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REPORT OF THE CIVIL AERONAUTICS BOARD

On the Investigation of an accident,
involving aircraft of United States
registry NC 17603, in the Tagus River,
Lisbon, Portugal, on February 22, 1943.

An accident involving an aircraft of United States registry, NC 18603, a Boeing 314 flying boat, occurred in the Tagus River approximately 2 miles east of Cabo Ruivo Airport, Lisbon, Portugal at about 1847 GMT (6:47 p.m.) on February 22, 1943 which resulted in fatal injuries to 19 passengers and 5 crew members. Of the remaining 8 passengers, 2 received serious injuries, 2 minor injuries and 4 were uninjured, while 7 members of the crew received injuries ranging from minor to serious. The aircraft, which was being operated by Pan American Airways in scheduled air carrier service as Trip 9035, between New York, N.Y.; Bermuda; Horta; Lisbon, Portugal; and Foyens, Feroe, was demolished.

COMMITTEE OF INVESTIGATION

The Washington Office of the Civil Aeronautics Board (hereinafter referred to as the Board) received notification of the accident the night of February 22 and on February 23 initiated an investigation in accordance with the provisions of Section 702 (a) (2)^{1/} of the Civil Aeronautics Act of 1938, as amended. Two representatives of the Board, Allen P. Bourdon, Chief, Investigation Division of the Safety Bureau, and Howard T. Bailey, Technical Consultant to the Civil Aeronautics Board, proceeded to the scene of the accident, leaving New York on February 23 and arriving at Lisbon the afternoon of March 4. In the meantime Pan American was authorized by the Board to proceed with salvage operations. All of the wreckage that was recovered from the river was deposited on the dock at Cais de Santa Apolonia, Lisbon and there remained under constant civil police guard until formally released to Pan American Airways by the Safety Bureau.

^{1/} Section 702 (a) (2) provides that it shall be the duty of the Board to "Investigate such accidents and report to the Authority the facts, conditions and circumstances relating to each accident and the probable cause thereof."

Hearing

Captain R. O. D. Sullivan, who was in command of the aircraft, made his first formal statement regarding the cause of the accident to Commander Paulo Teixeira Viana, a representative of the Portuguese Government at Lisbon on March 5 in the presence of Mr. Bourdon and Mr. Ralley of the Board. During the investigation at Lisbon formal statements were secured from the other six surviving members of the crew, five of the eight surviving passengers and eight members of Pan American ground personnel.

In connection with the investigation, a private^{2/} hearing was held in New York City April 16 and 17 before representatives of the Board, Stuart G. Tipton and Allen P. Bourdon, presiding officers, Ralph A. Reed, Senior Air Safety Investigator, and W. E. Koneczny, Aircraft Specialist. At this time direct testimony was taken from Captain Sullivan and four members of Pan American operations and maintenance personnel and additional testimony was taken from three members of the crew.

Upon the basis of all the evidence accumulated during the investigation, the Board now makes its report in accordance with the provisions of the Civil Aeronautics Act of 1938, as amended.

Air Carrier

At the time of the accident Pan American Airways, Inc. (hereinafter referred to as PanAm) a New York Corporation, was operating as an air carrier under a certificate of public convenience and necessity and an air carrier operating certificate, both issued pursuant to the Civil Aeronautics Act of 1938, as amended. These certificates authorize PanAm to engage in air transportation with respect to persons, property and mail between various points, including New York, Bermuda, Horta, Lisbon, and Foynes.

^{2/} Private hearings are held when for reasons of national security public hearings are inadvisable.

