File No. 408-43

REPORT OF THE CIVIL AERONAUTICS BOARD

On the Investigation of an Accident in Scheduled Air Carrier Operation which Occurred in the Province of Arequipa, Peru, on January 22, 1943

On January 22, 1943, at approximately 3:15 p.m. EST[1/], an accident occurred north by east from Chaparra, Province of Arequipa, Peru (latitude 15°29'S, longitude 73°49'W), in the Andes Mountains, at an elevation of about 13,000 feet above sea level. The four members of the crew and ten passengers were fatally injured, while one passenger escaped with serious injury. The aircraft, a Douglas DC3A, NC 33645, was demolished. It was being operated by Pan American-Grace Airways as Trip No. 9 in scheduled air carrier service between Santiago, Chile, and Lima, Peru, with a scheduled stop at Arequipa, Peru.

CONDUCT OF INVESTIGATION

The Washington Office of the Civil Aeronautics Board (hereinafter referred to as the Board) received notification and immediately 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. William K. Andrews, Chief, Investigation Section, Safety Bureau of the Board, proceeded to the scene of the accident, arriving there at about 6:00 a.m. on February 3, 1943.

There was no formal hearing conducted but upon the basis of all of 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.

1/ All times referred to herein are EST which corresponds to Peruvian Time.

SUMMARY AND ANALYSIS OF EVIDENCE

Air Carrier

Pan American-Grace Airways, Inc. (hereinafter referred to as Panagra), a Delaware corporation, was operating the subject flight, Trip No. 9 of January 22, 1943, as an air carrier under a certificate of public convenience and necessity and an air carrier operating certificate. These certificates authorized Panagra to engage in air transportation with respect to persons, property and mail, between Balboa, Canal Zone, and various points within South America, including Santiago, Chile, Arequipa and Lima, Peru.

The Aircraft

The aircraft involved, a Douglas DC3A, NC 33645, certificated to carry 21 passengers and a crew of 4, had been flown approximately 3179 hours and 26 minutes. It was manufactured by the Douglas Aircraft Company, Inc. of Santa Monica, California, and was purchased by Panagra on April 14, 1941. The aircraft was powered by two Pratt and Whitney S1C3-G engines, each of which had been operated 19 hours and 42 minutes since the last 100-hour check. The aircraft was equipped with Hamilton Standard hydromatic propellers. The authorized maximum take-off weight of the aircraft was 25,200 pounds but the weight at the time of take-off on the subject flight was 24,001 pounds. A check of Panagra's records indicated that the aircraft radio installation was made in accordance with Section 7A of Panagra's air carrier operating certificate. Panagra's radio records indicated that the overhaul and routine check had been made in accordance with the present schedule, which is based upon overhauling of aircraft radio units at four-month intervals.

Flight Personnel

The flight crew of Trip No. 9 was made up of Captain Gordon W. Gardner, First Officer Robert W. Turbyne, Flight Radio Operator James J. Ewing, and

Purser Jorge Alvarez.

Captain Gardner, age 25, a citizen of the United States residing in Lima, Peru, had accumulated approximately 1437 hours of flying time, 1151 of which were on Douglas equipment. He was properly certificated, holding an airline transport pilot certificate with multi-engine, land, 730-2190 h.p. rating. His last physical examination, required by the Civil Air Regulations, was taken on December 9, 1942, and showed him to be in satisfactory physical condition. He entered the employ of Panagra on March 1, 1941. In November 1942, he received his airline transport pilot certificate and on December 19, 1942, was assigned as captain over the Lima-Santiago-Buenos Aires route. Previous to the accident he had completed 45 trips over the Lima-Arequipa route, including time as pilot on cargo flights. All of Gardner's flight time as captain on Panagra's Douglas equipment was accomplished in a normal manner and without any known pilot irregularities. A check of his activities prior to his departure from Santiago on the subject flight revealed that he had retired at approximately 9:30 p.m. the night before, and that his physical condition and mental attitude on the day of the flight appeared to be excellent. A survey of his training and experience indicated that he was properly qualified to conduct the subject flight as captain.

