

No. 10

Philippine Air Lines, Inc., DC-3, PI-C144, accident at Nichols Air Base,
The Philippines on 20 October 1965. Report dated March 1966
released by the Aircraft Accident Investigation Board,
The Philippines

1. - Investigation1.1 History of the flight

Flight 741 was a scheduled domestic flight from Manila to Tacloban with stop-overs at Legaspi and Calbayog. The aircraft took off from runway 13 at Manila at 1032 hours Philippines local time with the co-pilot flying the aircraft from the right hand seat. When airborne he ordered the pilot-in-command to raise the landing gear. After having done so the pilot-in-command noticed that the aircraft was veering slightly to the left although the indications of the engine instruments were normal. The co-pilot stated that the right rudder seemed to be jammed. The pilot-in-command then took over the controls. At this time the aircraft was continuously and gradually turning and banking to the left. The pilot-in-command then ordered the co-pilot to check the engine instruments again, and their indications were found to be normal. Both engines were at METO power setting and the airspeed was 110 mph. When the aircraft reached 150 ft above the ground, at a heading of 050° and an airspeed of 85 to 90 mph, the left bank and turn were momentarily checked and the right rudder pedal was then forward. The co-pilot attempted to call the control tower, but the transmission was garbled. The aircraft then went back to its left bank attitude in spite of the effort of the pilot-in-command to control the turn. When he noticed that the airspeed had dropped to between 85 to 90 mph he pushed the control yoke to gain airspeed but there was no reaction. At this time the pilot-in-command felt that the left wing had hit something. He tried in vain to control and keep the aircraft in the air. The aircraft crashed at 1033 hours.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal		1	
Non-fatal	3	33	
None			

* Philippine local time = GMT + 8 hours

1.3 Damage to aircraft

The aircraft was substantially damaged by the impact and subsequent fire.

1.4 Other damage

Government-owned buildings were damaged during the accident.

1.5 Crew information

The pilot-in-command, aged 33, held an airline transport pilot's licence which was valid until 31 October 1965 with a rating on DC-3 type aircraft. His last route qualification check was conducted on 2 October 1965. On 17 March 1964 he was given a route qualification check and obtained unsatisfactory grades on engine run-up and pre-take-off check. However, on subsequent route qualification checks he was rated as average. He had a medical certificate valid until 30 October 1965. He had flown a total of 5 146 hours without accident.

The co-pilot, aged 29, held a commercial pilot's licence with a rating on DC-3's. His last local check ride on the DC-3 was conducted on 22 May 1965. He became a regular DC-3 co-pilot on 12 August 1965. At the time of the accident his medical certificate was valid, however, the Company's medical check had expired on 1 July 1965. He had flown a total of 2 843 hours, including 420 hours on this type of aircraft during the 90 days prior to the accident.

1.6 Aircraft information

The aircraft's certificate of airworthiness was issued on 18 December 1964 and was valid until 17 December 1965. The aircraft had flown a total of 28 139 hours.

The manifest prepared by company personnel and signed by the pilot-in-command contained an error in addition which when corrected exceeded the allowable trip payload by 83 kilograms. Computation of the actual weight based on the load manifest for the flight showed that the maximum allowable take-off gross weight of 26 900 lb at Manila was exceeded by 68 lb and that the maximum allowable landing weight of 26 000 lb at Legaspi could have been exceeded by 167.4 lb. The most possible forward and aft centre of gravity positions for the weight above, were calculated and found to be within the allowable limits.

The type of fuel being used was not stated in the report.

1.7 Meteorological information

A special weather report at 1035 hours showed that Manila weather was ceiling and visibility unlimited and the wind was 340°/4 kt.

1.8 Aids to navigation

Not mentioned in the report.

1.9 Communications

The co-pilot attempted to call the tower during the take-off, however the transmission was garbled.

1.10 Aerodrome and ground facilities

No information was contained in the report.

1.11 Flight recorders

Not mentioned in the report.

1.12 Wreckage

The aircraft followed a flight path of 330° before the final impact. It initially hit a branch of an Aguho tree then continued in a nose down attitude and hit an electric post. The aircraft struck the ground at almost a 30° angle and nosed over.

1.13 Fire

There was a post-impact fire.

1.14 Survival aspects

Rescue operations were performed on the aircraft, which was burning, by the CAA and PAF rescue teams. All the passengers and the flight crew were evacuated.

1.15 Tests and research

On 20 October 1965 a test was made on a DC-3 with the rudder trim tab indicator set to 12° "nose left". It was observed that the aircraft acted normally during the initial take-off roll until it gained enough airspeed when the right rudder pedal appeared hard and the aircraft yawed to the left. Opposite rudder pedal force and simultaneous application of adequate positive pressure on the yoke however counteracted the yaw.

2. - Analysis and Conclusions

2.1 Analysis

The various technical examinations and inspections conducted on the airframe, power plants and their components and accessories did not reveal any evidence of malfunctioning or failure prior to the accident. There was no evidence indicating that the aircraft was not airworthy at the time of the accident.

The recovered burned control pedestal revealed that both carburettor airscoop control levers were halfway between the hot and cold position and locked. The control levers were badly damaged by impact. The rudder trim tab indicator was recovered at the crash site at a setting of 8°45" "nose left" and the rudder trim tab was deflected 2 3/8 inches to the right, which was consistent with the trim tab setting.