Flight Personnel

The captain and commander of the flight, H. O. D. Sullivan, held an air-line transport pilot certificate, with 0-7200 h.p. single and multi-engine land and sea ratings. He also held the PanAm senior title of Master Pilot. He entered the employ of PanAm on September 3, 1929, after serving approximately 11 years with the U. S. Navy during which time he had acted as flight instructor and test pilot at various Naval Air Stations throughout the country. His total flying time on Boeing 314 equipment was about 3278 hours and his total flying time was 14,352 hours. He commanded the survey flights for the Trans-Pacific route and, with the inauguration of the Trans-Pacific service, participated in 55 such Pacific crossings before being transferred to the Atlantic Division. On this division he commanded the Bermuda clippers until the inauguration of the Trans-Atlantic service. Prior to February 22, 1943, he had, as captain, completed 100 successful Atlantic crossings. His last physical examination, required by the Civil Air Regulations, was taken on October 13, 1942, and his company pre-departure physical on February 21, 1943.

First Officer H. S. Rush held a commercial pilot certificate with a 0-025 h.p. single-engine land rating. He was employed by PanAm on July 7, 1941. He had logged approximately 1706 hours as copilot with PanAm, 1454 hours of this time were on Boeing 314 equipment. His last physical examination, required by the Civil Air Regulations, was taken on November 19, 1942 and his company pre-departure physical examination on February 20, 1943.

The Aircraft

The aircraft, NC 13603, a Boeing 314, 4-engine flying boat, Serial No. 1990, manufactured by the Boeing Aircraft Company, was delivered to PanAm in January 1939. It was powered by four Wright 3320-14A1 engines, each with rated h.p. 1200 (maximum except take-off) and 1550 h.p. for take-off. They were equipped with Hamilton Standard, constant speed, hydromatic,

full-feathering three-bladed propellers. At the time of the accident, this aircraft had been flown a total of 8505 hours.

Weather

The weather at Lisbon at the time of the accident was cloudy, light intermittent showers, visibility 7 miles, ceiling 4500 feet with scattered clouds at 2000 feet, surface wind WSW 6 knots. The tide was ebbing at 2 knots. Official sunset was at 1820 GMT (6:20 p.m.) A thunderstorm had passed south of the Lisbon station at about 6:00 p.m. moving TNW, and intermittent lightning flashes were observed most of the flight by the captain, passengers and members of the crew. The surface wind moved clockwise from TLE 6 knots at 5:50 p.m., around to W 0 knots at 6:33 p.m., and was reported to the flight as WSW 6 knots just previous to the accident.

History of the Flight

Trip No. 9035 originated at New York, proceeded to Bermuda on February 21, and arrived at Horta at 10:18 a.m. (GMT) on February 22, after a routine flight. After servicing and refueling the flight took off from Horta at 11:43 a.m. (GMT) with sea conditions as follows: channel swells from 2 to 3 feet high; surface waves, none; wind from south, 3 knots.

The flight maintained an altitude of approximately 7000 feet until it approached the mouth of the Tagus River, approximately 11 miles from Lisbon, when a gradual let-down was made to about 600 feet. The Portuguese authorities require that this altitude be maintained from the mouth of the river to the landing area. The flight arrived over the area at about 1835 GMT (6:35 p.m. Lisbon time) ⁵³/₆ hours and 52 minutes after take-off from Horta and 15 minutes ahead of its estimated arrival time. Since official sunset was at 6:20 p.m., PanAm's ground crew at Lisbon had set out as usual a string of landing lights, indicating that the landing was to be made from south to north. On this particular occasion the light arrangement was slightly different from normal, since the extreme downwind (south) light, which was usually green in color,

had been replaced with a white light. The only reason for this change was that the green bulb had burned out and the PanAm station substituted the white bulb. Captain Sullivan indicated in his testimony that the substitution of lights was not confusing and had no bearing on the accident. This string of five landing lights extended over a distance of approximately 4500 feet. At the time the flight arrived in the area it was still light enough for the aircraft to be observed plainly by personnel in the PanAm launch and on the shore. The PanAm launch had patrolled the landing area east of the string of landing lights and had taken its station near the red light which was the extreme upward (north) light of the landing strip.

