FOR IMMEDIATE RELEASE
January 9, 1940

A I R S A F E T Y B O A R D
Civil Aeronautics Authority
Washington, D. C.

The crash of a Pan American Airways' twin-engined flying boat at Rio de Janeiro on August 13, 1939, with fatal injuries to all but two of the sixteen persons aboard was attributed by the Air Safety Board to "loss of power from the left engine during the landing approach, necessitating an attempted landing under extremely hazardous conditions" in a report transmitted to the Civil Aeronautics Authority and made public today.

The accident occurred after a scheduled air line flight from Miami through the West Indies and down the east coast of South America, the last leg of which was from Victoria, Brazil, to Rio. The report said that the aircraft had circled over Rio and was making a normal approach to the seaplane landing area adjoining the air line's Rio base, in accordance with the company's established operating procedure, when it suddenly lost power from the left engine, yawed to the left, and started a descending turn in the same direction.

The airplane continued to lose altitude and to turn at a sharper and steeper angle until it struck a caisson anchored at right angles to a small island in the harbor immediately adjacent to its landing approach path. All four members of the crew and ten passengers were fatally injured in the accident, one passenger escaping with serious and another with minor injuries.

Ample evidence was obtained during the Air Safety Board's investigation of the accident that the left engine suffered a sudden loss of power at a critical time during the landing approach, although, since available evidence failed to supply any conclusive explanation for this loss of power, and a detailed examination of the engine, after disassembly, revealed no indication of structural failure or mechanical defects in flight, the report stated that "the cause of the loss of power from the left engine is unknown." Sailors from the Brazilian battleship, Minas Geraes, anchored nearby, who immediately swam or rowed to the scene of the accident and participated in firefighting and rescue activities were praised by the report for having demonstrated "a high degree of courage."

A copy of the full report is attached.

File No. 1353-39

AIR SAFETY BOARD

REPORT

TO THE CIVIL AERONAUTICS AUTHORITY

OF AN INVESTIGATION OF AN ACCIDENT INVOLVING AIRCRAFT

Accident involving aircraft NC 16933 of Pan American Airways, Inc., near Rio de Janeiro, Brazil, August 13, 1939.

An accident involving aircraft of United States registry NC 16933, while operating on scheduled trip of Pan American Airways, Inc., having occurred in the vicinity of Rio de Janeiro, Brazil, on the 13th day of August, 1939, with the resultant destruction of the aircraft and fatal injuries to all but two of the sixteen persons aboard, the Air Safety Board of the Civil Aeronautics Authority directed that full and complete investigation of the accident, pursuant to the provisions of Section 702(a)(2) of the Civil Aeronautics Act of 1938 (52 Stat. 973, 1013), be immediately begun, and that the facts, conditions and circumstances relating to the accident and the probable cause thereof be determined. It was further ordered that the investigation include such field investigation and research and such public or private hearing or hearings as might be considered necessary.

For the purpose of carrying out the above order, the Air Safety Board designated G. C. Miller, Chief of the Technical Section of the Air Safety Board, as investigator in charge, and Fred M. Glass, Chief, Examiners Section of the Air Safety Board, as legal adviser to the investigator in charge during the field investigation in Rio de Janeiro, and as Examiner empowered to order and conduct such public or private hearing or hearings in connection with the investigation as the Board might direct.

Investigation of the accident was begun in Rio de Janeiro on the 24th day of August, 1939, and the public hearing in connection therewith was ordered and held in the city of Miami, State of Florida, on the 3rd and 4th days of October, 1939, and reopened in the city of Washington, District of Columbia, on the 6th of December, 1939. Mr. Glass and Mr. Miller were assisted and advised during the public hearing, which was conducted under the personal supervision of Thomas O. Hardin, Chairman, Air Safety Board, by Frank E. Caldwell, Chief, Investigation Division, Air Safety Board.

