SECTION VI

U.S.S. ST. LO (CVE63)
Kamikaze Damage
Off Samar
25 October 1944

U.S.S. BISMARCK SEA (CVE95)
Kamikaze Damage
Off Iwo Jima
21 February 1945

Class .....CASABLANCA (CVE55)
Commissioned CVE63...October 1943
CVE95.....May 1944
Displacement (Full Load) .....10,400 Tons

Length (O.A.).....512 Ft. 3 In.
Beam (O.A.).....108 Ft. 1 In.
Draft (Full Load).. 20 Ft. 0 In.

References:

(a) C.O. ST. LO ltr. CVE63/L11 of 21 November 1944 (War Damage Report)
(b) BuShips Code 424 Memorandum, "USS ST. LO (CVE63) Report of Interview with Survivors"
(c) C.O. BISMARCK SEA ltr. CVE95/A16-3 Serial 001 of 25 February 1945 (Action Report)
(d) COMCORTDIV 72 ltr. CCD 72/A16-3/A4-3/wk Serial 008 of 14 March 1945 (Action Report, including C.O. MELVIN R. NAWMAN (DE416) Action Report of 21February)

Plates VI-1 - ST. LO - Kamikaze Damage
VI-2 - BISMARCK SEA - Kamikaze Damage

ST. LO (CVE63) and BISMARCK SEA (CVE95)

6-1. Raging hangar deck fires fed by gasoline in the tanks of planes; the detonation of torpedoes and bombs; the hazard to personnel fighting fires of exploding 20 and 40mm ammunition; the rupture of vital fire mains and sprinklers; and heavy casualties among damage control personnel—all were contributing factors in the loss of ST. LO and BISMARCK SEA. Since the experiences of these two vessels are parallel and afford one more illustration of the extreme hazard to aircraft carriers of hangar fires, when complicated by the presence of fueled planes and explosed bombs, torpedoes and ammunition, summaries follow of their damage and consequent loss.

ST. LO (CVE63)

6-2. On 25 October 1944, ST. LO was one of six CVE's in Seventh Fleet Task Unit 77.4.3 which came under gunfire attack from the central Japanese force during the Battle for Leyte Gulf. In the course of this action GAMBIER BAY (CVE73) was lost as a result of gunfire damage (Section III). ST. LO survived the gunfire action without damage.

6-3. The Japanese force retired soon after 0930 and General Quarters was secured aboard ST. LO about 1000. The flight deck was clear of planes, but there were 3 VF's and 5 VTB's in the hangar. Of these one VF and one VTB were inoperable. At 1045, the radar screen was clear, and damage control personnel were changing from Material Condition ABLE to Material Condition BAKER. Four of the VTB's in the hangar were being gassed and armed with one torpedo each while two of the VF's were also being gassed and armed with 50 caliber ammunition. The planes were spotted as shown in Plate VI-1. Four, Mk. 13, torpex-loaded torpedoes with detonators and igniters installed, which had been removed from the stowage outboard to port of the after elevator, were lying on the deck. Four torpedoes without detonators and igniters installed remained in the stowage to starboard of the after elevator. In addition, there were 64 bombs in the hangar including 6, 350-pound, depth bombs reported to have been TNT loaded and hydrostatically fuzed, on skids on the deck, 40, 100-pound, and 18, 500-pound, TNT loaded, unfuzed bombs in ready stowages on either side of the hangar. It is emphasized that gasoline was actually being discharged from nozzles into the tanks of at least 3 planes.

6-4. At 1047, with the ship on course 240°T., enemy planes were sighted dead ahead. General Quarters was sounded as the planes moved aft on the starboard side. The gasoline pumps were secured. Although it was reported that the gasoline mains were

drained and filled with CO_2, it is somewhat doubtful whether this actually was accomplished in view of the fact that 7-8 minutes were normally required to complete the operation. In any case there was no pressure on the gasoline lines and little or no fuel left in the hoses. One of the enemy planes broke off from the group, circled the stern of ST. LO and approached at an altitude of about 100 feet as if preparing to land. One 20 mm and one twin 40mm mount opened fire but with no apparent effect. The after 5"/38 caliber mount was prevented from firing by a jammed breach block suffered in the earlier gunfire action.

6-5. At 1051, 4 minutes after it was sighted, the plane apparently released one bomb which struck and penetrated the flight deck at about frame 130 some 8 to 10 feet to port of the centerline. Immediately after releasing the bomb, the plane nosed over and crashed on the flight deck at approximately frame 125 on the centerline. Eye witnesses described the crash as a terrific flash followed by a loud clatter as pieces of the plane skidded up the flight deck and over the bow. Burning gasoline was sprayed over the flight deck. Simultaneously with the crash, the bomb apparently exploded with a heavy, sharp detonation within the hangar. Surprisingly enough, there were few casualties among personnel on the gallery walkways at the forward end of the flight deck. A few men who did not have time to reach the gallery shelters were drenched by burning gasoline. Fire hoses on the flight deck had been in readiness for landing operations. Three hoses, served from the forward loop of the fire main, were placed in operation promptly, two with foam. The situation did not appear alarming to the Commanding Officer, who was in the island, since few pieces of plane debris were left on the flight deck and a two-foot diameter bomb entry hole appeared to be the only damage to the flight deck.

