commanding Officer
To: The Chief of the Bureau of Ships

Subject: War Damage Inflicted upon U.S.S. GRAMPUS, Report of.

Reference: (a) BuShips ltr. C-FS/L11-1(374); C-EN28/A2-11 of April 17 1942.

Enclosure: (A) Photographs of subject damage.

1. At 1906 (ZT) on May 17, 1942, the U.S.S. GRAMPUS surfaced on course 270° T., about twenty miles North West of the North pass to Truk Island in approximate Latitude 08°-02'-00" North and Longitude 151°-30'-00" East. This vessel had been conducting submerged patrol in assigned area. There was a moderate sea from the North East with a surface wind of about eight knots, estimated visibility 4,000 yards. At 1910 sighted a light astern that appeared to be a flash of a searchlight. At 1912 changed course to 340° T., and headed away. At 1917 echo ranging was heard on bearing 270° relative. Nothing sighted upon careful observation. At 1927 changed course to 000° T., and went to standard speed on two engines. At 1941 slowed to listen with sound gear. At 1947 simultaneously sighted and picked up with sound a vessel approximately 1500 yards on the starboard beam identified as a Japanese patrol vessel of about 500 tons. Immediately thereafter, the patrol vessel illuminated with its searchlight. The bridge was cleared and a quick dive was made to escape. At

1949 while at 30 foot depth, a sharp crack was felt in the vicinity of the bridge. The ship was checked quickly for leaks but no flooding was detected. The ship was ordered to run silently at deep submergence. At 1952 upon reaching 100 foot depth, the explosions of three depth charges were felt which were evidently close by. Between 2001 and 2005 eight depth charges were felt and screws and echo ranging heard on sound gear from three different sources. At 2044 one explosion was heard at a long range. Shortly afterwards lost contact with enemy. At 2125 surfaced on course 320° T.

2. A survey of the ship revealed that the following damage had been sustained: (1) Large shell hole approximately 4 feet in diameter in the starboard bulkhead of the cigarette deck. (2) Wooden gratings on cigarette deck splintered. (3) Cigarette deck above engine induction dished in and riddled with shrapnel holes. (4) .50 caliber machine gun mount blown off its foundation and a number of shrapnel holes in the mount. (5) Shrapnel hole about 1/2" in diameter in R.D.F. antenna loop shafting. (6) Port bulkhead and bridge structure including shelter space riddled with shrapnel leaving holes in plating varying from 3 inches in diameter to 1/4" in diameter. (7) Both after radio antennae carried away. None of the damage suffered was of a serious or military nature.

3. The best estimate of the size of the projectile used was of about 4.7" in diameter. It was evidently a high explosive shell with an instantaneous fuze. The shell pierced the bulkhead and exploded approximately three feet beyond its point of impact just above the engine induction. The fragmentation was small with a wide dispersion. The heaviest plating penetrated by the projectile and the shrapnel was 5 pound galvanized iron plate.

4. The damage was repaired by the repair force of the U.S.S. OTUS at Fremantle, W.A.

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12-3. The damage to GRAMPUS as the result of this attack was superficial (Photos 12-1, 12-2 and 12-3) and she remained on patrol in the TRUK area until 5 June, when she departed for Fremantle, W.A., arriving on 17 June. The nature of the damage indicates that a 3 or 4.7-inch common projectile was employed. The larger Japanese anti-submarine vessels, such as frigates and large gunboats, usually were provided with one or more 12 cm./45 caliber guns(4.7-inch) with common projectiles having bursting charges ranging from 4 to 7 pounds of TNT or picric acid. Smaller anti-submarine vessels, such as the PC-13 Class, usually mounted one 8 cm./40 caliber gun (3-inch) with common projectiles having bursting charges ranging from 1 to 1.5 pounds of TNT or picric acid. Special flat-nosed anti-ricochet projectiles were frequently used by the Japanese for anti-submarine work.

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12-4. Had the projectile struck a foot or so lower, or had GRAMPUS been a second or two slower in diving, serious damage would have resulted.

12-5. For other cases of gunfire damage to U.S. submarines, attention of the reader is invited to the following briefs of damage in Appendix I: SWORDFISH (SS193), 7 February 1943; SKATE (SS305), 6 October 1943; NAUTILUS (SS168), 19 November 1943; BOWFIN (SS287), 28 November 1943; ROCK (SS274), 29 February 1944; RONQUIL (SS396), 17 November 1944; BERGALL (SS320), 13 December 1944; POGY (SS266) 19 April 1945; MUSKALLUNGE (SS262), 8 August 1945.