Having considered the evidence adduced in the investigation and the report of same made to the Air Safety Board, the following facts, conditions and circumstances relating to the accident and conclusion as to the probable cause thereof are hereby reported to the Civil Aeronautics Authority pursuant to the provisions of Section 702(a)(2) of the Civil Aeronautics Act of 1938:

FACTS, CONDITIONS, AND CIRCUMSTANCES

Pan American Airways, Inc., a corporation organized and existing by virtue of the laws of the State of New York, having filed application for Certificate of Convenience and Necessity, pursuant to the provisions of Section 401 of the Civil Aeronautics Act of 1938, over certain routes including a route from Miami, Florida, to Buenos Aires, Argentina, operates as an air carrier engaged in

foreign air commerce between such termini via certain named intermediate points, carrying passengers, property and mail.

A regular scheduled trip of Pan American Airways, Inc., departed Miami, Florida, on Wednesday, August 9, 1939, enroute to Rio de Janeiro with scheduled stops at Antilla, Cuba; Port au Prince, Haiti; San Pedro de Macoris, Dominican Republic; San Juan, Puerto Rico; Port of Spain, Trinidad, Georgetown, British Guiana; Paramaribo, Dutch Guiana (Surinam); Cayenne, French Guiana; and the following points in Brazil: Belem, Sao Luiz, Luiz Correa, Camocim, Fortaleza, Areia Branca; Natal, Joao Pessoa, Recife, Maceio, Aracaju, Salvador, Caravellas, and Victoria. In command of the trip was Captain Addison G. Persons with a flight crew consisting of Captain George B. King, Co-pilot in charge; Russell Jenkins, radio operator; and Julio Trujillo, steward.

Captain Persons had been in the employ of Pan American Airways, Inc., since June 21, 1929, during which time he had accumulated a total of approximately 10,800 hours of flying time, approximately 560 hours of which had been in Sikorsky Model S43 and S43B aircraft. With the exception of a five-month period in 1930, Captain Persons had flown in the capacity of Captain during his entire experience with Pan American Airways, Inc. Captain King had been in the employ of Pan American Airways since October 2, 1933, during which time he had accumulated a total of approximately 4,275 hours of flying time, approximately 830 hours of which were in Sikorsky Model S43 and S43B aircraft. Captain King's experience had been in the capacity of Co-pilot prior to February 23, 1937, on which date he was promoted to the rank of Captain. His experience since that date included eight months' flying as Captain on regular operations of Panair do Brasil, an affiliate of Pan American Airways, Inc., from November, 1937, to July, 1938. Captain King was based in Rio de Janeiro during this entire time. Both airmen were possessed of required ratings and certificates of competency for the flight and equipment involved.

Although Captain King had flown the Miami to Rio de Janeiro route and had been approved as competent and authorized to fly various routes of the Eastern Division of Pan American Airways, Inc., such a period of time had elapsed since his last flight over part of this route that regulations of both the Civil Aeronautics Authority and Pan American Airways required a familiarization flight over the route before he could be authorized to fly between the two points in the status of Captain.1/ In accordance with regular company procedure in such

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1/ Provision No. 61.5140 (a) of the Civil Air Regulations:

"Regular route. After 6 consecutive months' absence from flight duty over a regular route, or part thereof, a first pilot shall no longer be deemed competent for the carriage of persons in air carrier service over such route or part thereof."

familiarization flights, Captain King was assigned to the flight herein involved as "Co-pilot in Charge."2/

