No. 20

Pluna Airlines, DC-3, CX-AGE accident at Carrasco Airport, Uruguay on 9 October 1962. Report released by the Directorate General of Civil Aviation, Uruguay.

1. Historical

1.1 Circumstances

The aircraft was undergoing the final flight test required for issuance of its Certificate of Airworthiness. It was to be a visual, local flight lasting about 1 hr 30 min. No passengers were aboard the aircraft. The take-off run began at 1514 hours, 200 m from the threshold of runway 23. This meant that 1 900 m of the runway remained for the take-off. The aircraft rose to a height which could not be determined but could not have been less than 5 m or more than 15 m. About 30 seconds after the commencement of the manoeuvre its right wing grazed the surface of the runway several times. During the later contacts the landing gear bounced off the ground with such force that the right tire burst and the landing gear leg broke causing the axle and propeller to hit the ground while the right engine was turning at almost full power. The aircraft again bounced into the air, rolled over completely and finally came to rest upside down. Between the time the aircraft bounced into the air and the moment it finally came to rest, the pilot turned the power off completely. This was proved by an inspection of the condition and final positions of both propellers and the engine control switches, which were in the "off" position. Fire broke out for reasons that could not be precisely ascertained.

1.2 Damage to aircraft

As a result of impact and fire it was estimated that damage to the airframe was 99%. The propellers were destroyed. Except for some isolated components of engine No. 2, the engines were completely destroyed.

1.3 Injuries to persons

All occupants of the aircraft, i.e. 10 crew, or maintenance crew, were fatally injured.

2. Facts ascertained by the Inquiry

2.1 Aircraft information

The aircraft did not have a valid Certificate of Airworthiness. It was undergoing the final flight test required for its issuance. At the time of the accident the aircraft was operating well within its licensed weight limits, and its load was correctly distributed.

It had undergone the general overhaul, reconditioning and inspection by Pluna Airlines required after 5 000 hours of airframe operation.

Based on a statement by the flight dispatcher, and related documentation, the flight was commenced under satisfactory technical conditions.

2.2 Crew information

The pilot-in-command held a category "C" airline pilot's licence which was valid until 14 March 1963. He had a total of 6 380 hours 45 minutes flying experience recorded with the Directorate of Civil Aviation of which 5 781 hours were on DC-3s.

The co-pilot held a category "B" commercial pilot's licence which was valid until 10 February 1963. He had flown 1 714 hours on DC-3s.

Others aboard were an inspector of the Directorate General of Civil Aviation, who was present for the airworthiness certification, and seven engineers of Pluna Airlines, who were observers. All possessed the licences required for the duties they were performing on the subject flight.

2.3 Weather information

The meteorological conditions were not a factor contributing to the accident.

2.4 Navigational Aids

Information not available.

2.5 Communications

Messages were exchanged with the control tower up to the time the aircraft took off. These were recorded. They indicate that the pilot-in-command accepted an immediate take-off ahead of other traffic.

2.6 Aerodrome Installations

The aircraft was using runway 23, the most suitable for the subject operation. This runway is 2 100 m long and 45 m wide.

2.7 Fire

The fire, which broke out following final impact, was probably caused by an electrical short circuit, friction heating or parts of the power plant igniting the scattered fuel.

Fire fighting was initiated with rapidity. One fire truck reached the aircraft in less than a minute. However, the capacity of the fire fighting equipment was inadequate to extinguish the great amount of fuel - 1 514 litres - which the aircraft had spread about.

Members of the Investigating Board, who arrived at the site about one hour after the accident occurred, saw several fire fighting teams still struggling to extinguish areas of fire that persisted in spite of the large quantity of extinguishing material that had been sprayed.

2.8 Wreckage

The aircraft was destroyed by impact and fire.

3. Comments, findings and recommendations

3.1 Discussion of the evidence and conclusions

Marks on the runway showed the starboard wing scraped it no less than four times, each time with increased violence. The following possible reasons for the wing's striking the runway were initially considered:

1) the position of the trimming tab of the aileron of the starboard wing

It is doubtful, however, whether the trimming tab, even at its extreme position, would affect the controllability of the aircraft to such an extent that one or both pilots could not counter its action.

2) failure of the starboard landing gear leg

This possibility was eliminated as, apart from other evidence, the aircraft was airborne at the time when contact with the ground was made.