First Officer Turbyne, age 27, a citizen of the United States residing in Lima, Peru, had accumulated approximately 722 hours of flying time, 280 of which were on Douglas equipment. He held a commercial pilot certificate with a single-engine, land, 210-630 h.p. rating and an instrument rating "valid only for piloting air carrier aircraft as a second pilot." His last physical examination, required by Civil Air Regulations, was taken on July 1, 1942 and showed him to be in proper physical condition. He entered the employ of Panagra on July 11, 1941, and made his first scheduled trip as a first officer on February 1, 1942. While taking his advanced training to obtain unrestricted

instrument and Douglas weight ratings, Turbyne continued serving as first officer for Panagra until the date of the subject accident. A survey of his training and experience shows that he was qualified to serve on the subject flight as first officer.

Flight Radio Operator Ewing held a radio telegraph second class license. He was employed by Panagra on May 17, 1942. Examination of his record shows him to have been competent to serve in this capacity.

History of the Flight

Trip No. 9 was cleared and departed from Santiago, Chile at 5:30 a.m. on January 22, 1943 with Lima, Peru as its destination. The flight proceeded without incident to Antofagasta and Arica, Chile, and thence to Arequipa, Peru, reaching the latter point at 1:59 p.m. It left Arequipa at 2:09 p.m. with the proper amount of fuel, and, at 2:25 p.m., Captain Gardner reported to Arequipa 2/ that the flight was "leaving control zone 3/ altitude 12,200, climbing on instruments, course 290." This report was made by radio telephone to Arequipa and because of the short range of the radio equipment on the aircraft, the message was not expected to be received at Lima. According to company procedure, the message was forwarded for the records to Lima, via air mail, the following day. Therefore, the flight dispatcher at Lima, who was supposed to control the flight, could not have been aware of the course the flight was pursuing. The two "estimated" position reports, sent by CW from Trip No. 9, as over Rio Siguas at 2:30 p.m. and Rio Ocono at 2:54 p.m., were received and logged by Panagra ground stations at Arequipa, Pisco and Lima. Both of these position reports were estimated, indicating that they were based on dead reckoning rather than actual observation of geographical

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2/ The elevation of Arequipa is 8041 feet.

3/ Airport Traffic Control is confined to flight operations within 30 miles of the center of the airport * * * * *(From Panagra's Circular "Traffic Control Procedures")

fixes. While proceeding from Arequipa to Lima, at approximately 3:15 p.m., Trip No. 9 struck a mountain peak at an elevation of about 13,000 feet above sea level, caught fire and was completely destroyed.

Search

After the report at 2:54 p.m. Trip No. 9 was never heard from again, although the Panagra gound stations at Lima, Pisco and Arequipa made numerous and almost continuous attempts to establish radio contact. When it became evident that the flight had encountered trouble, Panagra officials were notified and plans were made for a search. Captain Nelson departed from Lima in a DC2 at 4:43 a.m. the morning of January 23. The search was joined by Captain Sterling in a DC3 later the same morning. Cloud conditions made the search difficult, if not useless. However, four Peruvian Army planes, one U. S. Army plane, and three of Panagra's planes continued the search until the morning of January 24, when a radio message was received from Captain Nelson stating that the wreckage had been located. A ground rescue group immediately departed for the scene of the accident, arriving there at about 9:00 a.m. on January 25.

