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Adopted: January 16, 1942
Released: January 16, 1942

File No. 5106-41

Docket No. SA-50

CAB Report

REPORT OF THE CIVIL AERONAUTICS BOARD

Of the investigation of an accident involving civil aircraft of the United States NC 15376 which occurred in San Juan Harbor, Puerto Rico, On October 3, 1941.

I.

CONDUCT OF INVESTIGATION

An accident involving aircraft NC 15376, a Sikorsky S-42B, occurred during a landing in the harbor at San Juan, Puerto Rico, on October 3, 1941, about 5:48 p.m. (EST), while the aircraft was operating in scheduled air carrier service between Miami, Flordia, and San Juan, Puerto Rico, as Trip 203 of Pan American Airways, Inc. 1/ The accident resulted in the destruction of the aircraft, fatal injuries to two passengers, serious injuries to two members of the crew, and minor injuries to four members of the crew and seven passengers. The remaining passengers were not injured.

The Civil Aeronautics Board 2/ was apprised of the accident about an hour after it occurred. Immediately after receiving this notification, the Board initiated an investigation of the accident in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. An investigator and an examiner were sent to the scene of the accident and arrived there about 1:00 p.m., October 5, 1941. In accordance with instructions of the Board, the damaged aircraft had been placed under guard and the wreckage had not been disturbed except to the extent necessary to remove injured persons, cargo, and to conduct the subsequent salvage operations in removing the wreckage from the water. Upon arrival, the investigator took custody of the wreckage and began his inspection.

After the inspection of all the parts of the aircraft was completed by the Board's personnel on October 7, 1941, the aircraft was released to Pan American.

Public Hearing

In connection with the investigation of the accident a public hearing was held in Miami, Florida, on October 22, 1941. Robert W. Chrisp, an attorney for the Board, acted as Presiding Examiner, and the following personnel of the Safety Bureau of the Board participated in the hearing: Frank E. Caldwell, Chief, Investigation Division: James H. Douglas, Assistant to the Chief, Investigation Division; and Harold G. Crowley, Accident Reports Consultant.

All of the evidence available to the Board at the time was presented at the hearing. Eleven witnesses testified and fourteen exhibits were introduced. Depositions of passengers on the airplane and other witnesses who saw the accident were received in evidence at the hearing. While the Examiner and the representatives of the Safety Bureau were the only ones designated to ask questions directly of the witnesses, the Presiding Examiner, acting under instruction of the Board, announced at the opening of the hearing that any person who had any evidence, questions, or suggestions to present for consideration in the proceeding might submit them in writing to the Examiner. No such questions were submitted during the hearing.

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

1/ Hereinafter referred to as "Pan American".

2/ Hereinafter referred to as the "Board".

II.

SUMMARY AND ANALYSIS OF EVIDENCE

Air Carrier

Pan American Airways, Inc., a New York Corporation, was operating at the time of the accident as an air carrier under a currently effective certificate of public convenience and necessity and an air carrier operating certificate theretofore issued to it pursuant to the Act. These certificates authorized it to engage in air transportation with respect to persons, property and mail between various points, including Miami, Florida; Antilla, Cuba; Port au Prince, Haiti; San Pedro de Macoris, Dominican Republic; San Juan, Puerto Rico; Port of Spain, Trinidad; Belem, Brazil; Rio de Janeiro, Brazil; Porto Alegro, Brazil; and Buenos Aires, Argentina.

Flight Personnel

On the flight under discussion the crew consisted of Captain Charles A. Lorber, First Officer Harvey E. Breaux, Flight Mechanic J. E. Donnelley, Radio Operator W. P. Mahoney, and Flight Stewards Joe Catala and A. E. Calligari.

Captain Lorber, aged 45, had accumulated a total of approximately 11,384 hours of flying time and held airline transport pilot certificate No. 4554 with 4-M Land and 5 Land and Water ratings. Since his employment by Pan American in 1928 he had accumulated a total of approximately 1500 hours on Sikorsky S-42 airplanes and had had about 690 hours of night flying. He started piloting over the subject route in 1929 and subsequent to that date had flown on both the Atlantic and Pacific routes of Pan American. Since Captain Lorber's return to the Eastern Division on January 16, 1941, he had made approximately six night landings at San Juan in S-42 airplanes. His last physical examination as required by the Civil Air Regulations was taken on May 6, 1941, and showed that he was in a satisfactory physical condition. Captain Lorber had from time to time been given flight checks on various aircraft, including S-42's. His last flight check on an S-42 followed his transfer from the Atlantic Division to the Eastern Division. This is in keeping with the policy of Pan American. All pilots are checked when transferred from one division to another. Captain Fatt, chief pilot in the Eastern Division, stated that in checking Captain Lorber on S-42's "he had a tendency to land with his nose down". He further stated that this difficulty was promptly corrected and that Captain Lorber thereafter made several landings which were satisfactory and normal. Company records indicated that Lorber was a well qualified and proficient pilot.