6-6. In the hangar, however, the situation was much different. The bomb, which could not have been large because the flight deck suffered no noticeable distortion, apparently detonated just above a VTB plane, probably TBM I28, on the port side, which was being armed and gassed. Two survivors said a plane on the starboard side caught fire first, probably FM Q8. It did not explode, but one man said "it... looked like it was smashed apart". Gasoline from this plane and perhaps from other sources formed a large pool on the hangar deck which burned with flames about 18 inches to 2 feet high over an area roughly extending the entire width of the hangar between frames 120 and 155. The hangar sprinkling system was immediately turned on but only the water curtain in the vicinity of frame 100 and the sprinklers forward of frame 100 had sufficient pressure to deliver water. Sprinklers aft of frame 100, over the area of the fire, produced only a trickle of water. Fire hoses were

led out but only one had sufficient pressure to be used. The pressure was lost a few minutes afterwards.

6-7. About 45 seconds after the first detonation, a second explosion occurred in the hangar. The Commanding Officer described this as a "whoosh" and agreed that it was definitely low order. One survivor from the hangar deck stated that it was the explosion of a plane on the port side of the hangar opposite the plane which started to burn first, probably TBM I28, and that it was characterized by the presence of more black smoke than flame. Dense black smoke poured from the bomb hole in the flight deck, from around the port edge of the flight deck in the vicinity of frame 160, and from around the edge of the forward elevator. Personnel of a fire fighting party which was directing water down the bomb hole in the flight deck were severely burned.

6-8. The explosion apparently did not rupture the flight deck but raised it a few feet in way of the bomb entry hole and along the port side aft of amidships and separated the deck from the port hangar bulkhead in the vicinity of frame 160. The bomb hatch on the port side of the hangar deck by the after elevator was lifted out of the its opening and thrown against the port side of the hangar; and the bomb hatch beneath, in the second deck on the port side of the after mess hall, was lifted out of its opening, but settled back although not exactly in position. Little damage to structure elsewhere in the ship was reported. The evidence leads to the conclusion that the second explosion was a gasoline vapor explosion.

6-9. At about 1054 (1-2 minutes after the second explosion), a very heavy, sharp detonation occurred in the hangar. This explosion was not observed by any survivors from the hangar deck but was described by the Commanding Officer as very large and accompanied by a bright yellow flash. A large section of the flight deck on the port side between frame 130 and the after elevator was demolished. Survivors from the after walkway reported that the after elevator platform blew upward and disappeared. The forward elevator was tilted so that the forward edge was a few feet above the flight deck. It appears this was a high order detonation. Steering control was lost and never regained. At this point the Commanding Officer, still on the bridge, had the word passed to "Prepare to Abandon Ship". The order was passed by word of mouth and over remaining sound-power circuits. These were: JA - from the bridge to Damage Control; 2JZ - from Damage Control to repair parties and patrols; 1JV and 2JV- between the bridge and the forward engineroom.

6-10. At 1056, a fourth explosion occurred. Since the lower deck spaces had been evacuated, there is no information on the effect

on the interior of the ship of this and subsequent explosions. No additional damage to the flight deck was noted, but the forward half of the forward elevator platform was folded back over the after half. Reports as to the severity of the explosion are conflicting. A resume of survivors' reports gives the impression that it was possibly a low order detonation or a gasoline vapor explosion, but the Executive Officer, who was on the flight deck at the time, described it as a sharp, heavy detonation. The additional damage to the forward elevator and the Executive Officer's description seem to indicate that the explosion was high order.

6-11. By this time, personnel had begun to leave the ship. The after engineroom had been abandoned after the second explosion because of heavy smoke drawn in by the ventilation system. All the engineroom personnel reached the forward messroom, but only one man survived. He went aft over the fantail. The others started forward and were in passage B-202L at the time of the third explosion. Some were killed by the doors to the repair locker in the passage, which were blown off by the explosion,and the rest were either unsuccessful in escaping from the ship or died of injuries. The forward engineroom was abandoned at about the time of the fourth explosion (1056-1059). Prior to evacuating the enginerooms, the boilers were filled with water and boiler fires were secured. Pumps were left running. There is good reason to believe that the throttles were closed inasmuch as the machinery spaces were abandoned in an orderly manner.