Witness

Alfred John Howard, a passenger and the lone survivor on Trip 9, was an experienced pilot and had held a Class "A" British flying license, which corresponds to a U. S. private pilot certificate. He was seated on the left side in the third seat from the back of the cabin just in front of the emergency door. He stated that the flight entered the overcast about 15 minutes after leaving Arequipa and that he could not determine how long they had been in the overcast before the crash occurred, as he had been reading and dozing part of the time. In his opinion, the flight from the time of departing Arequipa appeared perfectly normal and had they broken out of the overcast or had the engines not been operating normally prior to the crash, he stated that he would have noticed it. He recalled that his safety belt

was unfastened and his only recollection of the actual crash was described as, "I felt a loud noise and the ship shuddered. We seemed to hit something solid, and my first flash impression was that we hit a very bad bump, but I realized that couldn't be because the window on the left broke and some broken glass came by me, and then I must have gone blank." He stated that later he remembered hanging on to his seat very tightly and starting to move slightly to his right because the exit was to his right and behind him. He remembered crawling away from the flames which, as far as he could recall, were coming from the lefthand side of the fuselage. Mr. Howard remained at the scene with the wreckage until help arrived three days later.

Examination of the Wreckage

The aircraft's course at the time of first contact with the mountain was estimated to have been in a somewhat westerly direction, in a laterally level but slightly climbing attitude. The major portion of the fuselage was completely burned, while portions of each wing lay badly broken in an inverted position among the rocks of the mountain. From the appearance of the rocks and the broken portions of the aircraft's right wing tip, it appears that the right wing contacted the mountain first, followed by the violent contact of the propellers and engines, with the complete mass of the aircraft cartwheeling up the mountain and coming to rest in an inverted position at a point approximately 450 feet beyond the point of first impact.

The engine gear assemblies were torn from from each engine due to impact with the mountain. The gear units, however, remained intact as units and upon inspection were found to be free to rotate as assemblies, indicating no operational failure at this source.

The propellers were still secured to the engine propeller shafts, with the leading edge of each blade badly scarred and scuffed, and examination indicated that normal cruising power was being applied when the plane first struck the mountain. Because no special tools were available at the scene of

the accident, removal of the domes, which had been damaged by impact, was impossible, and a reading of the blade pitch settings, etc., could not be made. However, it was ascertained that the small lock screws in the blade shank bushing of the left propeller had sheared due to the ground impact, which allowed the blades to rotate in the bushings. All three blades were rotated approximately 160° from their normal operation angle; that is, the leading edge of each blade was twisted to form the trailing edge in regard to blade or engine rotation.

At the time of impact, both engines were torn free of the structure at that point where the diagonal members form their attachment to the engine mount. They rolled approximately 3000 feet down the mountain in an almost straight line, shedding their accessories, etc., with each contact with the ground before eventually stopping at the bottom of the incline.

The main oil sump of the right engine was quite badly damaged but was found to be free of any foreign particles. The main oil pressure screen contained a small portion of carbon and lint, but this is not unusual in a recently overhauled engine.

A thorough check of the remaining parts of the engines, aircraft, and accessories revealed no evidence of malfunctioning but indicated that the flight was proceeding in a normal manner.

Radio Equipment

Inspection of the log books of NC 33645, covering a period from January 1 to January 22, 1943, showed no malfunctioning of radio equipment that had not been corrected, and generally reflected satisfactory operation of the installation and its component parts.

On the flight in question, all scheduled contacts were made and, from the facts available, it appears that all communications were accomplished in a normal manner and that the aircraft radio installation was functioning properly. The entire radio installation was destroyed at the time of the accident.

Weather

Weather reports obtained from Panagra, plus the study of the Southern Hemisphere maps prepared by the United States Army Weather Central on January 22, revealed that a cold front had moved into the extreme southern portion of Peru and accounted for the rain that had already occurred in the Arequipa area. It is believed that the front was near or slightly to the north of the location of the accident at the time it occurred. This would account for cloudiness, low ceilings and rain in that area. The fact that the wind shifted from south-southeast to south-southwest, subsequent to take-off of trip No. 9 from Arequipa, could account for the plane having drifted several miles to the right of its course and this condition evidently had not been included in the pilot's reckoning. Velocity of the south-southwest wind was estimated from available information to have been approximately 20 m.p.h.