First Officer Harvey E. Breaux, aged 24, had accumulated a total flying time of approximately 583 hours. He had been employed by Pan American for approximately six months prior to the accident. At the time of the accident he held commercial pilot certificate No. 61667 with a rating of second pilot. His last physical examination as required by the Civil Air Regulations was taken on August 4, 1941, and showed him to be in a satisfactory physical condition.

Flight Mechanic J. E. Donnelley had been employed by Pan American for approximately 13 years and had flown as a flight mechanic for approximately 5000 hours. At the time of the accident he held a currently effective aircraft and engine mechanic certificate issued by the Civil Aeronautics Administration.

Radio Operator W. P. Mahoney had been employed by Pan American for one year and eight months and had flown as a radio operator in aircraft for approximately 926 hours. At the time of the accident he held a currently effective radio telegraph license, first class, issued by the Federal Communications Commission.

Mr. Catala and Mr. Calligari, flight stewards, had been employed by Pan American since July 13, 1939, and April 16, 1941, respectively.

Thus, it appears from the evidence that Captain Lorber and First Officer Breaux held the proper certificates of competency for the aircraft involved and were physically qualified. The evidence further indicates that the remaining members of the crew were well qualified to perform their respective duties.

Airplane and Equipment

Aircraft NC 15376, a Sikorsky Model S-42B, was manufactured by the Sikorsky Aircraft Corporation of Bridgeport, Connecticut, and was purchased by Pan American in May, 1936. It was powered by four Pratt and Whitney SIEG engines and was equipped with Hamilton Standard constant speed propellers equipped with brakes. At the time of the accident the aircraft had been flown a total of 7,832 hours and 9 minutes. The airplane and its equipment had been given a 100-hour inspection on September 29, 1941, and a pre-flight inspection prior to departure from Miami on October 3, 1941. The evidence shows that the engines and propellers had been maintained properly and that none of the engines had exceeded the major overhaul period of 550 hours authorized in the maintenance competency letter issued by the Civil Aeronautics Administration to Pan American. This model aircraft and its equipment had been approved by the Civil Aeronautics Administration for air carrier operation over routes flown by Pan American for 32 passengers and a crew of 6. It had been certificated for operation with a standard gross weight of 41,000 pounds. 3/ The total weight of the aircraft upon departure from San Pedro de Macoris, Dominican Republic, the last stop before the accident, was 39,407 pounds which was 1,593 pounds less than its approved standard weight. The center of gravity limits of the subject aircraft, as prescribed by the Civil Aeronautics Administration, are from 29 percent to 36.1 percent of the mean aerodymanic chord. The aircraft was actually loaded so that its center of gravity was at 33.2 percent of the mean aerodynamic chord.

The condition of the airplane and the maintenance records produced by Pan American indicated that the airplane was in an airworthy condition when it was dispatched from Miami, Florida, on October 3, 1941, for the flight to San Juan, Puerto Rico.

History of the Flight

Pan American Airways, Inc., Trip 203 of October 3, 1941, originated at Miami, Florida, and was bound for Buenos Aires, Argentina, with numerous intermediate stops including those at Antilla, Cuba; Port au Prince, Haiti; San Pedro de Macoris, Dominican Republic; and San Juan, Puerto Rico. The trip was dispatched to San Juan, Puerto Rico, and departed Miami at 7:33 a.m. (EST), about 18 minutes after the scheduled time of departure.

Prior to departure from Miami, the flight crew, with the assistance of other company personnel, prepared a flight plan for the trip. This flight plan was based on weather reports issued by the United States Weather Bureau and Pan American weather observers for var-

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3/ The "standard weight" of an aircraft is the maximum allowable gross load for landing.

ious points along the route. The weather over the route, as far as San Juan, Puerto Rico, was good, except for anticipated head winds, and indicated contact flight. San Juan is an overnight stop on Trip 203, the flight being continued the following morning with a different aircraft.

The flight proceeded uneventfully to Antilla, Cuba, where it arrived at 11:12 a.m. (EST) (52 minutes late) and departed at 11:30 a.m. (EST) (50 minutes late). The landing and take-off were without incident.