6-12. At about 1058, a fifth heavy explosion occurred which demolished the port hangar bulkhead between frames 120 and 190. Some 2-3 minutes later, word was passed to "Abandon Ship". Remaining personnel immediately started leaving via knotted lines, hose lines and by jumping overboard. At about 1105, a sixth explosion of considerable violence occurred as the Commanding Officer was leaving the bridge. It blew out the starboard hangar bulkhead between frames 120 and 190.

6-13. The seventh and eighth explosions were not observed except by personnel in the water. The last explosion is believed to have been the first which caused any extensive damage to the underwater hull. When the ship was attacked she was in a right turn and so heeled to port. Flood water from the ruptured port fire mains flowed to the port side and the ship retained a port list even when straightened on her course. The Commanding Officer stated that the ship had a 7-8 degree list to port when he left immediately after the seventh explosion. Within five minutes of the eighth explosion, the ship had capsized to starboard and sunk bottom up. A large hole in the bottom, observed between the after stack and the after elevator by two sur-

vivors just before she sank, supports the possibility that the last explosion was the detonation of one or more of the munitions in bomb magazine C-402M, located between frames 152 and 168.

6-14. Some time after ST. LO disappeared there were 2 or 3 underwater explosions. It is possible that these were some of the depth bombs from the hangar which were hydrostatically fuzed (depth setting unknown) at the time of the attack, although it appears doubtful that any of these could have survived the hangar fire in an intact condition.

6-15. Damage to the light steel partition bulkheads of gallery deck and upper deck spaces was fortunately relatively minor up to the time personnel evacuated them. Bulkheads of compartments A-0208-2C, Radio Central; A-0207-2C, Communication Office; and A-0205K, Air Plot around the forward elevator on the gallery deck are known to have been caved in but the time is not certain. Some statements were made that lightening hole covers in passageway A-0204 1/2T were blown out, but others said they were only bulged. Although an alteration was issued after the LISCOME BAY disaster, authorizing continuous welding around the patch plates, this had not been accomplished and the plates were only tack welded. The port-side passage between frames 48 and 65 was caved in by the second explosion and the third explosion was reported to have blown the port bulkheads in this area against the side of the ship. The same passage on the starboard side was unaffected by the first two explosions and not observed later. The bulkhead of Air Plot was caved in 3 or 4 feet by the third explosion. The athwartship passage at frame 100 was unaffected by the first two explosions and not observed subsequently. Some of the lightening hole covers in the passage at frame 146 were blown off and the light metal bulkhead between the passage at frame 186 and clipping room No. 19 was caved in by the first explosion. Bulkheads of officers' staterooms to starboard of the forward elevator on the upper deck were caved in by the first explosion and the motion picture projection room was blown away by the second explosion. Undoubtedly additional damage to interior structure was caused by the third and subsequent explosions, but it was not observed.

6-16. Very little damage was done to the hangar deck and second deck by the first two explosions. No fragment damage was reported from the bomb detonation, but it is likely that the second deck was penetrated by fragments in the area beneath the bomb detonation inasmuch as three breaks were reported in the fire main on the second deck in the vicinity of B-203L and C-201L after the first explosion. Survivors also reported considerable display of sparks from electrical

circuits in the overhead of the forward crew's mess, B-203L, undoubtedly from ruptured electric cables which were probably cut by fragments. Since heavy smoke rapidly filled the second deck compartments and no lighting except flashlights and hand battle lanterns was available in the forward and after crew's mess compartments and in the galley spaces after the first explosion, it is understandable that fragment holes in the overhead were not observed. Multiple cracks were reported in the hangar deck in the vicinity of the after uptakes after the first two explosions. As noted previously, the port bomb hatch in the hangar deck was blown from its hinges and thrown against the port side of the hangar by the second explosion and the port bomb hatch in the after crew's mess was blown from its hinges, but fell back nearly in its seat. The door opening into the after elevator pit from the after crew's mess was blown out by the second explosion.

6-17. Little is known of the damage caused by the third and subsequent explosions to the hangar deck and lower decks. The door at the after end of the hangar leading to the fantail was blown out by the third explosion and as noted previously several of the men from the after engineroom who were trying to escape from the forward crew's mess through passage B-202L were fatally injured by the two forward doors of the repair locker which were blown from their hinges. No structural damage below the second deck was reported other than the hole or holes observed in the bottom between the after stack and the after elevator after the eighth explosion.

6-18. All radios and radar were put out of commission by the first explosion. Although lights came back on in the radios when power was restored, no signals were received. Radios were out completely after the second explosion. Internal communications except for a few sound-powered circuits were also out of commission after the first explosion. Signals to stop all engines sent by the bridge to the enginerooms after the third explosion were never received. Word to stand by to abandon ship was passed over the 2JZ Damage Control Circuit which was still working after the third explosion.