The flight proceeded without incident to Port of Spain, Trinidad, arriving during the afternoon of Thursday, August 10, 1939. A Sikorsky Model S42 aircraft was used on the flight to Port of Spain but at this point the equipment was changed and the flight was continued the next morning by Captain Persons, Co-pilot King, Radio Operator Jenkins and Stewara Trujillo in NC 16933, a Sikorsky Model S43 (flying boat) aircraft of United States registry, manufactured by the Sikorsky Aircraft Division of United Aircraft Corporation, Bridgeport, Connecticut, under date of December 20, 1936. NC 16933 had been approved by the Civil Aeronautics Authority for air carrier operation over the route flown by Pan American Airways, Inc., between Miami and Rio de Janeiro with an approved gross weight of 19,500 pounds. It was powered with two Pratt and Whitney Model S1EG Hornet engines, Serial Nos. (left) 2824 and (right) 2825, both rated at 750 horsepower, and Hamilton Standard Constant Speed propellers, hub Models 3E 50-211 and blade Models 6105 A-18. The aircraft at the time of departure from Port of Spain had been operated a total of 3650 hours and 12 minutes, while both engines had been operated a total of 1399 hours and 52 minutes, 353 hours and 38 minutes of which had been since last overhaul.3/

NC 16933 had departed Miami, Florida, on August 3, 1939 under the command of Captain Weber on regular scheduled operation of Pan American Airways, Inc. and had arrived in Port of Spain on August 10, 1939 after having operated on various scheduled trips in the West Indies.

Four 100 gallon main tanks and two 55 gallon reserve tanks installed in NC 16933 gave the aircraft a total gasoline capacity of 510 gallons. The installation of the entire fuel system, including these 6 tanks, of NC 16933, is illustrated on a blueprint drawing of this system designated Appendix "A", attached hereto and made a part of this report. It is to be noted in connection with such installation that outlets from both main tanks supplying each engine

2/ Pan American Airways, Inc. Circular Memorandum No. 449, executed under date of August 18, 1938 by Edward P. Critchley, Operations Manager, Eastern Division, in effect on the date of this flight, provides.

> "When a pilot on an airline training flight has been designated 'Co-pilot in Charge' he is under the direct supervision of the Captain.
>
> "The 'Co-pilot in Charge' will make all landings and take-offs, set all courses, and make all corrections for courses. However, if in the opinion of the Captain there is the possibility of the slightest error being made it is to be clearly understood that the Captain is in charge of the flight and his orders are to be carried out by the 'Co-pilot in Charge' with regard to landings, take-offs, setting the course, etc."

3/ Approved overhaul period for this model engine for the Eastern Division of Pan American Airways, Inc. is 500 hours.

passed through one valve and that the pilot could switch only from main tanks to the reserve tank and could not select between main tanks to the same engine. Each main tank, as is to be further noted, had a float valve, the purpose of which was to close the outlet from the tank when the gasoline supply became exhausted and thus prevent an air lock in the fuel lines. Experience of Pan American Airways, Inc., however, with this installation had resulted in the decision to eliminate these float valves and change the selector valves so as to enable the pilot to select between the two main tanks to each engine as well as the reserve tank. Detailed drawing of such revised fuel system installation is also illustrated in Appendix "A." Although such changes had been made in several similar aircraft operated by Pan American Airways, Inc., no change had been made in the fuel system in NC 16933 as illustrated herein in Appendix "A."

The trip proceeded on Friday, August 11 to Belem, Para, where the aircraft received the regular overnight inspection check and a complete change of spark plugs. The next day the flight continued to Recife via scheduled intermediate points where another scheduled overnight stop was made and the aircraft again serviced in the company's shops at that point..

Scheduled departure was made the next morning, Sunday, August 13, 1939 and the aircraft proceeded toward Rio de Janeiro landing at Maceio, Aracaju, Bahia, Caravellas and Victoria. Computations based on company records of the flight indicate that the average fuel consumption of NC 16933 on the operation from Miami, Florida, to Port of Spain, Trinidad, was 83.9 gallons per hour; from Port of Spain to Victoria was 84.6 gallons per hour, and over the entire operation from Miami to Victoria was 84.3 gallons per hour.