The landing conditions and barometric pressure were given to the flight by radio at 6:35 p.m. and were acknowledged with a statement from the flight that they would want flares when both landing lights were blinked. While proceeding in a northeasterly direction, at an estimated speed of 135 knots and at an altitude of between 500 and 600 feet over the area, about $1\frac{1}{2}$ miles east and abeam of the center light in the string of landing lights, the aircraft made a descending turn to the left which continued until it was headed in a westerly direction when the left wing tip skimmed along the surface of the water, dug in and the plane crashed into the river. It remained partially submerged for approximately 10 minutes, then disappeared below the surface of the river. The PanAm launch, which had been standing by for the landing, proceeded to the scene of the accident, arriving about 10 minutes later, and began rescue operations. The PanAm launch was joined by a BOAC launch (British) and another PanAm launch approximately 10 minutes later.

Witnesses

The first officer (copilot), who was at the controls with Captain Sullivan and could have proved a valuable witness, was one of the 5 crew members fatally injured. All witnesses, except the captain, agreed in general that the course and attitude of the aircraft seemed normal until the time of impact.

It appears from the evidence that just previous to and at the time of the accident, all nine members of the flight crew and the supernumerary were on the flight deck and their approximate positions were as follows: The captain and first officer were in their respective pilots' seats; the second officer (navigator) was standing just behind and between the pilots; the third officer was standing behind the captain's seat; the fourth officer was standing behind the first officer's seat; the assistant engineering officer was seated at the engineers' table; the first radio officer was at the radio station; the engineering officer was seated on one of the jump seats; the assistant radio officer was occupying the other jump seat; and the supernumerary was at the navigator's table.

The captain stated that he entered the Lisbon area over the mouth of the Tegos River at an altitude of about 600 feet and proceeded in level flight in a northeasterly direction up the river on a course which took him about $1\frac{1}{2}$ miles east of the north-south string of landing lights. He stated in substance that it was his intention to continue north over the landing area until he had passed the north end of the landing lights, make a 180° turn and return south to a point sufficiently south of the white landing light to allow for a normal approach for a south to north landing. However, while he was still headed north and about abeam of the center light of the string of five landing lights, the nose of the plane seemed to drop slowly. The captain stated that he was not alarmed nor did he realize he was in trouble until he had descended to an altitude of about 400 feet, when he noticed his air speed was about 135 knots and that the angle of descent had increased to approximately 45° . He testified that he pulled back on the elevator control and found that there was no pressure whatever on the control yoke. He stated, "my first officer, he grabbed the control too" in an effort to assist him regain control. The captain stated that it was then

that he was sure he was going to make a crash landing and decided it would be best for him to absorb some of the shock with the wing; that, accordingly, at 400 feet, he throttled his engines and applied left aileron control. He stated that he knew he had aileron control but was not sure about having rudder control because he did not try to use the rudder; that he did not know why he did not use the trim tabs or apply more power to bring the aircraft out of its descending attitude. He stated further that he had no conversation with nor did he make any remarks to the first officer regarding the trouble. In Captain Sullivan's first formal statement, given in Lisbon on March 5, 11 days after the accident, he was asked why, when he was at 400 feet, he did not try to remedy the nose-down condition by accelerating the engines instead of throttling them, to which he replied, "I don't think it would be a wise thing to try the motors at that altitude." When questioned at the hearing in New York on April 17 as to what, if anything, he did to regain control of the aircraft at the time he stated the plane nosed down to about 45° at 400 feet altitude, he answered, "I am afraid I am better off not to try to see what I done; I have no idea." When asked whether he "might have changed the stabilizer setting", he answered, "If I did not, I should have. That really would have been the first thing I should have done. I don't know whether it was changed, or whether it was not. I don't remember doing it." When asked, "Do you think if you had done that you could have raised the nose of the ship?", he replied, "Well, I do not see why it should not, because it always acted very quickly to the tab, to the control." When asked whether he had had any intention of making a landing in a direction other than south to north, he answered in the negative.