Flight Dispatch

William Henry Howell, a British subject who held dispatcher certificate No. 10912-40, was the Flight Watch Control dispatcher at Lima but was not on duty at the time of the accident. In this position, he was charged with exercising control over all flights from Santiago, Chile, until arrival in Lima, Peru. His assistant, T. R. Unsworth, uncertificated as a dispatcher, was on duty the afternoon of the subject flight. Unsworth was authorized by Panagra to act as dispatcher in Howell's absence. According to Panagra, this was in keeping with the dispatch requirements, as laid down in their operations specifications, as Howell was available for consultation when Unsworth was on duty. According to the Air Carrier Branch of the CAA this practice does not agree with their interpretation and the CAA has since taken corrective action.

Panagra's Flight Procedures

This portion of the line, Arequipa to Lima, is practically cloudless for ten months of the year and is flown contact. Several pilots, who have flown

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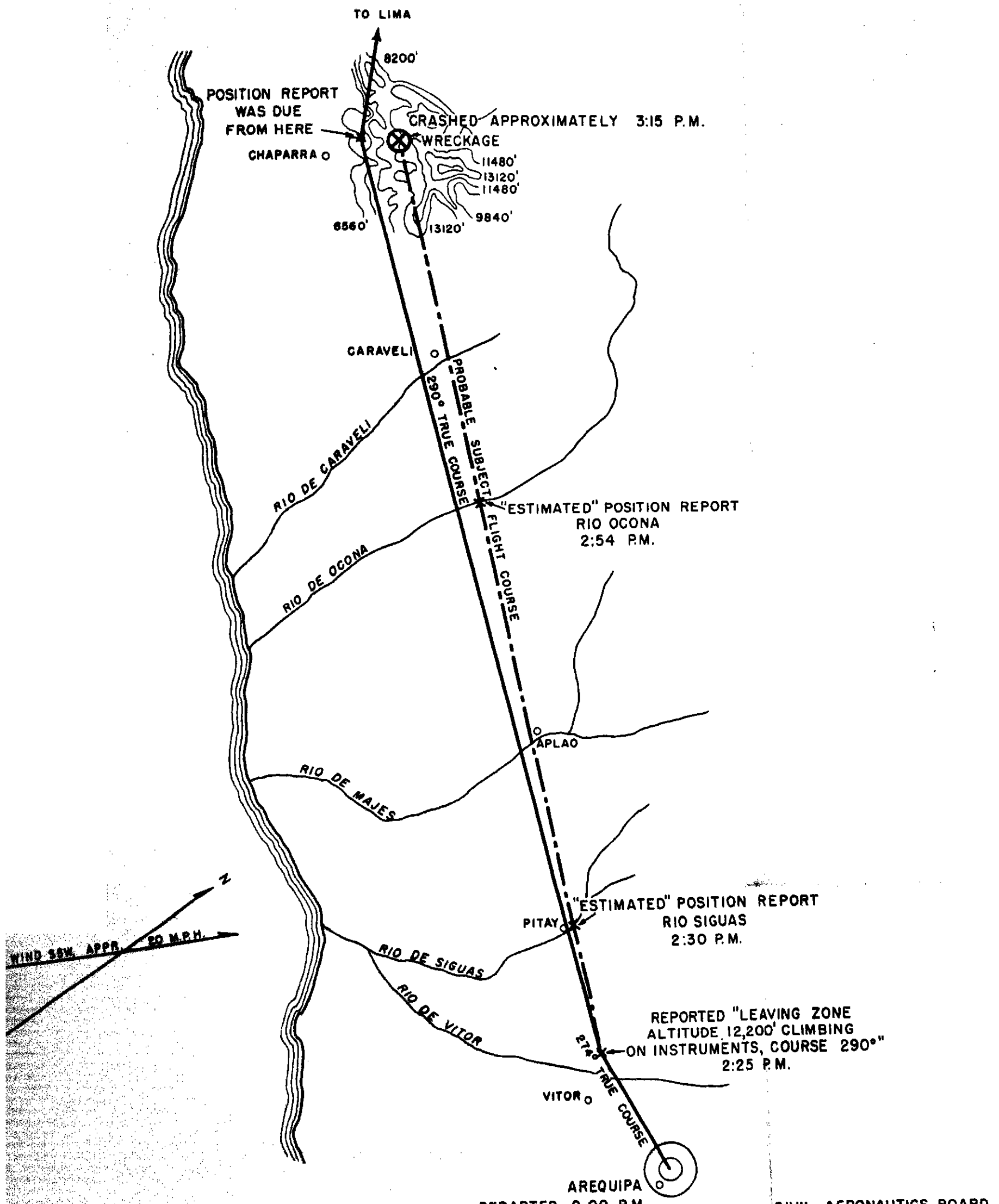