The plane departed Victoria, the last scheduled stop before Rio de Janeiro, a distance of approximately 300 miles to the south, at 2:31 P.M. with a gross weight of approximately 19,000 lbs., including gasoline, mail, property and the following passengers, who gave their addresses as indicated·

Henrie May Eddy, Evanston, Illinois, U.S.A.
James Harvey Rogers, California, U.S.A.
Robert Landman, Kansas City, Missouri, U.S..
Evaristo Gomes Miranda, Recife, Brazil
Anton Ommundsen, Jr., Rio de Janeiro
Emanuel Valensa, Rio de Janeiro
Pablo Lavin, Buenos Aires, Arg.
Edgar Delly Oliveira, Andarahy, Bahia, Brazil
Alberto Oliveira Santos, Victoria, Brazil
Lucila A. Oliveira Santos, Victoria, Brazil
Osvaldo Hirth, Rio de Janeiro
Mario Souto Lyra, Bahia, Brazil

According to records of the Victoria Station and other available evidence, 120 gallons of 87 octane fuel was taken aboard at this point, making a total of approximately 275 gallons of gasoline aboard at the time of departure, distributed in the following manner· 80 gallons in each of the two inside main tanks, 50 gallons in each of the two reserve tanks, and the balance in the two outside main tanks (designated in Appendix "A" attached hereto as tanks 2, 3, E1, E2, 1, and 4, respectively).

Weather conditions enroute were favorable and the aircraft proceeded to Rio de Janeiro in scheduled time, reporting by radio at 4 20 P.M., one hour and 49 minutes after departure from Victoria, that Rio de Janeiro had been sighted. Weather conditions at Rio de Janeiro at the time were clear with unlimited visibility. Landing conditions reported to the aircraft as it approached the city were "Wind south southeast six sea choppy Kollsman 30.16."

The aircraft approached Rio de Janeiro at approximately 4.30 P.M. and flew directly over the city at an altitude of approximately 2000 feet and gradually circled to the left passing back out to sea and flying over Nictheroy, which is in an easterly direction from the landing area. The flight then proceeded for some distance in a northwesterly direction, gradually losing altitude during the maneuver until an altitude of approximately 500 feet was reached a mile or so northwest of the landing area. At this point the aircraft turned 180° and approached the landing area in a normal glide. According to company personnel, the approach of NC 16933 herein described is the normal procedure in landing international flights at Rio de Janeiro, and is followed mainly for the purpose of giving passengers an aerial view of the city and harbor before landing. Official sunset at Rio de Janeiro on the day of the flight was approximately 5:35 P.M.

The landing area to be used by NC 16933 lies between the mainland and an island, Ilha dos Cobras, which lies a short distance off the mainland to the northeast and is connected with the mainland by the bridge Alexandria. The use of this area is prompted mainly by its freedom from swells and proximity to Pan American's landing base, though as is to be noted on the drawing of the area attached hereto as Appendix "B" and made a part of this report, its use necessitates an approach over the bridge Alexandria, the top of which is 33 feet above the surface of the water, and a turn of approximately 10° to 15° shortly after passing the bridge before leveling out for the landing.

Anchored just off the quays along the northeast side of Ilha dos Cobras to the left of the flight path of NC 16933 were a diving bell and caisson, and just beyond on the northeast side of the island, was the Brazilian battleship, Minas Geraes, designated A, B, and C, respectively, on Appendix "B" attached. The diving bell, which was located some 600 feet to the left of the flight path of NC 16933, was approximately 100 feet in width, 65 feet in height and extended out from the edge of the island for a distance of 145 feet. The caisson, which was constructed of steel, iron and concrete and was the floating end of a nearby drydock of the Brazilian Navy, was anchored some 18 feet off shore at an angle of approximately 75° to the shoreline, and a distance of 60 feet to the northeast of the diving bell. The caisson measured 123 feet in length, and the top deck, which was 18 feet above the water, varied in width from approximately 12 feet at each end to approximately 20 feet in the center. The Minas Geraes, Brazilian battleship, was moored alongside the quay on the northeast side of the Ilha dos Cobras, a distance of approximately 185 feet beyond the caisson, with the bow extending out from the northwest corner of the island for approximately half the distance of the caisson. The foredeck of the Minas Geraes was only a few feet higher above the surface of the water than the top of the caisson, although the superstructure of the battleship, which was a short distance back of the northwest corner of the island at the time in question, rose to a height of approximately 170 feet above the surface of the water.