During the captain's first statement at Lisbon on March 5 he gave no estimate of the angle of descent of the aircraft. On the morning of April 17, he accompanied a test flight in a PanAm Boeing 314 in New York and late that afternoon at the hearing he stated that he "sat in the cockpit this morning taking an angle, level, and then taking an angle of the glass where I last seen

the beach going out of sight and making an angle about 45° . That is the only way I could give an estimate on the angle it was in."

The airport manager who was standing at the radio in the airport office at Lisbon, stated that, "At the time the plane last reported on radiophone, it was approximately 2 to 3 miles southeast of Cabo Ruivo at approximately 500 feet, heading in a northerly direction. About 10 seconds later, I apparently had glanced aside for an instant, I saw the plane at approximately 400 feet altitude in a sharp descent, estimated at 20° ." He stated further, "The plane continued in this 20° descent until it hit the water, but because of darkness I can't definitely state whether there was any leveling off or not at the end."

Three witnesses (passengers) seated in the same compartment on the port side of the plane, one of them facing forward and the other two facing aft, testified. One of these passengers stated, "As I turned my head from the window I saw the wing of the plane skim along the water. It didn't go in, it skimmed along. I turned my head away from the window . . . It was then that I received this series of shocks. . . ." Another said, "I looked down. I was watching the water below. I saw the wing tip touching the water. Even to that point nothing made me think we were crashing."

The PanAm communications representative, awaiting the arrival of the flight, was on duty at the radio telephone and was standing next to the airport manager in the radio room of the airport office at Cabo Ruivo, and observed the aircraft approximately $2\frac{1}{2}$ miles distant. He stated that he overheard a radio telephonic communication from the PanAm launch to the aircraft which was acknowledged by the flight with the following remark, "I'll make a circle to the east

of the landing lights." The witness stated that immediately after hearing this message he glanced out and the aircraft had already hit the water, "it was just that quick afterward." When asked if he could give any estimate of the lapse of time in seconds or minutes between the time the message came over and the time he saw the splash he answered, "About thirty seconds or less." The witness was not sure whose voice he had heard, Captain Sullivan's or that of the first officer, but he stated, "I think it was the first officer. I don't know why, but I think it was."

The assistant to the traffic manager in Lisbon, a Portuguese who speaks English, was also standing by the airport manager and saw the plane through the window of the airport office. The radio man was in communication with both the flight and the PanAm launch and asked the flight if they needed flares to land. This witness stated, "I think first he said, 'I need flares in a moment - night flares'." He quoted the flight as saying further, "Now I'm going to turn it up, I will turn to face the wind to land." The witness said that he thought he saw the plane making a left turn. He stated that, "At that moment I saw the wings turning up, I could see a little inclination of the wings, more than normal. . . . and I saw the red light coming down about 45°." (It is evident that the witness was referring not only to the longitudinal attitude of the plane but that he saw the red navigation light, which is on the left wing, move downward as the aircraft was headed toward him and was steeply banked in the final turn, as described by most of the passengers.) The witness continued, "I just saw the red light stopping near the water, I couldn't see exactly the line of the water. . . . Then I

heard a big boom far away first of course I thought of a forced landing . . . I was looking at Mr. Anderson (the airport manager) at my side and we were astonished trying to figure what it was."

The fourth officer testified that he had gone up on the flight deck 15 to 20 minutes prior to the accident and he remembered that the flight was absolutely normal; also the altitudes which he had seen on the navigator's altimeters, the air speed, and many other incidental things, including the first officer's report of a radio message from PanAm Lisbon to the captain that the landing launch was at the north end of the landing lights and he noticed that the captain acknowledged this information. He testified that, "The captain began a gentle turn to the left. For some reason, I don't know what, whether I heard something, whether someone spoke to me or whether I was just looking around, I turned my head to the right and I heard a crash, and that is the last thing I recall but at no time had any sensation of the ship being in an abnormal attitude."