On arrival at Port au Prince, Haiti, where a landing was effected at 1:43 p.m. (EST) (1 hour and 3 minutes behind schedule) a slight swell was running on the surface of the water. As the aircraft decelerated and settled farther into the water the crew felt a shock on the aft end of the hull structure. This shock was not severe, but, in accordance with Pan American's custom, the captain ordered an inspection of the aircraft. This was performed by First Officer Breaux and Flight Engineer Donnelley. It consisted of a visual inspection of the aircraft's empennage and of the inside of the hull and revealed that no damage had been incurred. Following this inspection and the transaction of routine loading and unloading at Port au Prince the flight was resumed at 2:11 p.m. (EST) (1 hour and 11 minutes behind schedule).

Trip 203 proceeded to San Pedro de Macoris, Dominican Republic, where a normal landing was effected at 3:52 p.m. (EST) (1 hour and 17 minutes behind schedule). At 4:09 p.m. (EST) (1 hour and 19 minutes behind schedule) the flight departed for San Juan, Puerto Rico. The aircraft carried 21 passengers, a crew of six, 985 pounds of baggage, 614 pounds of mail, 1225 pounds of express, 79 pounds of company mail and cargo, and 775 gallons of fuel. This load, as previously stated, was under the allowable limits and was properly distributed with reference to the center of gravity of the aircraft.

The flight plan for this leg of the flight called for contact flight at a cruising altitude of 9000 feet with an estimated flight time of 1 hour and 40 minutes, indicating time of arrival at San Juan as 5:49 p.m. Official sunset was 5:23 p.m. (EST) at San Juan. The alternate destination was given as the point of departure, San Pedro de Macoris.

Captain Lorber stated that the aircraft was flown at an altitude of about 8000 feet over most of the route and when the flight was about 60 miles out of San Juan he had descended to an altitude of about 7000 feet. At this point the captain started a descent at a rate of about 400 feet a minute. This procedure would place the aircraft, according to the captain's estimate, at an altitude of about 1000 feet at the time it arrived at a point 15 minutes out of San Juan Harbor.

The radio log of the flight between San Pedro de Macoris and San Juan, Puerto Rico, reveals a number of contacts, all of which were routine and made by CW (telegraphic code) radio. The last routine contact was made at 5:30 p.m. (EST) and, as recorded, read as follows:

> "NC 15376 at 5:30 p.m. sighted the San Juan Airport. The estimated time of arrival over the airport is 5:45 p.m. The altitude at 5:30 p.m. is 1000 feet and will be maintained until the aircraft is over the airport. Signed — Lorber."

This is the customary "sighted" message and indicates that the destination is in sight. Immediately after this, the captain attempted to make voice contact with the ground station

using a two-way radiotelephone recently installed for short distance use between the aircraft in flight or afloat and the local ground station and the stand-by landing launch. This effort was unsuccessful because the apparatus was inoperative. The ship's operator then called the land station in code, on the aircraft's regular radio set, and asked for the landing conditions. The land station replied that he did not have them. The ship's operator relayed that message to the captain and remarked that they should be obtained. The ship's operator then retuned his radio to voice frequency and succeeded in hearing part of a conversation between the landing launch and the ground station, in which was mentioned the fact that the ground operator had obtained the landing conditions. The radio operator on board the airplane then asked the ground operator, "How about it?" and was told to stand by until they, the landing conditions, were checked. The ship's operator replied, "O.K., go ahead". The operator in charge of the land station then transmitted the landing conditions, "Wind west 3 Sea slight Kollsman 2992". This message was filed at the San Juan radio station at 5:45 p.m. (EST). This message was not received by the aircraft because it was just about to contact the water, and, in accordance with regular procedure, the operator had turned off the aircraft's radio.

Captain Lorber, during this time, had continued to descend until the aircraft was at an altitude of about 500 feet at a point a few miles west of San Juan Harbor. He then aligned the aircraft with a row of anchored reference landing lights in the harbor and started a final approach.

Mr. Jahncke, the Relief Airport Manager, had ordered the crew on the landing launch to prepare equipment for a night landing a considerable period of time before darkness. Seven reference landing lights were arranged in a line 2000 feet long from east to west and parallel with the wind. A red light was placed on the upwind end, a green light on the downwind end and the intermediate lights were white. In using this system of lights as a landing reference, the aircraft usually lands from the green light toward the red light and to the right side of the entire line so that the captain, who is seated on the left side of the aircraft, will have the lights continually within ready visual reference. Before the lights had been arranged, the crew on the launch had ascertained that there were no floating obstacles in the landing area. After placing the lights the launch stood by approximately abeam of the green light and about 300 feet north of it. The company procedure is to project the beam of the landing launch's searchlight in an upwind direction parallel to the row of landing lights so as to enable the landing aircraft to land between the beam from its searchlight and the string of landing lights. However, this was not done in this instance because the beam of the searchlight would have been directed toward the incoming aircraft since it was being brought in downwind and might well have blinded the pilot.