The approach of NC 16933 continued toward the bridge Alexandria in a normal manner along the line of flight designated on Appendix "B" by the line from point D to point E until a position was reached, designated on Appendix "B" as point F, a distance of some 800 feet from the bridge Alexandria at an altitude of approximately 145 feet. At this point the aircraft suddenly yawed to the left and began a gradual descending turn in this direction which became sharper as the aircraft progressed. The turn continued until the aircraft stalled just before reaching the caisson and struck the caisson below the top and just back of the northeast end. The right motor struck an iron capstan on top of the caisson, broke loose from the aircraft and rolled between two iron bitts on the end of the caisson where it wedged itself. The hull of the aircraft split open just aft of the leading edge of the wings and numerous parts of the hull, right wing and interior of the aircraft were strewn about the top of the caisson. A large part of the right wing and part of the interior of the cabin struck the water on the opposite side, while the remainder of the hull and contents, left engine and left wing dropped into the water on the southwest side of the caisson. Fire broke out immediately following impact and the top of the caisson was soon a mass of flames. Sailors on the Minas Geraes immediately swam and rowed to the caisson and with the aid of fire extinguishers and water hose finally extinguished the blaze, although a considerable part of the aircraft was destroyed by the fire before their efforts were successful. Personnel involved in the fire fighting and rescue activities demonstrated a high degree of courage.

The left engine and wing, bow of the plane, instrument board, and numerous other parts which either dropped into the water on impact or were thrown into the water from the top of the caisson during the rescue work, sank to the bottom. The hull and right wing, however, remained afloat long enough to be towed to shore.

The accident resulted in the death of everyone aboard the aircraft with the exception of two passengers, Oswaldo Harth and Mario Souto Lyra. The former sustained serious injuries although the latter was only slightly injured.

Although conflicting in the detailed descriptions of the maneuvers of the aircraft subsequent to the time the left turn above described was begun, testimony of witnesses indicated that only one engine was operating during the turn, but that this engine was apparently operating at high r.p.m. until the noise ceased just before the aircraft struck the caisson. Testimony of survivors indicated that there was no excitement aboard the aircraft prior to impact and that conditions were normal in every respect.

Divers began work the next morning in bringing to the surface all parts of the aircraft on the bottom. Such operations continued for several days and with the aid of several boats, such parts, as well as wreckage and debris from the surface of the water and top of the caisson, were removed to the Panair do Brasil hangar. Detailed inspection was then made and readings taken by company personnel of various instruments, controls, and component parts of the wrecked aircraft. The general condition of the instruments, however, and the fact that many of the instrument hands moved freely after salvage prevented any importance being attached to such readings.

The flap selector valve, though badly burned, indicated a "flap down" setting at time of impact. The tank selector valve of both the right and left engines was set on reserve tanks. The individual engine shut off valve of the right engine was in the "off" position, although definite indications were that this valve setting had been moved during impact.

The right engine fuel pump was in an inoperative condition due to damage by fire. The left engine fuel pump, however, was not touched by fire and tests were run to determine its operative condition. On the first attempt the pump would not operate, although on removal of salt water, salt crystal and a small amount of dirt found under the relief valve, it functioned normally. The right carburetor was crushed by impact and badly burned by fire. The left carburetor, however, was found on disassembly to be in good order except for corrosion. The butterfly valves of this carburetor were found to be closed, although no importance was attached to such condition as they moved freely. The fuel cross-over valve was found to be closed. The ignition system was so badly burned that no determination could be made as to its condition at time of impact.

On subjecting the engine control panel to close examination, evidence was found that fire had reached the common shaft of the control bellcranks while that part of the aircraft remained in the fire area on top of the caisson, and had frozen the segments on it. When the cockpit broke (presumably when it fell from the caisson into the water) all controls were pulled aft by the then "frozen" bellcranks. Such condition would indicate that at the time of the accident the throttles were "on"; propeller controls were in "low pitch", and mixture controls were "full rich."