6-19. Lights went out throughout the ship after the first explosion, but came on again in a few seconds except in the hangar and in second deck spaces in the vicinity of the detonation. Circuit breakers which had tripped out on the switchboard in the forward engineroom were reset immediately and power restored to the ship. The lights again went out after the second explosion from the same cause, but did not come on in many spaces when power was restored. Automatic battle lanterns and emergency lights functioned properly

in many spaces but did not switch on in all compartments. After the third explosion the lights again went out and few came back on. Overhead lights in Damage Control, B-201-6L, and in the forward engineroom were reported to be on when these spaces were evacuated after the third explosion.

6-20. No damage to machinery in the forward and after machinery spaces was observed before the spaces were evacuated. The after engineroom lost communication with the bridge after the first explosion and never regained it. Smoke and fumes drawn in by the ventilation system after the first explosion filled the after engineroom. The smoke became denser after the second explosion and it was decided to abandon the space. Boilers were secured and it is probable that the throttle was closed. When the after engineroom was abandoned, the fire pumps were operating, but no fire main pressure could be built up; boilers and the main engine were normal; the condition of the generator was not known. Smoke conditions in the forward engineroom apparently were not so serious and all machinery was functioning normally. Personnel did not evacuate this space until they received word after the third explosion to prepare to abandon ship.

6-21. Although momentary losses of power were observed after the first and second explosions, the electro-hydraulic steering gear functioned up to the time of the third explosion. Lights remained out in the steering gear room after the first explosion and automatic battle lanterns failed to switch on. After the third explosion both steering gear pump motors stopped, the 1JV sound powered circuit was dead, and the man on watch abandoned the station.

FIRES AND EXPLOSIONS

6-22. Inasmuch as the ship was in the process of changing from Condition BAKER to Condition ABLE at the time of the bomb hit, the condition of the fire main is not known. The horizontal loop of the fire main could have been segregated at frames 98 and 99 by closing valves 2-98-1 and 2-99, or at frames 109 and 110 by closing valves 2-109-1 and 2-110-2, to form a forward loop served by two pumps in the forward engineroom, and an after loop served by two pumps in the auxiliary machinery space and machine shop, B-407E, and by two pumps in the after engineroom. The after loop could have been further segregated at frames 113 and 114 by closing valves 2-113 and 2-114, or at frames 132 and 134 by closing valves 2-132 and 2-134-2, to form forward, after and center loops served respectively by the pumps in the forward and after enginerooms and the auxiliary machinery space. Hoses had

been led out on the flight deck in preparation for landing of planes.

6-23. The scattered gasoline fires left over the forward end of the flight deck by the plane crash were rapidly extinguished by three hoses, two connected to foam generators served from the forward loop of the fire main. The gasoline fire ignited in the hangar by the bomb explosion was fed from ruptured plane tanks. This fire quickly spread over the width of the hangar between frames 120 and 155. Hangar sprinkling was turned on immediately but only the hangar curtain at frame 100 and the hangar sprinklers forward of frame 100 delivered water. Only a trickle of water came from the sprinklers over the area of the fire. The hangar sprinklers forward of frame 100, however, demonstrated the effectiveness of such installations by keeping that portion of the hangar cool and free of fire until after the third explosion which is believed to have disrupted the forward fire main loop.

6-24. The forward engineroom reported normal pressure of 110 pounds at the fire pumps after the first explosion; the auxiliary machinery space could get no more than 40 pounds pressure at the fire pumps although they were operated at top speed; and the after engineroom reported they could build up no pressure at the fire pumps. After the first explosion, two breaks were reported in the port side of the after fire main loop, one in B-203L near the after bulkhead and one in C-201-4L. A third break was reported in the riser in C-201L leading from the port side of the after loop to four lower deck fireplugs. The compartments in which the breaks occurred were dark, so it was difficult to determine their size. Apparently they were large enough, or other breaks had occurred, to cause the loss of pressure in the hangar sprinkling system aft of frame 100. From the above it appears likely that the fire main system was segregated into two loops by valves 2-109-1 and 2-110-2.

6-25. The initial ruptures in the fire main were caused either by shock or by fragments from the bomb detonation. No shock effects, except tripping-out of circuit breakers on the main switchboard in the forward engineroom, were reported from the bomb detonation. However, much of the fire main system on CVE 55 Class vessels was made of cast iron which is notoriously susceptible to shock damage. No fragment damage was reported from the bomb detonation, but the rupture of electric circuits in the overhead of the forward crew's mess indicates that the hangar deck probably was penetrated by fragments. Therefore, it appears that the ruptures in the fire main might have been caused by either shock or fragments.