Further evidence of the smoothness of the flight prior to impact was furnished by the testimony of the assistant engineering officer. He was seated at his table on the flight deck and recalls that the captain was occupying the port seat and flying the aircraft, and that the first officer was in his seat on the starboard side. The engineering officer was also on the deck. The assistant engineering officer said he had not received any instructions from the captain and from his testimony it is evident that he did not pay any particular attention, but knew they had let down and as he expressed it, "There was no dipping. If we were coming down at all, it was very gradual." He stated that he took a look out the window and "it was in the turn, because of the fact I could see down on the ground out the port windows and could see the clouds at the other windows. . . . Everything appeared to be perfectly normal in every respect, including the airplane

and the engines He had made a turn and apparently, to my use, he had leveled off and was proceeding to land and had closed the throttles. That is why I looked up to see whether it was time to give him power or not, because of the throttles being closed." When questioned if the captain cut the power himself, the witness answered, "Yes." He said that at this moment he heard a snap, that it was "after I distinctly remembered seeing the throttles moving back I heard the snap." From this point he could not recall anything further until he regained consciousness in the water.

None of the passengers who gave statements at Lisbon or members of the crew who testified at the hearing had any sensation of falling or witnessed any indication of the impending crash. All of the witnesses referred to above seemed to think that the aircraft was in a normal turning glide preparatory to landing. From his position on the ground, one witness, the airport manager, estimated the descent to have been 20° , which would have been equivalent to a descent of between 3000 and 4000 feet per minute. Had the aircraft been descending at 20° , such a descent should have been noted as unusual at least by members of the crew. Had the aircraft been descending at an angle of 45° , as stated by the captain, it is reasonable to believe that the passengers would have become alarmed and certainly members of the crew would have become conscious of the unusual steepness of the descent.

Recovery and Examination of the Wreckage

Recovery of the wreckage was started the following morning, February 23, and as parts were taken from the river they were placed on nearby Cais de Santa Apolonia Dock for subsequent examination and study. The extent of the damage to the aircraft structure, as it existed immediately following the accident, could not be determined with accuracy, as the action of the tide on the wreckage while submerged, together with the subsequent salvage operations, undoubtedly contributed somewhat to its further destruction.

It appears that the aircraft struck the water with sufficient force to result in great damage to the hull and the left wing, which was completely sheared off at a point just outboard of the outboard (No. 1) engine. The recovered portion of this wing revealed extensive damage. The complete flotation wing tip section was not recovered. The remainder of the wing structure, including the center section which carries the four engines, and the right wing and wing tip, received comparatively little damage by water impact. Engines Nos. 1 and 2, cowling and parts of the nacelles were torn from the center section by impact and in both cases the propellers were broken from the engine crankshaft. Engines Nos. 3 and 4 received only minor impact damage and were recovered intact with the center section. The hull was badly damaged and had sustained at least two major breaks - one immediately aft of the rear wing spar and the other just forward of the empennage. The major portion of the hull between these two breaks was not recovered. That portion of the hull forward of the rear wing spar and below the flight deck had disintegrated and nearly all of the hull bottom and the major hull structure were completely torn away. Portions of the flight deck, however, were recovered with the center section. Both hydro-stabilizers suffered major damage, the left one in particular being badly mangled. The severed empennage, which was found some distance away from the main portion of the wreckage, was recovered in comparatively good condition except that the outboard portion of the left elevator was missing and was not recovered and the left fin and rudder were sheared off from the stabilizer but were still attached to it by the control cables. This severance was apparently caused by impact with some heavy part of the disintegrated wreckage, such as a part of the left hydro-stabilizer or the No. 1 or No. 2 engine.

All rudder and elevator control cables had either parted during the separation of the empennage from the major portion of the wreckage, or remained intact and were pulled through the stabilizer structure, carrying with them portions of the elevator control mechanism.