The condition of the wreckage when spread out in place on the floor of the Panair do Brasil hangar definitely indicated that fire was most intense on the right side of the aircraft in the vicinity of the right reserve fuel tank. The right wing, aileron and right side of the flap were badly burned while the left wing showed no sign of fire except in the immediate proximity of the left nacelle. All parts of the flap, which was found in "full down" position, and ailerons were accounted for except a few feet of the flap to the right of the center line of the aircraft.

Both the right and left propellers were found in position on their respective motors. The right propeller and right motor remained on top of the caisson and were damaged only by fire and impact while the left engine and latter propeller remained under water for 24 hours. Inspection of the blades of this/ propeller indicated that it had suffered very little damage. The only appreciable damage, a 90° bend in No. 1 blade, was done when the motor and propeller were lowered on shore by the crane during salvage operations. It was found necessary to hammer the counter-weight bracket towards high pitch in order to dismantle the propeller. No. 1 blade was found to have been forced in a position about 40° lower than normal low pitch and several indexing teeth, bushing screws, and dowel pins were found to be sheared. No. 2 blade was slightly bent and was 40° past normal high pitch. Bushing screws, dowel pins, and indexing teeth of this blade were also found to be sheared. No. 3 blade was slightly bent and was found to be in normal low pitch. Bushing screws, dowel pins, and indexing teeth were normal. The cylinder was found in normal low pitch and apparently suffered no damage on impact. The condition of No. 1 and No. 2 blades, and the fact that No. 1 blade sheared the pin towards low pitch

and No. 2 blade sheared the pins toward high pitch, would seem to indicate that the propeller, while turning slowly or not at all, met an obstruction between those two blades, which, when the weight of the motor bore down, pushed one blade toward high and the other toward low pitch. The third blade remained unchanged. The condition of the propeller was of such a nature as to indicate that the left engine was putting out very little, if any, power at time of impact.

The right propeller suffered much more damage on impact than did the left. The No. 1 blade was broken in two about 18" from the tip and was driven about 60° past high pitch. Several indexing teeth were sheared, and bushing screws and dowel pins were sheared off. No. 2 blade was bent and a piece about 4" wide and 10" long was torn out about 15" from the tip. The blade was past high pitch about 60° and bushing screws, dowel pins, and several indexing teeth were sheared. No. 3 blade was turned a full 180° from normal high pitch; blade bushing screws and pins were sheared; and indexing teeth were sheared all around. The counter-weight brackets of No. 2 and No. 3 blades were broken off and No. 1 and No. 2 blades were dented in such a manner as to indicate that the leading edge struck first, while No. 3 blade had deep dents on the trailing edge. The head of the cylinder was forced off by the impact, which also forced the cylinder into high pitch. The general condition of this propeller, particularly the deep dents and cuts on two blades, would seem to indicate that the right engine was turning at high r.p.m. at time of impact with the caisson.

Both the left and right motors were then torn down, and on detailed examination and inspection were found to be in the following conditions:

Right Engine. All cylinders showed signs of intense external heat. On two cylinders the exhaust and on one the intake rocker arm housing was completely knocked off. The power section appeared to be in order except for signs of intense heat on the outside. The sump was broken in such manner as to indicate damage by impact. The nose section was cracked and the nose section fixed gear bolts were sheared. All push rods were bent and housings were badly burned and crushed. All spark plug insulators were burned away. Two teeth of the impeller reduction gear were broken off and subsequently found in the housing. All breaks were clean cut and of such a nature as to indicate that they were due to sudden stopping of the engine while operating at a high degree of power output. The intake manifolds and carburetor were badly burned and crushed. The rear plug insulators were burned away and all accessories were badly burned.