6-26. The third explosion, which appears to have been a high order detonation, probably was the detonation of one or more of the 6, 350-pound depth bombs or the 4 torpedoes located on the hangar deck in the vicinity of the gasoline fire. The depth bombs were reported to be loaded with TNT. The torpedo warheads were definitely torpex-loaded. The depth bombs were on skids on the starboard side at about frame 120 near the forward edge of the fire area, but two of the torpedoes were on skids on the port side of the hangar deck at frame 130, practically in the middle of the fire. The time between propagation of the fire and the high order detonation was extremely short (3 minutes). Therefore it is probable that the explosion was the detonation of the warheads of one or both of the torpedoes which were in the center of the gasoline fire and contained torpex which is much more sensitive to roasting than TNT, rather than the detonation of one or more of the depth bombs. The location of the major damage to the flight deck would seem to bear this out.

6-27. The fourth, fifth and sixth explosions probably were high order detonations. It is unknown, however, whether they were torpedo warheads, GP bombs or depth bombs. It is difficult to determine the character of the seventh explosion, but the evidence that the eighth explosion involved munitions in the bomb magazine, C-402M, is fairly good.

6-28. It is not difficult to envision the means by which the effects of raging fires and violent explosions in the hangar finally reached the bomb magazine. The force of the relatively moderate second explosion was sufficient to blow out the bomb hatch on the hangar deck, lift and twist the hatch on the second deck in its seat, and blow out the door between the after elevator pit and the after crew's mess. Burning gasoline was reported to be entering the after crew's compartment on the second deck after the second explosion and a large amount of burning debris was blown into the after elevator pit by the third explosion. The damage to the hangar deck and second deck hatches left only the hatch in the first platform deck intact after the second explosion. One survivor reported initiating sprinkling of the magazine, but the early loss of fire main pressure in the after loop precluded effective sprinkling of this compartment. In the course of the fourth, fifth, sixth and seventh explosions structural damage and the conflagration undoubtedly were carried deeper into the ship until burning gasoline and debris may have fallen into the magazine itself where it could have initiated the detonation of one or more of the 353 GP, SAP and depth bombs and 316, 5-inch HE rocket bodies stowed therein. It is doubtful that fragments from the seventh or

earlier explosions initiated the magazine explosion because there was an interval of about 5 minutes between the seventh and eighth explosions. However, fragments may have initiated burning of the TNT filler of one or more of the stowed bombs, which in turn might have initiated the detonation of some of the contents of the magazine.

FLOODING AND DAMAGE CONTROL

6-29. Up to the time the ship was abandoned little flooding, except from the ruptured fire mains, had taken place and no control measures had been undertaken. The Commanding Officer reported that the ship was in a starboard turn and consequently had a list of 3 or 4 degrees to port at the time of the bomb detonation. By the time she had been straightened on a course, she retained a port list of 2 or 3 degrees. This was attributed to an accumulation of water on the port side from the ruptured fire mains. The list to port had increased to 7 or 8 degrees by the time the Commanding Officer went over the side just after the seventh explosion. Between this time and the eighth explosion the list appeared to decrease slowly and after the eighth explosion the ship rolled rapidly to starboard and sank stern first, bottom up, within 5 minutes. The rapidity with which stability and buoyancy were lost indicates extensive flooding and it is possible that the explosion in the bomb magazine destroyed longitudinal watertight integrity from bulkhead 118, the forward bulkhead of the after engineroom, to the stern.

CONCLUSION

6-30. Although the hangar was about as highly lethal with respect to content of fueled planes and exposed munitions as any carrier at the time of attack, it is believed that the initial gasoline fire might have been controlled and the subsequent gasoline vapor and munition explosions prevented had the hangar sprinkling system aft of frame 100 delivered water to cool the hangar and serve foam lines to extinguish the flames. The inadequacy of cast iron for use in vital systems on board ship has been demonstrated frequently. As it was, with the loss of fire fighting ability and with the conflagration out of control, the situation became hopeless and there appears no way in which the loss of ST. LO could have been prevented.

BISMARCK SEA (CVE95)

6-31. On 21 February 1945, BISMARCK SEA was operating as part of a support group approximately twenty miles east of Iwo

Jima. The sky was overcast and visibility poor. Wind and sea were variously reported as force 3 to force 6, and rising toward the end of the action. At 1715,the ship went to General Quarters and set Material Condition ABLE because of bogies in the area. The fire main was split into six sections with six fire pumps on the line. The bomb magazines were closed, but several 500-pound GP bombs which had been removed from planes, were still in the hangar. Nine torpedoes (with warheads) were in their customary stowage in the after part of the hangar. Available reports do not indicate whether the torpedoes were TNT or torpex-loaded, but it is probable that they were torpex-loaded.