About five minutes after the lights had been strung, the incoming plane was sighted from the launch. Shortly afterwards a white flare was fired from the launch in accordance with regular procedure for the purpose of calling the attention of the aircraft's crew to the general locality of the lights. The radio operator on the launch attempted on four different occasions after the aircraft was sighted to transmit landing conditions to it by radiotelephone but, as previously stated, these attempts were unsuccessful due to the failure of the aircraft's radiotelephone. It is also customary to fire a green flare from the launch during the latter part of the aircraft's approach to indicate that the landing area is clear. Mr. Jahncke, in charge of the launch, stated that this was not done because it had not become completely dark.

Before beginning his final approach, the captain elected to land in the direction in which he was then approaching, i.e., toward the east, the direction opposite to that which

was indicated by the colored lights. He decided to land in this direction because he had concluded from the absence of any significant drift of the smoke which was rising from numerous fires around the harbor's edge that the wind was negligible. Captain Lorber stated that he could see the green light at the far end of the string of landing lights. Captain Lorber stated that he made his approach in the normal gliding attitude, at the usual speed and rate of descent. He ordered the flight mechanic to put the carburetor mixture controls in the full rich position and this was done. First Officer Breaux stated that during the final approach the air speed was about 80 knots (approximately 92 m.p.h.). At an altitude of about 400 feet, the flaps were extended fully. When the aircraft had about 200 feet of altitude the propellers were put in low pitch. The aircraft's landing lights were then turned on. The aircraft passed the red anchored landing light at an altitude estimated by the captain as 10 feet. According to Captain Lorber, a brilliant moon, which was almost directly overhead, tended to reduce the usefullness of the aircraft's landing lights because it made them reveal the water surface less clearly. About 20 or 30 percent of the 2000-foot landing strip, marked by lights, had been passed when the aircraft first made contact with the water at an air speed of about 82 m.p.h. This was at approximately 5:48 p.m. (EST). The captain immediately closed the throttles. The boat continued planing ahead for a short but undetermined period of time, possibly two or three seconds, when the captain observed that it was turning to the right. He applied rudder control to the left and then, noticing that this did not have the desired corrective effect, applied power to both of the right engines. This application of power also failed to arrest the turning and the aircraft continued to swerve as the nose dug increasingly into the water. Cabin occupants were thrown violently forward and sidewise to the left against their safety belts. The swerve to the right became violent and the left wing float struck the water. About this time the aircraft's hull broke completely into two sections at a point approximately over the main step of the hull. The location of this break was through that section of the hull where the forward passenger compartment, "D", joins the cargo compartment. The two sections of the hull filled rapidly with water and sank to a depth of about 15 feet where they grounded.

Three small children, aged one, two, and three years, had been occupying Compartment D with their mother. At the time of the accident the largest child was sitting beside his mother, with his safety belt fastened. 4/ The mother was holding one of the smaller children, while the flight steward was sitting on the opposite seat holding the other child. On first contact with the water, both children who were being held were thrown violently from the arms of the mother and the steward. 5/ Almost immediately after the hull of the airplane broke in two at Compartment D, all of the passengers in the aircraft were thrown around violently in complete darkness. Both the adults who were in Compartment D were almost completely submerged and were unable to find the two children whom they had been holding. The bodies of these children were subsequently recovered.

Captain Lorber and other crew members made every effort to direct the rescue of all passengers. The crew on the Pan American landing launch and other persons in the vicinity immediately rendered aid and all the occupants of the aircraft except the two small children referred to above were taken ashore. Hospitalization was provided for those requiring it.

4/ Prior to landing the sign requesting passengers to fasten their seat belts had been turned on and the first steward ascertained that the passengers had complied.

5/ After the occurrence of this accident, Pan American devised and put into use a harness arrangement by which a child in arms is secured to the body of the person holding the child.

Condition of the Wreckage

Prior to the arrival of personnel of the Board and personnel connected with the Civil Aeronautics Administration, the wreckage had been salvaged by United States Navy and Pan American personnel. It had been taken to the nearby Naval Air Station where it was readily accessible for examination.