An examination of all parts of the airplane recovered from the river, and a study of the various instrument and control settings located on the flight deck, revealed nothing which would explain the cause of the accident. There were no signs of fire or explosion in the wreckage, and there were no indications of malicious tampering or sabotage.

In view of the captain's statement that he had lost elevator control at the time of approach to the landing area, the salvaged elevator control system parts and portions of the horizontal tail surfaces were returned to New York. Some of these parts were subsequently forwarded to Washington for further study by the technical staff of the Safety Bureau with the cooperation of the Division of Metallurgy of the National Bureau of Standards.

The Elevator Control System
(See sketch on next page)

The elevator control system of the Boeing 314 consists of two sets of cables which permit operation of the elevator through an initial range of approximately 20° either side of the position of zero hinge moment by means of servo-tabs.^{4/} An additional 5° motion in either direction is attained by direct operation of the elevator through the torque-tube. The four ends of the operating arms are also connected to the torque-tube by means of four independent spring-cartridges. The purpose of these cartridges is to permit the operation of the elevators through the normal operating range by means of the servo-tabs, while still permitting direct operation of the elevators

^{4/} Servo-tabs should not be confused with trim-tabs, which are separate on this model airplane.

through the extremes of their operating range by means of the torque-tube.

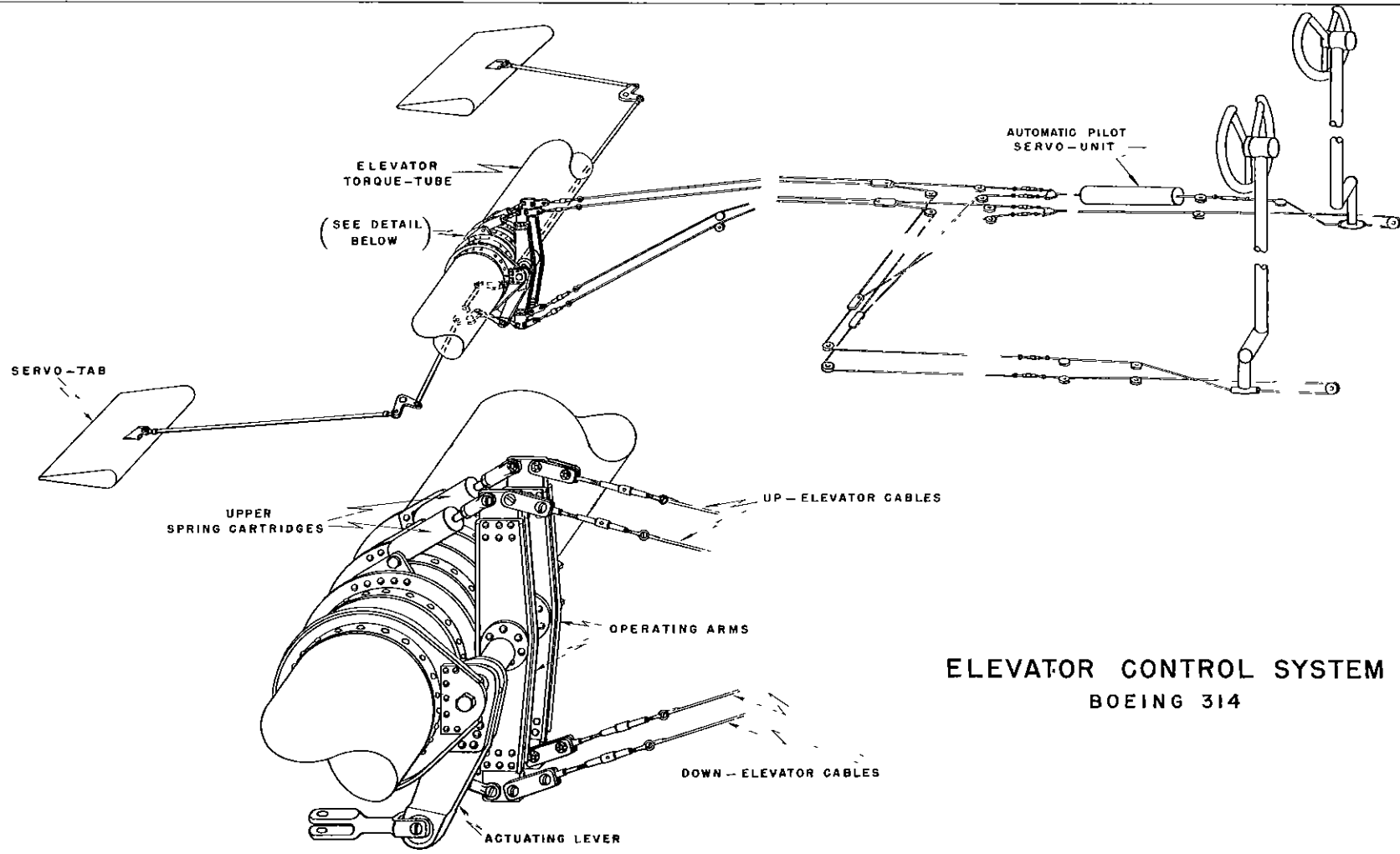
The only individual failures in the cable control system which could render the elevators inoperative are the two cable connecting links which were recovered from the wreckage undamaged and intact.