6-32. At 1815 all planes had landed, including three extra TBM's from other ships. This made a total of nineteen VF's, fifteen TBM's and two OY1's (Army) on board. In order to handle the extra TBM's it was necessary to send four VF's which had not been defueled to the hangar deck, completely filling that space. All other planes in the hangar had been defueled and the gasoline system was secured and purged with inert gas. The four fueled VF's were stowed just forward of the after elevator.

6-33. At about 1845 (sunset was at 1815 and only half-light remained), enemy aircraft which had been picked up by radar were observed closing the group. One plane flying 20 to 25 feet above the water approached BISMARCK SEA from the starboard side. As soon as it was clearly seen at about 1000 yards, the after starboard guns opened fire and tracers were observed to be hitting. Firing was continued until the guns could depress no further. The plane struck the starboard side of the hangar abreast the forward end of the after elevator at 1847.

6-34. The plane's engine came to rest in the after elevator pit. On entering the ship, the plane knocked four torpedoes from the starboard rack and scattered them about the hangar deck. The five torpedoes on the port side remained in their racks. The elevator cables were severed, apparently, and the elevator fell to the hangar deck. At the time of the crash, it was on its way up and nearly at the flight deck. The reason for the failure of the elevator locks has not been determined. Steering control was lost. As there were no survivors from the steering gear room the cause for this casualty is not known. TBS went out following the first hit. The AC motor-generator sets which supply radio transmitters began stopping intermittently. The overspeed trip on this equipment was difficult to keep adjusted under shock conditions. This equipment continued to give trouble until the ship was abandoned.

6-35. It is inferred from reference (c) that an explosion occurred at the time of the first hit, but whether it was the detonation of a bomb carried by the plane or the combined effect of impact and the plane's gasoline bursting into flame has not been determined. Fire immediately engulfed the area of the crash and personnel in the conflagration station turned on the water curtains and sprinklers. All systems responded except the after sprinkler bay and after water curtain. The gauges at the fire pumps in the after engineroom revealed that pressure had dropped from 125 to 40 pounds which indicated that the after loop had been broken. Members of the forward and flight deck repair parties immediately led hose lines aft from plugs forward of frame 136 and within about two minutes appeared to be bringing the fire under control.

6-36. At about 1849, a second plane, diving almost vertically and using the flames as an aiming point, crashed through the flight deck just forward of the after elevator and exploded among the fueled fighters parked in this area of the hangar. Evidently the plane carried one or more bombs. The explosion was heavy and considerable structural damage resulted. It was said that the entire rear area of the hangar was demolished and that all hands on the fantail were blown into the sea. The sides of the hangar were blown out. Lightly constructed bulkheads and decks in the gallery were disrupted in the neighborhood of the crash and as far forward as amidships. Survivors reported that bulkhead 100 on the gallery level was blown forward. The torn decks of the 20mm and 40mm clipping rooms in the after part of the gallery permitted ammunition to fall into the hangar. Within a few minutes 40mm and 20mm cartridges began exploding from the heat of the fire.

6-37. The second plane tore a hole in the flight deck somewhat larger than the dimensions of engine and fuselage. A part of the wing was noticed on the flight deck near the island. The crash and the and the ensuing explosion killed a majority of the repair personnel who were fighting the hangar fire. No. 3 sprinkler bay and No. 4 water curtain were carried away, but sprinklers and water curtains forward of frame 136 remained intact and continued to function properly. Survivors believed that the hangar deck was ruptured and Repair III personnel, stationed in the after mess hall on the second deck, were wiped out by the detonation. It is probable that the conflagration extended to second deck spaces through the ruptured hangar deck. Repair III did not respond to telephone communication, and fire was reported in the starboard side of the galley, which was just forward of their station on the second deck.

6-38. Interior communications remained intact except sound-powered circuits to Repair III, steering gear compartment, Battle II and the fantail. The damage control station maintained communication via sound-powered phone circuits with the conflagration station until that station was abandoned, and with Repair II and Repair V. It was reported that the damage control (JZ) circuit was overcrowded by talk between battle dressing stations, making it difficult to contact repair parties. Communication between bridge and main machinery spaces continued satisfactorily. Lighting aft failed, cause unknown.

6-39. The after part of the ship became a raging inferno with the fire entirely out of control. Flames were shooting high above the flight deck through the plane-hole in the deck, through the after elevator opening and through the opened sides of the hangar. An escort vessel standing by described this fire as "a holocaust engulfing the carrier from her stern to amidship". At 1900, word was passed for all hands to man abandon ship stations. Evidently the IC room in the gallery amidship was still tenable, for the word was passed over all circuits and relayed from the IC room continuously. Men went to their stations in an orderly manner.