Left Engine. No evidence of extensive fire was found in this motor except some scorching of front ignition harness, burning of front plug insulators and drops of molten aluminum on heads and intake manifolds of No. 2, 3 and 4 cylinders, where the cowling was burned away. All cowling fittings on the rocker boxes were knocked off and No. 5 cylinder intake and exhaust rocker housing was broken. Some push rods were bent but indications were that this was done in salvage. The nose section, rear section, accessory section, reduction gearing and power section appeared to be in good condition. The crankshaft turned freely. All accessories were in order but quite corroded from salt water. The sump was broken but the evidence indicated that this was also done in salvage. The impeller showed very slight scratches. The engine mount was bent and broken, and two lower members were broken in tension while two

upper left side (outside) members were bent in compression. All indications were to the effect that at least the bend of the upper members was due to a blow on No. 5 cylinder directed upwards and towards the left of the motor. The oil radiator appeared intact except for salt water corrosion.

The condition of the engines, especially when consideration is given to the condition of the respective propellers, indicates that the left engine was putting out little, if any, power at the time of impact, while the right engine was still operating at high r.p.m.

Based on the 84.3 gallon per hour fuel consumption of NC 16933's engines from Miami to Victoria, it was estimated that the aircraft would have consumed 175 gallons of gasoline during the two hours and four minutes that elapsed between its take-off from Victoria and its crash at Rio de Janeiro. Since company records showed that approximately that amount of fuel was contained in the aircraft's main tanks when it took off from Victoria, the possibility was considered that these tanks may have run dry at a critical time during the landing approach, thus starting the series of events which resulted in the accident. However, as both tank selector valves were found turned on the reserve tanks, no conclusive evidence is available, particularly in view of standard company approach procedure4/ to indicate or substantiate that the striking parallel between the computed consumption of the flight and the estimated amount of fuel in the main tanks had any bearing whatever on the outcome of the trip. The plausibility of accounting for the accident on this theory suffers still further because of the known variation in the aircraft's fuel consumption on various legs of the flight from Miami to Victoria.

Several other possible causes for the failure of the left engine, such as carburetor ice, etc., have been given exhaustive consideration. However, since there is no conclusive evidence to indicate the presence of any one or combination of such factors, the cause of the failure of the left engine of NC 16933 must remain undetermined in the absence of more informative and conclusive evidence than is now available.

4/ Pan American Airways, Inc. Circular Memorandum No. 330 issued August 18, 1937 by Edward P. Critchley, Operations Manager, and in effect on the date of this flight, provides:

"Operating Procedure - S-43 Amphibians
"On the S-43 amphibians equipped with four main tanks and two reserve tanks, a minimum of 35 gallons of gasoline will be carried in each reserve tank leaving any port.

Prior to arrival at any port, and preferably at the time the instrument check is made, the gasoline tank controls will be switched to the reserve tanks so that the landing will be made taking fuel from a source not affected by fluctuations of engine consumption or unknown errors of measurement, either mechanical or human, at the same time permitting a switch back to the main tanks if there is any mal-functioning of the reserve tanks."

7. The aircraft circled the city of Rio de Janeiro and began the approach for landing in an area between the mainland and Ilha dos Cobras in a manner consistent with the general operating procedure of the company at this point.

8. The approach was normal until the aircraft, flying at an altitude of approximately 145 feet, reached a point approximately 800 feet distant from the bridge Alexandria, which connects Ilha dos Cobras and the mainland. At this point the aircraft yawed to the left and began a gradual descending turn in this direction which continued at a sharper and steeper angle until just before it struck a caisson anchored off the northwest corner of Ilha dos Cobras.

9. The aircraft crashed at approximately 4:35 P.M.

10. The accident resulted in destruction of the aircraft by impact and fire, minor injuries to passenger Mario Souto Lyra; serious injuries to passenger Oswaldo Harth, and fatal injuries to the other 14 occupants.