Inspection disclosed that the hull had broken into two pieces just forward of the step. The forward section of the hull exhibited considerable damage, especially on its left side, from bending and compression loads, such as would be caused by severe impact with the water. It appeared that the bulk of the impact had been taken by the left portion of the bow. A severe dent, apparently from compression loads, was found on the left top side of the bow about eight feet back. The right side of the front section of the bow and the front portion of the keel remained generally intact. The left flap was broken off along a line of cleavage more or less coinciding with the hinge line, indicating that it had been down at the time of the accident. The left wing tip pontoon was torn completely from the left wing, and was damaged in such a way as to indicate clearly that the impact loads were from the nose and the left side of this pontoon. The left wing was broken completely away from the hull. It was damaged in a manner suggesting that the direction of the water loads had been against the leading edge which was crushed backwards for a distance of about 70 percent of the span. The right wing also was torn from the hull but was damaged much less than the left wing. There appeared to have been much less water load on its leading edge. The right wing tip pontoon remained attached to the wing and was not damaged severely. Most of the empennage units were broken from their respective fastenings but this breakage appeared to have been incurred during the salvaging operations.

The control system in general was badly damaged as was to be expected because of the heavy loads imposed during impact and subsequent salvage. It was, therefore, impossible to determine positively that the control system was intact prior to impact. However, the evidence indicated that the entire control system had remained fully operative until the time of the accident.

All four engines were subsequently torn down and inspected but no indication of power plant failure or interruption was disclosed. The condition of the blades of the four propellers, although some of them were bent during salvaging, indicated that little or no power was being applied at the time they were submerged.

All four ignition switches were on. The switch which operates the sign indicating that passengers should fasten their seat belts was on. The landing light switches were on. The flap control handle was in the "down" position and the flap indicator showed "full down". All mixture controls were in the full rich position. The propeller pitch settings were found to be in various positions. Numbers 1 and 4, the outboard left and right controls, respectively, were in "take-off" position, while Numbers 2 and 3, the inboard left and inboard right controls, respectively, were found to be about half-way between "take-off" and "cruise" positions. The throttle positions were found as follows: Number 1 half-way between the open and closed position, Number 2 in the fully closed position, Number 3 in the one-quarter open position, and Number 4 in the fully open position. The positions of the throttle and propeller pitch controls, as ascertained subsequent to the accident, are not definitely indicative of their positions prior to the accident, their fore and aft travel making it possible for the strong accelerations in the aircraft during the crash to have changed them.

In addition to the parts of the aircraft the conditions of which have been described above, all remaining component parts and all the instruments installed in the aircraft were

thoroughly examined. No failures during flight and no conditions which could have contributed to the accident were revealed. As stated before, the voice radio installed in the airplane was inoperative during the final approach to San Juan. This radio equipment was so badly damaged during or subsequent to the accident that it was impossible to determine why it did not function.

A thorough inspection failed to disclose evidence of any appreciable amount of corrosion which might have contributed to the weakening of the general structure of the aircraft.

The nature of the damage to the hull and wings indicated that it was the result of the aircraft's being subjected to severe water loads applied first against the lower left portion of the bow and then against the left wing's leading edge, and that in the interval between these two impact loads the left wing tip pontoon was crushed and broken backwards and laterally from the left.

Conduct of the Flight

The dispatching of the flight from Miami, Florida, to San Juan, Puerto Rico, with three intermediate stops was in accordance with proper procedure. The fact that the flight was conducted at an altitude of 8000 feet over most of this leg of the route, rather than at the 9000 feet prescribed in the flight plan, is not pertinent to the accident, although it was forecast that the most advantageous winds would exist at the 9000-foot level. San Pedro de Macoris, the last port of departure, is not equipped for landing at night and according to company procedure, flights are not dispatched from that port later than a time which will allow return and landing at that port during daylight, if mechanical trouble or unfavorable weather is encountered before reaching a point half way to San Juan. The time of departure from San Pedro de Macoris was 4:09 p.m. (EST). This departure time, taking cognizance of the slight difference in times of sunset at San Pedro de Macoris and San Juan, was consistent with the above procedure.

Flight 203 was scheduled to arrive at San Juan before sunset, but because it had left Miami 18 minutes late and had become increasingly so as it progressed because of head winds, it was apparent to the crew during the latter portion of the flight that a night landing would be necessary at San Juan Harbor.

This is consistent with proper procedure since night landings at San Juan Harbor with the type of equipment involved were allowed by the Pan American's Operations Specifications, which are a part of the terms and conditions of the air carrier operating certificate issued to Pan American by the Administrator of Civil Aeronautics. The harbor appears to be entirely suitable for night landings so long as the pilot involved is proficient 6/ and Pan American's system of lighting and patrolling the landing area is followed.