6-40. When "Go To Abandon Ship Stations" was passed to the machinery spaces, the boilers were secured and the main engines stopped, but the necessary auxiliaries were left running to furnish water pressure on the intact sprinklers and water curtains which were left operating. There was no damage to the machinery spaces and all personnel survived. A slight amount of smoke was noted in the after machinery space when it was abandoned. Abandon ship stations aft could not be used because of the fire, and men from these stations went forward. Access to the after part of the ship was cut off. Word was passed on the bull horn to take the life rafts from the planes. The general announcing system loudspeakers in the after part of the vessel failed at about this time.

6-41. At 1905, word was passed to abandon ship. While this was being carried out, a third and much more violent explosion occurred in the vicinity of the fire on the hangar deck. This was probably the detonation of one or more torpedo warheads which were lying on the hangar deck in the center of the conflagration. The explosion rocked the ship, demolished the after portion of the flight deck and blew away the sides and after end of the hangar. Walkways and gun sponsons aft were either blown off or gave way and fell into the sea. The ship immediately assumed a small starboard list which gradually increased. This indicated that progressive flooding was taking place. The abandon ship evolution continued for approximately an hour with destroyer and destroyer escort vessels

assisting in recovery of survivors. The fire progressed until it enveloped the entire hangar and flames were observed over the complete length of the ship.

6-42. Within about an hour, the starboard list had increased to twenty degrees where it appeared to remain for a short time. The fire had greatly diminished in intensity and the entire after portion of the ship appeared to be gutted. At 2007, MELVIN R. NAWMAN (DE416), one of the assisting vessels, reported that about 35 men still appeared to remain on the stricken ship and in the water and that few of the survivors wore life jackets. NAWMAN observed that free surface effect was much in evidence as BISMARCK SEA rolled from port to starboard without regard to the existing sea. Loud crashing noises were heard which sounded like machinery ripped loose from its bed plates or planes crashing around on the hangar deck. Bismarck Sea began listing more and more to starboard, and, at about 2007, listed sharply to starboard and appeared to hang for perhaps 30 seconds at an angle of 80 degrees. At this time, the island broke away and disappeared.

6-43. At 2008, BISMARCK SEA rolled over on her beam ends, hung for a moment, then turned completely over. Her forefoot projected about 20 feet above the surface of the water with perhaps 150 feet of her keel exposed. By 2015, the carrier had disappeared, plunging stern first. There was no explosion but a great mass of steam was observed. Within two minutes, the escort vessel maneuvered into the center of the slick left by the carrier. There was debris everywhere. Recovery of remaining survivors was difficult, because of darkness and a choppy sea. Of the 943 officers and men on board, 625 were rescued by the assisting vessels. It was believed that roughly 125 of the 318 persons lost were killed prior to abandoning ship.

FIRE FIGHTING AND AMMUNITION BEHAVIOR

6-44. Although fire caused the loss of BISMARCK SEA, there were other concurrent factors. These were in order of importance:

1). The loss of repair personnel. With all available repair personnel grouped near the after elevator to fight the fire caused by the first crash, the second plane fell among them, exploded and killed the majority. The men of Repair III on the deck below also were killed.

2). The detonation of the torpedoes stowed on the hangar deck. Although the decision to abandon ship had been made prior to this detonation, the knowledge of its likelihood rightly determined the decision. Had these torpedoes been stowed elsewhere, there would have been a chance of controlling the fire and preventing

its spread until it burned out.

3). The four gassed VF planes in the hangar. Because of the presence of extra planes and the need for haste, these four craft had been squeezed onto the hangar deck without degassing. The gasoline from their tanks added to the conflagration of the second plane crash. Although this ship did not discuss the adequacy of defueling facilities, measures are being taken to increase the speed of defueling planes for all aircraft carriers as discussed in Section IV.

4). The hazard of exploding 40mm and 20mm ammunition to personnel fighting fires. The gallery deck in way of clipping rooms was torn open by the second explosion and ammunition fell into the fire, roasted and exploded.

6-45. Fire fighting equipment and personnel initially functioned as planned. When the conflagration station turned on the water curtains and sprinklers after the first hit, only the after curtain (No. 4) and after sprinkler bay (No. 3) failed to operate. Probably the fire main was ruptured between frames 168 and 184. It was reported that the main was split into six sections, each supplied by a separate pump, but it is not known which valves were closed to effect this segregation. Unless authorized alterations had been accomplished, it would not have been possible to split the after loop because of the absence of a valve in the cross-connection at frame 162. Thus a break in the main aft of the valves at frame 135 (port and starboard) would immobilize the after loop. This evidently occurred. The remainder of the hangar sprinkling system confined the fire to the after end of the hangar. Repair party personnel attacked the fire vigorously with hoses led from forward and it appeared that their efforts would be successful until the second plane crash and detonation of its bomb load killed practically all of the personnel fighting the fire. Active fire fighting measures were not reorganized after this crash before it was decided to abandon ship. It is notable that the sprinklers and water curtains forward of frame 130 effectively controlled the forward progress of the fire until the ship was abandoned. About this time the fire swept forward and engulfed the entire hangar. Whether the auxiliaries, which had been left running when the machinery spaces were secured, stopped operating or the fire main was damaged extensively by the violent explosion that occurred while the ship was being abandoned, is not known.