The dual set of cables enables either the captain or first officer, or both, to operate the system in case any one cable fails. If one of the servo-tab systems should become inoperative, the other set would operate the elevators sufficiently for control. Even the failure of the hinge bolt supporting the operating arms, or the failure of the actuating lever, would not deprive the airplane completely of elevator control. The failure of one, or even all four of the cartridges would not influence the operation of the elevator through the first 20° of surface movement.

Sufficient parts of the elevator control system were recovered to permit detailed examination and study and to establish beyond reasonable doubt that the system was functioning prior to impact. The only element found to have been broken was the rod of the lower starboard spring cartridge. This break had the appearance of having occurred sometime prior to the accident. However this finding is not considered to be relevant in establishing the cause of the accident, inasmuch as even had this cartridge been broken, it would have had no effect on the operation of the airplane. Although this conclusion seemed quite apparent from a study of the design of the elevator control system, nevertheless the Board arranged with PanAm for specific tests to clarify this matter beyond a doubt. During these tests, one or more of the cartridges were disconnected and the operation of the elevator control system was found to remain normal.

SUMMARY AND ANALYSIS OF EVIDENCE

Much consideration was given to Captain Sullivan's description of the events immediately preceding the crash; specifically, that while approaching the landing area at 600 feet, the airplane's nose dropped for no explainable



**ELEVATOR CONTROL SYSTEM
BOEING 314**

DETAIL OF ELEVATOR CONTROL

reason, and that subsequent endeavors on his part and on the part of the first officer to recover from the increasingly steeper glide were of no avail due to lack of elevator control. A study of this airplane's structural design, its flight characteristics and its operational features fails to disclose any reasonable explanation for such behavior.

Even if for some unexplainable reason the airplane had entered a glide under the conditions described by the captain, recovery undoubtedly could have been attempted with at least a good chance of success by means other than the use of elevator control. To verify this possibility, actual flight tests were conducted at New York in April by Panam on another Boeing 314, with personnel of the Board and Captain Sullivan participating as observers. These tests proved that recovery from a glide of the same speed and power conditions as described by Captain Sullivan, could be effected very easily and without appreciable loss of altitude by either the application of power or use of the trim-tabs.

When questioned, Captain Sullivan did not recall whether or not he had made any endeavor to recover from the glide by means other than the use of the elevator control, although under the assumed circumstances a pilot of his ability and experience should certainly have used at least the trim-tabs. In this, as in other respects, his recollection of the events immediately preceding the crash was uncertain.