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this route the year around for ten years, stated that they had never been on instruments in this area, except for short periods to climb up or let down through a cloud layer. Panagra officials stated that no written instructions had been published for guidance of their pilots on flight procedure between Arequipa and Lima. According to Panagra's chief pilot, verbal flight instructions had been given to Captain Gardner. These instructions were, in part: That he was to plan his trips so that he would do no en route instrument flying; that, when climbing through the overcasts after take-off from Arequipa, a proper track is approximately 270° (west) toward the ocean; and, that when necessary, he could climb up or let down through a cloud layer so that the trip could be continued comfortably with safety. Even while flying on top of a cloud layer on this route, geographical fixes, such as mountain peaks to the east and the Pacific Ocean to the west, are visible and therefore the flight would not be considered, in the true sense, as on instruments. There is evidence to show that Gardner was familiar with this flight procedure. According to one of Panagra's copilots, he accompanied Captain Gardner on a trip from Arequipa to Lima when somewhat similar weather conditions prevailed, and Gardner proceeded on a 290° course over the overcast; while proceeding on this heading, the overcast build up in front of him and he changed his course to 270° west, proceeded to the ocean, and then resumed a 285° heading to Lima.

Clearance for a flight from Arequipa to Lima is apparently automatic if the weather at these two stations is above minimum. Weather reports indicate that the conditions were above minimum and that clearance was justified, in accordance with the operation procedure of Panagra. Company operating procedure did not require the pilot to file a written flight plan prior to departure from any station on the line. Apparently this practice had developed because of the meteorological and airway facilities under which the line is operated. The company stated that the system of position

reporting then in use was developed in place of a predetermined flight plan and constituted the filing of a brief flight plan at each check point. Information furnished by the company indicates that Arequipa had been designated by Panagra as a control airport; that all pilots prior to departure from such a control airport should inform the local control of the route they expected to follow within the airport control area (30 mile radius). According to Panagra, Gardner did not make this report. At the time of departure from the airport control area (30 miles), the pilot was required to file a message indicating his altitude, course, and whether on instruments, estimate or contact. Gardner made this report in detail by radio telephone to Arequipa at 2:25 p.m.

It is apparent that the subject flight left Arequipa at 2:09 p.m., contact, and entered the overcast on instruments at the time of, or before, it reported leaving the airport control zone at 2:25 p.m. It was evidently still on instruments when its estimated positions were reported by CW to Lima at 2:30 p.m. and at 2:54 p.m. However, the dispatcher at Lima had no way of determining whether the pilot was proceeding on top of the overcast, as he would be permitted to do, or in the overcast, which was against company flight procedure. According to the statement of the surviving passenger, the flight probably never did break out of the overcast. The accident occurred at approximately 3:15 p.m. It is evident, therefore, that the flight had been proceeding on instruments in the overcast, contrary to Panagra's flight procedure, for about 50 minutes. Coincidental with the subject accident, investigation disclosed that a Peruvian pilot of Faucett Airlines reported that he had flown from Arequipa to Lima about an hour earlier on the same day and had encountered bad weather in the vicinity of the accident. However, he changed his course from 285° to 270° (west), proceeded to the coast line, and then resumed his heading toward Lima.