Testimonies of both pilots showed that while taxiing from the ramp to take-off position and during the take-off roll there was free movement of the rudder pedals. When the aircraft became airborne, it started to veer slightly to the left. Pressure was applied on the right rudder pedal to correct the turn but it was unsuccessful due to an apparent restriction of the travel of the rudder pedal. Finally when the airspeed had decreased to between 85 and 90 mph, the pilot succeeded in moving the right rudder pedal forward and the left turn and bank was momentarily checked.

At zero airspeed, with the rudder trim tab indicator set to 8°45" "nose left" the travel of the rudder pedal would not be affected. As the airspeed increased the deflected rudder trim tab generated a force which was directly proportional to the square of the airspeed. This force caused a corresponding deflection of the rudder which consequently deflected the rudder pedals, as if the pilot force was applied to the left rudder pedal. This condition caused the aircraft to veer to the left during the take-off roll and to yaw and bank to the left when airborne. When the airspeed was lower or more or less equal to 85 to 90 mph, the rudder pedal force necessary to offset the asymmetric condition created by the rudder trim tab deflection corresponding to the rudder trim tab indicator setting of 8°45" was less than the maximum force a pilot can exert. However when the pilot-in-command took over the control at the time when the aircraft was at a speed of 105 to 110 mph, the rudder resistance felt might have given him the impression that the rudder had jammed, but when the airspeed went down to 85 to 90 mph, the pilot-in-command was able to move the right rudder pedal forward and check the left hand yaw and bank.

These observations are consistent with the effect of the rudder trim tab indicator set to 8°45" "nose left" at different airspeeds.

According to data furnished by Douglas Aircraft Company, Inc., "a pedal force of 29 pounds per degree of rudder trim tab deflection is required on DC-3 to counteract the trim tab at 110 mph with METO power". The rudder trim tab deflection of the aircraft was 8°45" "nose left" attitude. Therefore a force of 253 lb on the right rudder pedal was necessary to counteract the trim tab deflection whereas a normal pilot can only apply a force in the order of 160 lb for prolonged application and 200 lb for temporary application.

The possibility of an improper and undetected deflection of the control surfaces before take-off was thoroughly examined. The study of the nature and extent of damage of the rudder trim tab system revealed that the improper setting and the associated deflection of the rudder trim tab was not caused by impact. No evidence of an abnormal setting and deflection on other control surfaces, which could have contributed to the unusual behaviour of the aircraft, was found.

Although the pilots testified that they performed the normal pre-flight inspection and observed the pre-take-off checklist, the Board believed that the rudder trim tab was deflected prior to take-off. Should the required preflight inspection and pre-take-off checklist have been rigorously performed such abnormal setting of the rudder trim tab indicator and the deflection of the rudder trim tab would have been detected before take-off. During the investigation both pilots testified that during the flight they did not think of the rudder trim tab but that the pilot-in-command concentrated on the control yoke and the rudder pedal to correct the unusual attitude of the aircraft. The pilot-in-command should have checked his rudder trim tab indicator setting when he felt that the control yoke and the rudder pedal did not give the desired reaction.

The fact that the aircraft was loaded slightly beyond its allowable gross take-off weight, the testimony that the landing gear was retracted late, and the finding of the carburettor airscoop level locked between the hot and cold position which could have reduced the power of the engines, when considered separately may not have significantly affected the low altitude reached, which was estimated to be from 100 to 150 ft. However, if all of the above facts were to be considered collectively, including the bank of the aircraft which was observed to have been no more than 45° they could have caused the low altitude reached during the flight. Based on the probable flight path, the time duration of the flight from take-off up to the initial impact was approximately 60.5 seconds. The time

span from the moment the pilot took over the controls up to the time when he was able to momentarily check the left bank and correct the unusual behaviour of the aircraft, was approximately 16 seconds. It was felt that if the aircraft had gained a higher altitude the pilot would have had sufficient time to perform all necessary corrections to avoid this accident.

2.2 Conclusions

Findings

The crew were properly certificated.

The aircraft had a valid certificate of airworthiness. It was loaded slightly beyond its allowable gross take-off weight. No evidence of power plant malfunction or control system failure was found.

The rudder trim tab indicator was recovered at a setting of 8°45" "nose left".

Although the pilots testified that they performed the normal pre-flight inspection and observed the pre-take-off checklist, the Board believed that the rudder trim tab was at that improper setting prior to take-off.

The duration of the flight from take-off up to impact was approximately 60.5 seconds.

Cause or

Probable cause(s)

The Board determined that the probable cause of this accident was the failure of the pilot to set the rudder trim tab to the proper position before take-off and during the flight. The continuous left turn and bank of the aircraft which resulted in this accident was due to the undetected deflection of the rudder trim tab.

The Board further determined that the overload of 68 lb over and above the allowable take-off gross weight of 26 900 lb at Manila was a contributory factor to this accident.

3. - Recommendations

The Board submitted the following recommendations:

1. that the Philippine Air Lines be directed to improve its procedures in preparation of load manifests by requiring all personnel who are assigned in the preparation of load manifests to undergo training on weight and balance and aircraft specifications. CAA certification as to the competency of the above personnel should be required;