6-46. Reference (c) stated that Diesel fire pumps were considered a "must" on ships of this Class. The Bureau considered, however, that the CVE55 Class had good pumping capacity (7200 gallons per minute at 125 pounds pressure) and that the pumps were well dispersed. Consideration of weight did not justify

the addition of Diesel pumps. The fate of BISMARCK SEA would not have been altered by their presence. Reference (c) also commented on the inadequacy of "victaulic" couplings in the fire main but there is no evidence that one of these couplings failed.

6-47. The detonation of one or more torpedoes after roasting in the intense gasoline fire is substantiated by other war experience. The stowed torpedo presents two explosive hazards: the warhead and, to a much lesser degree, the airflask. The explosion of an airflask causes limited damage, comparable to that of a bomb of less than 100 pounds.* The damage is principally due to blast since little fragmentation occurs. Airflasks can be exploded by fragment attack, missile impact or heat. The phenomenon does not always occur, however, since cases exist where fragment penetration has merely resulted in bleeding of the airflask.** Torpedo warheads, which contain large charges of TNT or Torpex, present the greater hazard. They are, however, remarkably stable under fragment attack. Thirteen cases are on record of warheads struck by fragments. In some cases the explosive filler burned when the warhead was punctured by fragments. In others, the filler did not even burn. In one case, BROWNSON (DD518)***, a torpedo warhead may have detonated from a direct bomb hit. The loss of the ship prevented drawing definite conclusions.

6-48. War experience indicates that torpedo warheads are susceptible to detonation when subjected to intense heat for a protracted period of time. The time necessary generally varies from 15 minutes to an hour, although in the case of ST. LO it is considered to have been only 3 minutes. There are at least four ships other than BISMARCK SEA upon which this probably occurred.**** An early analysis of DOWNES (DD375) favored the explosion of two air flasks as the cause of damage, but subsequent examples of air flask explosion show that it was more likely a warhead detonation. Two ships reported bad fires adjacent to torpedo warheads without detonation. Evidently the temperature was not great enough or the roasting period was not long enough. In the case of BISMARCK SEA, the third detonation occurred about 20 to 22 minutes after the first plane crash. One or more torpedo warheads probably detonated. It is interesting to note that the aircraft bomb magazines, located some 20 feet directly below the detonation, were not affected.

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* BuShips War Damage Reports Nos. 13 and 51

** Section VII (A); BuShips War Damage Report No. 51

*** BuShips War Damage Report No. 51

**** See DOWNES (DD375) BuShips War Damage Report No. 13
WASP (CV7) BuShips War Damage Report No. 39
OMMANEY BAY (CVE79) 4 January 1945 Section IV of this Report.
ST. LO (CVE63) 24 October 1944 Section VI of this Report

That a mass detonation of these magazines did not occur must be considered a matter of good fortune since aircraft bombs are subject to mass detonation from fragments and blast. The case of LISCOME BAY (CVE56)* indicates the effect of such mass detonations.

FLOODING AND DAMAGE CONTROL

6-49. There was apparently no flooding other than that due to fire fighting before the detonation of the torpedo warhead. No reports of the damage resulting from this blast are available. Flooding probably took place on the first platform through opened shell plating and progressed through C-303L, C-302A, and C-301A into the after machinery space. The addition of water at the height of the first platform with free surface extending the full breadth of the vessel, combined with an extensive free surface on the hangar deck due to the continuous operation of the fire main and sprinkler system, was in time responsible for the loss of stability and eventual capsizing. The account of GAMBIER BAY and KALININ BAY (Section III) contains a discussion of the stability characteristics of the CVE55 Class and the extent of typical damage required to produce negative metacentric height.

CONCLUSION

6-50. Insofar as the loss of damage control and fire fighting personnel was a primary factor in the loss of the ship, BISMARCK SEA's experience teaches that too great dependence on specialists is dangerous. The inevitable necessity of specialization brought about by technical advances results in an indifference and even total ignorance on the part of other personnel. This is disastrous when an entire group of "specialists" is put out of action. Principles of damage control and fire fighting, on which the bare survival of the ship may depend, should be understood and practiced by every member of the crew. The survival of HADLEY (DD774) (War Damage Report No. 51) may be attributed to the "constant daily drills in damage control using all personnel on the ship, and especially those who are not in the regular damage control parties." Whether such a practice would have altered the fate of BISMARCK SEA under the circumstances is doubtful, but in many critical cases, the ability of any and all personnel to practice damage control may be the deciding factor in the survival of the vessel.

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* BuShips War Damage Report No. 45.