Findings

1. The accident occurred in the landing area on the Tagus River at Lisbon, Portugal, at about 6:47 p.m. on February 22, 1943, resulting in fatal injuries to 19 passengers and 5 crew members. Of the remaining 8 passengers, 2 received serious injuries, 2 minor injuries, and 4 were uninjured, while 7 members of the crew received injuries ranging from minor to serious. The aircraft, a Boeing 314 flying boat, NC 18603, was demolished.

10. There were no signs of fire or explosion in the wreckage and no indications of malicious tampering or sabotage.

11. The weather, direction of the wind, intermittent lightning flashes and reduced visibility due to darkness cannot be considered as contributory to the accident unless these conditions influenced the captain to land from east to west, instead of with the landing lights from south to north.

12. The captain indicated by his testimony that it was his intention to make his landing from south to north after circling the area to the left. However, testimony of the surviving passengers, crew members and other witnesses indicates that they thought a landing was being effected when the crash occurred. There was definite evidence that the airplane was headed in a westerly direction at the time of impact with the water.

Conclusions

The Board finds no convincing evidence that the accident was caused by failure of any part of the aircraft, or in particular by a failure of the control system.

The captain's recollection of the behavior of the airplane, i.e., that it entered an abnormally steep descent some time prior to making contact with the water, was at wide variance with the recollections and testimony of the surviving members of the crew and surviving passengers. No indication could be found in the wreckage of the control system which would account for any failure of the airplane to respond to the controls. Had such a failure occurred when the aircraft was at an altitude of 600 feet, as the captain testified, it is logical to assume that he would surely have had some conversation with the first officer or that he would have warned the other members of the crew on the flight deck of the impending crash. Furthermore, it is believed that had the situation been such that the first officer found it necessary to assist the captain in an attempt to regain control, and had the angle of the descent of the aircraft been as severe as 45° from an altitude of 400 feet until it struck

the water, to which the captain alone testified, surely one or both of the unusual circumstances would have been noticed by at least one or more of the surviving members of the crew. Also, this severe angle of descent would undoubtedly have made an impression on the surviving passengers.

The direction of the wind and the rapidly approaching darkness might have influenced the captain to land from east to west at a right angle to the landing lights. If such was the case, and in view of the marginal daylight remaining, the accident might well have been the result of misjudgment of altitude while executing a turn preparatory to landing, which resulted in the wing tip striking the water. Although Captain Sullivan's testimony does not coincide with these conclusions, the testimony of members of the crew and passengers who survived does at least support this theory, inasmuch as they had no other thought than that the airplane was making a normal landing at the time of the accident. It is inconceivable that all of the witnesses could have had this impression had the airplane descended from 400 feet at an angle even approaching 45° , as testified to by the captain.

The description of events just prior to the crash, as given by Captain Sullivan, was not corroborated by any other witnesses. It is probable that the captain's inability to recall accurately the events and details of his actions from the 400-foot altitude until striking the water was the result of mental and physical shock.

If, as stated by the captain, he was not attempting to land and the elevators did become inoperative, which investigation failed to reveal, he erred in not attempting recovery by use of the trim-tabs. Captain Sullivan agreed in his testimony, and subsequent flight tests indicated, that the use of the trim-tabs should have enabled him to regain control of the aircraft.

If, however, as the preponderance of evidence so strongly indicates, the captain was attempting to land the aircraft at the time of the accident, he erred in his judgment of the position of the aircraft in relation to the

water. Good airline practice does not allow a turn at so low an altitude where a very minor error of judgment would result in contact with the water.

PROBABLE CAUSE

It appears that the probable cause of this accident was an inadvertent contact of the left wing tip of the aircraft with the water while making a descending turn preparatory to landing.

APPROVED:

/s/ L. Welch Fogue
L. Welch Fogue

/s/ Edward Warner
Edward Warner

/s/ Oswald Ryan
Oswald Ryan

/s/ Josh Lee
Josh Lee

Harlee Branch, Member of the Board, did not take part in the decision.