Weather conditions were favorable for operation over the portion of the route involved. Investigation of all weather services disclosed that the forecast and other weather advice, made available to Captain Lorber, including the conditions of the water surface at all points of landing, were substantially accurate. All weather observational facilities involved functioned in an entirely normal manner throughout the flight.

6/ Immediately after the accident the Administrator prohibited night landings at San Juan and other points on this route, pending the conclusion of this investigation and a demonstration by the pilots of their ability to make such landings.

We have concluded previously in this report that the aircraft involved in the accident had been properly maintained and was in airworthy condition when it took off from Miami, Florida. An examination of the carrier's records shows that it had been given the required periodic checks and a pre-flight inspection prior to its departure from this point. The possibility of damage to the aircraft during the landing at Port au Prince was thoroughly investigated by crew members at the time and no damage was found. The water surface at the time of this landing was not unusual. The waves were much too small to be of any importance and the swell, estimated at less than one foot in height, was not of sufficient magnitude to produce severe landing loads. Moreover, all three of the flight officers testified that the aircraft, engines and controls functioned normally during the remainder of the flight to San Juan, including the landing and take-off at San Pedro de Macoris.

The fact that the aircraft's radiotelephone was inoperative is not material for at most it is used only as an additional radio facility to the flight while operating in close proximity to a station. The conventional (telegraphic) radio set was still available to Captain Lorber had he desired to obtain landing instructions prior to landing. Since Captain Lorber had knowledge of the wind conditions at the time of his approach to San Juan and could see the landing lights laid out in the harbor, his failure to obtain landing instructions did not contribute to the accident.

The Board having concluded that Pan American's facilities at San Juan are adequate for night water landing, it is now faced with the question as to whether the crew on the landing launch at San Juan performed their assigned duties in a satisfactory manner. The evidence indicates that they did.

Mr. Jahncke, the Relief Airport Manager in charge of the landing launch, had personally supervised the placing of the landing lights in the harbor. In fact, all members of the crew of the launch were well qualified and performed their assigned duties in a satisfactory manner. The lights were laid out properly with regard to the wind direction, and all were lighted. The area adjacent to these lights, which was entirely suitable for the landing, had previously been scrutinized by the crew of the landing launch and found to be clear of obstructions. According to company procedure, the launch stood by after placing the lights approximately abeam of the green light and about 300 feet north of it. The engine in the launch was kept running. When it was determined that the airplane was approaching for a downwind landing, the search-light was turned in the opposite direction so that its beam would not impair the pilot's vision. The white flare was fired from the launch in accordance with regular procedure. Although darkness had not become complete, the crew of the launch should have followed the regular procedure and fired a green flare, signifying "all clear". However, the failure did not contribute to the accident since the pilot was not in any way mislead.

Immediately following the crash the launch proceeded at maximum speed to the scene of the accident and participated in rescuing the passengers and crew. The rescue work was performed commendably. Particularly noteworthy was the work of one Harold Roebuck, a native Puerto Rican, who repeatedly dived and swam through the partially submerged cabin freeing passengers and removing them from the wreckage. This action was attended by considerable hazard and physical discomfort as the surface of the water was covered with gasoline from the wreckage.

Next, we must determine whether the conduct of the flight by Captain Lorber is in any way subject to criticism. There appears to be no question as to the manner in which he

operated the trip prior to arriving in the vicinity of San Juan. He began his final approach without receiving landing instructions which appears to be contrary to Pan American's established procedure. While, as previously indicated, this failure clearly appears to have had no bearing upon the subsequent accident, it constitutes an act of carelessness which cannot be condoned. The failure of the pilot's radiotelephone provides no excuse for this lapse since by delaying the landing for a few minutes, instructions could have been secured by the ship's radio operator.

Captain Lorber landed downwind and in a direction opposite to that indicated by the landing lights laid out by Pan American's ground crew. There appears to be no justification for this violation of standard procedure. While landing a flying boat in the most convenient direction irrespective of the direction of very light winds has generally been considered as a safe practice, Captain Lorber's action in this instance is subject to criticism because of the careful preparations which had been made by the ground crew for his landing. The landing launch is carefully located with respect to the landing area lights in order that it can assist in marking the landing area by the beam of its search-light and in order that it can be as close as possible to the point at which the airplane first makes contact with the water. By landing in the wrong direction Captain Lorber made it impossible for the landing launch to perform these vitally important functions with maximum speed and efficiency. At the time of the accident the wind was variable, although generally from a westerly direction, and of approximately 3 m.p.h. velocity.