11. Personnel involved in the fire fighting and rescue activities demonstrated a high degree of courage.

12. Available evidence indicates that the initial yaw to the left was caused by loss of power from the left engine and that the aircraft was maintained in a controlled gliding turn following the initial yaw to the left. The cause of the loss of power from the left engine is unknown.

13. Testimony of witnesses and the condition of the propellers and engines of the aircraft after the accident indicated that the right engine was operating at high r.p.m. and that the left engine was turning at very low r.p.m. from the time the aircraft began the turn to the left until it crashed into the caisson.

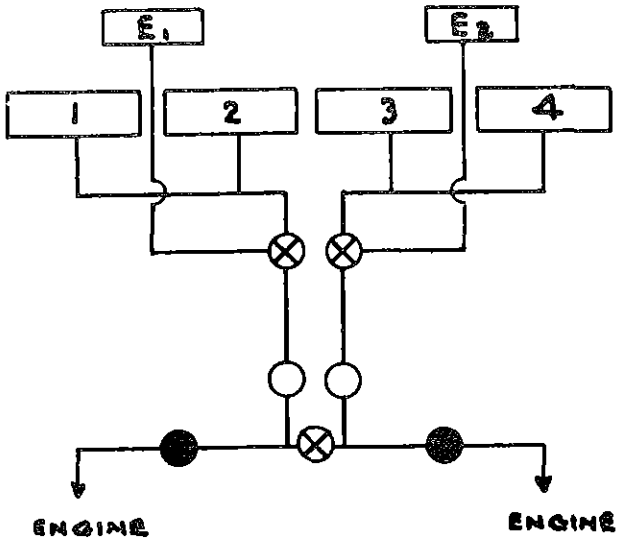
14. Experience of Pan American Airways, Inc., with Sikorsky S43-B aircraft of the type as NC 16933 indicates that such aircraft will lose altitude rapidly and yaw toward the inoperative engine in the event single engine flight is attempted with the flap down.

15. Evidence adduced during the investigation indicates that the aircraft's turn to the left in continuation of the initial yaw was the result of the pilot's decision to attempt a landing in the water to the left of the original flight path, which attempt proved to be beyond the operating capacities of NC 16933 under flight and other conditions existent at the time. Further indications are that other available choices were likewise beyond the operating capacities of NC 16933.

PROBABLE CAUSE

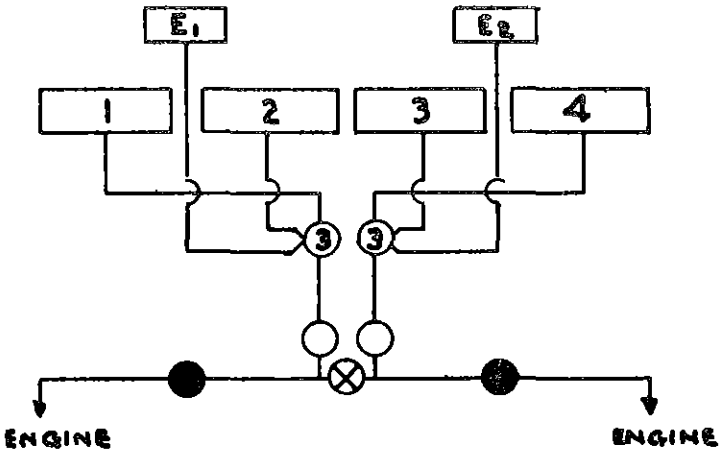
Loss of power from the left engine during the landing approach necessitating an attempted landing under extremely hazardous conditions.

FUEL SYSTEM OF NC-16933



- • CHECK VALVE
- ⊗ 2-WAY VALVE
- ● SHUT OFF VALVE
- ○ WOBBLE PUMP

REVISED FUEL SYSTEM FOR PAN AMERICAN AIRWAYS, Inc., S-43 AIRCRAFT



- ③ 3-WAY VALVE
- ○ WOBBLE PUMP
- ● SHUT OFF VALVE
- ⊗ 2-WAY VALVE

APPENDIX "A"

4-50968