On January 9, 1943 and on one other occasion, about a year prior to this

date, the Acting Chief of the Air Carrier Branch, Fourth Region, of the Civil Aeronautics Administration, addressed communications to Panagra's Operations Manager at Lima, Peru, in reference to a "Route Manual". The CAA realized the importance of written instructions for en route operations and these communications requested that Panagra's operations personnel give some thought to the preparation of such a route manual to be furnished pilots and operating crews which would contain detailed procedures and instructions concerning the en route and terminal operations. Subsequent to the accident, Panagra stated that such a manual was being prepared.

Findings

Upon the basis of all the evidence available to the Board at this time, we find that the facts relating to the accident involving Panagra's Trip No. 9 of January 22, 1943, are as follows:

1. The accident occurred at approximately 3:15 p.m. on January 22, 1943, and resulted in fatal injuries to four members of the crew and ten passengers, and serious injuries to one passenger. The aircraft, NC 33645, was completely destroyed by impact and fire.

2. At the time of the accident, Panagra held a certificate of public convenience and necessity and an air carrier operating certificate authorizing it to conduct the flight. Both certificates were currently effective.

3. The aircraft, NC 33645, was currently certificated as airworthy at the time of the accident.

4. The flight crew were physically qualified and held proper and current certificates of competency to perform their duties on the subject flight.

5. Panagra's Trip No. 9 originated at Santiago, Chile, with Lima, Peru, as its destination. It had been cleared in accordance with

company procedure from Arequipa to Lima, Peru, and departed at 2:09 p.m.

6. There was no evidence of failure or malfunctioning of any part of the aircraft.

7. The weather was not severe enough to be considered a contributing factor to the accident, had company flight procedure been followed.

8. The operation of Trip No. 9 was normal until it encountered weather which, on the course the pilot elected to take, necessitated instrument flying; the flight was continued on instruments, contrary to company policy.

9. On account of the SSW wind (approximately 20 m.p.h.) the flight had drifted off course NNE over the higher terrain.

10. Even though the CAA had on at least two occasions expressed to Panagra the advisability of Panagra's publishing a flight route manual for guidance of its pilots and dispatchers, this had never been accomplished and instructions concerning flight procedures were given orally to new pilots.

11. Evidence indicates that Captain Gardner was familiar with company policy against "en route instrument flying" between Arequipa and Lima.

CONCLUSIONS

The evidence disclosed by investigation leaves little doubt that this accident would have been prevented had the pilot followed normal operating procedure. When departing from Arequipa, Peru, for Lima, Peru, company procedure calls for a normal heading of 290° when the flight can be made contact or above the overcast. When weather conditions exist which necessitate a continuance of flight on instruments,

company procedure calls for a normal course of 270° until the coast is reached. This latter course is over lower and less hazardous terrain and it is a phenomenon of this regeion that clear weather always prevails over the coastal area at this time of year. Although this company procedure had not been set up in writing for the guidance of its pilots, there is evidence which indicates that Captain Gardner was aware of this procedure. If he had any reason for departing from the normal procedures, there is no evidence that he reported it.

It is also evident that absence of adequate dispatch control of flights was a definite contributing factor.

PROBABLE CAUSE: Action of the pilot in continuing the flight on instruments in the overcast, contrary to company flight procedure of which, according to the evidence, the pilot was aware.

CONTRIBUTING FACTORS:

1. Absence of adequate flight dispatch control by the company.
2. Failure of the company to inaugurate and maintain written flight and operating procedures in such a form as to be constantly available for the guidance of pilots and dispatchers.

APPROVED:

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/s/ Edward Warner
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/s/ Harllee Branch
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