Various passengers and both stewards, who were seated in different cabin compartments, testified that they were thrown violently against their safety belts. This appeared to them to have occurred almost simultaneously with the landing. The conclusion to be drawn is that this severe deceleration started at the time of, or very shortly after, initial contact with the water. Such a deceleration occurring nearly simultaneously with first contact would have resulted from an extremely nose-low landing. A preponderance of testimony indicates that passengers were thrown violently sideways about the same time that they were thrown forward. This is an extremely strong indication that the right swerve experienced by the aircraft also had its origin simultaneously with or immediately following first contact with the water. This, in turn, could be caused by, and leads to the conclusion that, the aircraft was making some leeway, i.e., side motion relative to the water, when it first contacted the water. Although lay testimony is not often of primary importance particularly in cases involving so precise a maneuver as the night landing of a large flying boat, it appears that a quite accurate reconstruction of the accident can be accomplished from the testimony referred to above. These cabin occupants were unable to see either directly ahead or directly downward and were therefore unable to testify accurately regarding the attitude of the aircraft prior to the time of first contact. However, their testimony as to events subsequent to the time of first contact, taking due cognizance of the short interval elapsed, clearly establishes the nature of the landing. The conclusion that must inevitably be drawn is that contact, severe longitudinal deceleration, and violent turning occurred almost simultaneously. Such a set of conditions would result if first contact with the water was made while the aircraft was nose-down and moving laterally relative to the surface of the water.

This conclusion is supported by an analysis of the forces present during the landing of a marine aircraft. We find that when the ship first contacts the water the point of initial contact is in the neighborhood of, or slightly ahead of, the step. The step itself is located a short distance astern of the center of gravity. In other words, the point of first contact, from which the initial retarding force acts, is in the neighborhood of the vertical projection of the center of gravity. This means that there is little, or at most, a negli-

gible tendency for the airplane to rotate or "yaw" about the point at which the retarding force acts. Directional stability on the water is neutral. If the flying boat is landed in a tail-low attitude the point at which the water retarding forces act is definitely to the rear of the center of gravity. This tends to provide positive directional stability. If, on the other hand, the flying boat is landed in a nose-down attitude, the decelerating force acts forward of the center of gravity tending toward directional instability unless controlling forces are promptly applied. Serious consequences may result if the airplane happens to be turning or if it has any leeway or side motion relative to the water.

We are forced to the conclusion, therefore, first, that the subject aircraft was landed in an unduly nose-low attitude; and second, that at the time of first contact while in that attitude, it was moving sideways relative to the water. It appears from the record that there were no extraneous turning forces which might have been caused by non-uniform application of power or by faulty rudder tab setting.

Having arrived at this conclusion as to the manner in which the airplane struck the water, we must determine whether this resulted from faulty operation of the airplane by the pilot.

Captain Lorber testified that he was handling the throttles during the approach and landing at San Juan. This duty is sometimes performed by the flight mechanic who handles the engine's controls under the captain's direction while some captains handle the throttles themselves. This is a matter of personal preference varying with different captains. The fact that Captain Lorber handled the throttles himself appears to have no significance in this accident.

Captain Lorber, First Officer Breaux, and Flight Mechanic Donnelley testified that the approach up to and including contact with the water was not abnormal as far as they could observe.

Captain Lorber testified that he retarded all four throttles immediately upon the aircraft's first contacting the water and that he did not subsequently apply any power except that which he applied to the two right-hand engines in an effort to arrest the swerve. The Chief Pilot of the Eastern Division of Pan American, Captain Fatt, testified that the correct manner of handling the throttles during the landing of the subject type of aircraft consists in making the final approach with about 16 or 18 inches of manifold pressure with the engines turning at about 2250 r.p.m. and continuing this condition for a period varying between 10 and 20 seconds after the aircraft first contacts the water. The purpose, according to Captain Fatt, in allowing the power so to continue was to have enough control of the airplane to prevent the nose from being forced further into the water. He states that the aircraft has this tendency and that a sudden cessation of power augments it. Another reason that has been advanced in favor of maintaining the amount of power existing at the time of first contact is to make sure that the aircraft has made permanent contact with the water, rather than having touched the top of a swell, before the power is reduced.

According to other experts, the proper landing procedure consists of making the approach with from 12 to 14 inches of manifold pressure and about 2200 r.p.m. and then in completely throttling the engine at the time of contact. The landing maneuver is not subject to regularly established procedures in regard to throttle manipulation as that is affected by many variables, such as slight changes in attitude of the aircraft and condition of the water surface, as well as the loading and weight disposition of the aircraft, and, of course, the primary consideration, that of wind.

Pan American's established procedure includes no specific directions as to throttle manipulation during landings of aircraft of this type. By long-established custom the manner in which captains handle throttle controls during landings is left to their own individual judgment. It is not believed that Captain Lorber's action in reducing the power to an idling condition at the time of contact can justifiably be criticized or that it contributed to the subsequent swerving of the aircraft.

However, it appears that Captain Lorber, through misjudgment, landed the airplane in an unduly nose-low attitude and while it was making some leeway. The surface of the water of San Juan Harbor was slightly disturbed in some areas and glassy in others. The existence of a glassy surface is frequently conducive to misjudgment of height above the water as well as, to a lesser extent, misjudgment regarding the attitude of the aircraft. Another factor tending to lessen depth perception was the presence of a bright moon nearly directly overhead. This had the effect of illuminating the smooth surface of the harbor with sufficient light to decrease the effectiveness of the aircraft's landing lights.

With such a surface condition, a small amount of side motion of the aircraft relative to the water would be difficult for the flight crew to observe. Although all known and reported winds were light, they were nevertheless of such strength and so related to the direction in which the landing was being made as to have drifted the airdraft somewhat to the left.

The procedure which Captain Lorber followed when the swerve started, in first applying rudder in the opposite direction and then applying power on the inside of the turn, is in accord with the best technique.

Following the accident, the action of Captain Lorber, as well as that of other crew members, in assisting and directing rescue operations, was exemplary.

III.

CONCLUSION

Findings

Upon all of the evidence available to the Board at this time, we find that the facts relating to the accident involving aircraft of United States registry NC 15376, which occurred at San Juan Harbor, Puerto Rico, on October 3, 1941, are as follows:

1. The accident, which occurred at approximately 5:48 p.m. (EST) on October 3, 1941, to Pan American's Trip 203 of that date, resulted in major damage to aircraft NC 15376, fatal injuries to two passengers, serious injuries to two members of the crew, and minor injuries to seven passengers and four members of the crew.

2. At the time of the accident Pan American Airways, Inc., held a currently effective certificate of convenience and necessity and an air carrier operating certificate for the route involved.

3. Captain Lorber and First Officer Breaux were physically qualified and held proper certificates of competency to operate as air carrier pilots over the route involved.

4. Aircraft NC 15376 was certificated as airworthy at the time of the accident.

5. Trip 203 was cleared in accordance with proper procedure from Miami, Florida, to San Juan, Puerto Rico, via Antilla, Cuba; Port au Prince, Haiti; and San Pedro de Macoris, Dominican Republic.

6. At the time of departure from Miami, Florida, and at the time of the accident, the gross weight of the airplane did not exceed the permissible gross weight and the usable load was properly distributed with reference to the location of the center of gravity.

7. At the time of departure from San Pedro de Macoris, Dominican Republic, the aircraft carried more than three times as much fuel as would normally be required, at cruising flight, to proceed to its next scheduled stop, San Juan. San Pedro de Macoris was the alternate port. 7/

8. Until the time of the attempted landing at San Juan Harbor, Trip 203 had proceeded normally throughout its entire route except for becoming increasingly behind schedule.

9. Weather reports for San Juan had consistently indicated variable light winds and good ceiling and visibility. This condition prevailed during the flight and at the time of the landing.

10. After arriving near San Juan, Captain Lorber began a contact approach.

11. The aircraft did not receive landing conditions transmitted over the radiotelephone because the aircraft's voice apparatus was not functioning.

12. The ground station's attempt to transmit, via CW, landing conditions to the incoming aircraft was so belated that the message was not received.

13. Captain Lorber was flying the aircraft at the time of the accident.

14. Aircraft NC 15376, its engines, and all of its equipment, with the exception of the radiotelephone, were functioning normally until contact with the water.

15. Following the approach NC 15376 contacted the water in an unduly nose-low attitude while moving sideways relative to the water.

16. Almost immediately after first contact with the water the aircraft swerved violently to the right and broke into several major sections.

PROBABLE CAUSE

On the basis of the foregoing findings and the entire record available to us at this time, we find that the probable cause of the accident involving aircraft NC 15376 (Pan American's Trip 203) on October 3, 1941, was the failure of the captain to exercise requisite caution and skill in landing. The smooth surface of the water which rendered difficult the captain's depth perception, as well as the exact determination of any lateral movement of the aircraft, constituted a substantial contributing factor.

7/ The subject flight was, during its latter stage, actually without an alternate as San Pedro de Macoris is not equipped for night landings.

BY THE CIVIL AERONAUTICS BOARD:

/s/ George P. Baker
George P. Baker

/s/ Harllee Branch
Harllee Branch

/s/ Edward Warner
Edward Warner

Pogue, Chairman, and Ryan, Member, did not participate in the adoption of this report.