3) failure of the port engine attachment clamps through faulty installation

This was considered, since several of the clamps were found to have been incorrectly installed. However, it would have been necessary for several of the supports to fail at the same time, which is highly improbable. For this and other reasons, rupture of the engine supports was concluded to have been the consequence of and not the cause of the accident.

The end of the starboard wing's aileron was found separate from all the other components. It was evident from marks on it that the aileron was at an angle of -10° throughout and thus exerted a considerable disaligning force, which operated all the time or at least as long as the wing was in contact with the ground.

The configuration of the aircraft was normal and in conformity with the settings of the control surfaces. Given these factors, the Inquiry looked for the reason for the incorrect operation or non-operation of the controls. It considered three possible causes in detail:

1) pilot error
2) obstruction of the aileron control
3) inverted operation of this control

No evidence was found to support 1) or 2). The pilots were experienced, and the two control columns were recovered in normal working condition.

It was possible to establish that the installation, from the control columns as far as the triangle joints was correct, however, the latter had been attached to the opposite cables leading to the bellcranks, causing the inverted functioning of the whole system. (See Figure 6)

The Pluna mechanics believed that an inverted connection was not possible without giving rise to friction and easily detectable noises. Tests were, therefore, made on another DC-3 aircraft which was undergoing maintenance. The results showed that the system appears to function quite normally whether the triangle joints are correctly attached or inverted. Thus, the only way of determining correct installation is by visual inspection after the connections have been made.

The Board then looked into the maintenance operations and checks which had been carried out on the aircraft. It felt that no single individual could be held responsible for executing the work in a negligent or careless manner since several persons had taken part in the repairing, fitting and checking of the aileron controls.

Only one error could be specifically established. That was the pilot's failure to complete a test or pre-flight procedure. The Pluna Test Flight Plan mentions specifically "Functioning and Direction of Ailerons and Trimming Tabs" among the items under "Tests on the Ground".

The following points were brought out when the Board of Inquiry was investigating this accident:

- there was a lack of qualified mechanics - the airline has no mechanics' training school;
- the work schedules, although adequate, were not accurately kept;
- there were no specific schedules for final inspection;
- the maintenance staff did not possess proper manuals in Spanish.

The Board heard opinions alleging that the flight crew showed defective judgement on two occasions:

- it was asserted that the take-off was rushed and insufficient time was given to the pre-flight control check procedures required prior to a test flight, owing to the pressure of traffic and perhaps the demands of the control tower. Based on the recorded communications between the tower and the aircraft, the Board considered the procedure to be normal.
- it was asserted that after the first contact of the wing with the runway, seven seconds after lift-off, the pilot did not reduce power and discontinue the flight. The Board considered that if this course of action had been taken the damage might have been less; but it did not have sufficient material to substantiate this. In order to pass judgement on the pilot's behaviour during the actual emergency, certain additional factors would have to be known.

After the first contact with the runway the pilot had five seconds to make a decision, and he may have failed to take the best one. It also must be remembered that the aircraft was still in flight at this time, and that the brake system was, therefore, inoperative.

Based on established facts, the Board of Inquiry believed that the only known failure by the crew was that they carelessly checked or failed to check the direction of movement of the ailerons prior to take-off.

3.2 Probable cause

The accident was attributed to a maintenance error, which was not noticed by the airline inspectors and the inspector from the Directorate General of Civil Aviation. This was followed by an omission on the part of the pilot.

3.3 Recommendations

Following this accident the Board of Inquiry and the Directorate General of Civil Aviation made the following recommendations:

1. Pluna should take steps to improve its existing system of checks so as to eliminate verbal "Seen. O.K." reports.

2. Pluna should arrange for workshop job schedules to be signed in all cases and only by persons holding a proper licence.

3. Pluna should take steps to provide maintenance staff with Spanish language manuals and make these easily accessible to them.

4. Pluna should entrust trial flights to specific crews specializing in this activity.

5. Pluna should introduce some system to eliminate the possibility of inverted connection of DC-3 aileron controls. It is suggested that bolts of different diameter be used for each aileron or that the length of the right-left cable sections be modified.

6. The airport authority should improve the access facilities of vehicles to the operational area so as to provide more effective control in emergencies.

Test flight
Take-off
Ground loop
Other personnel - inadequate maintenance inspection
and
Pilot - inadequate pre-flight inspection and/or preparation

ICAO Ref: AR/745

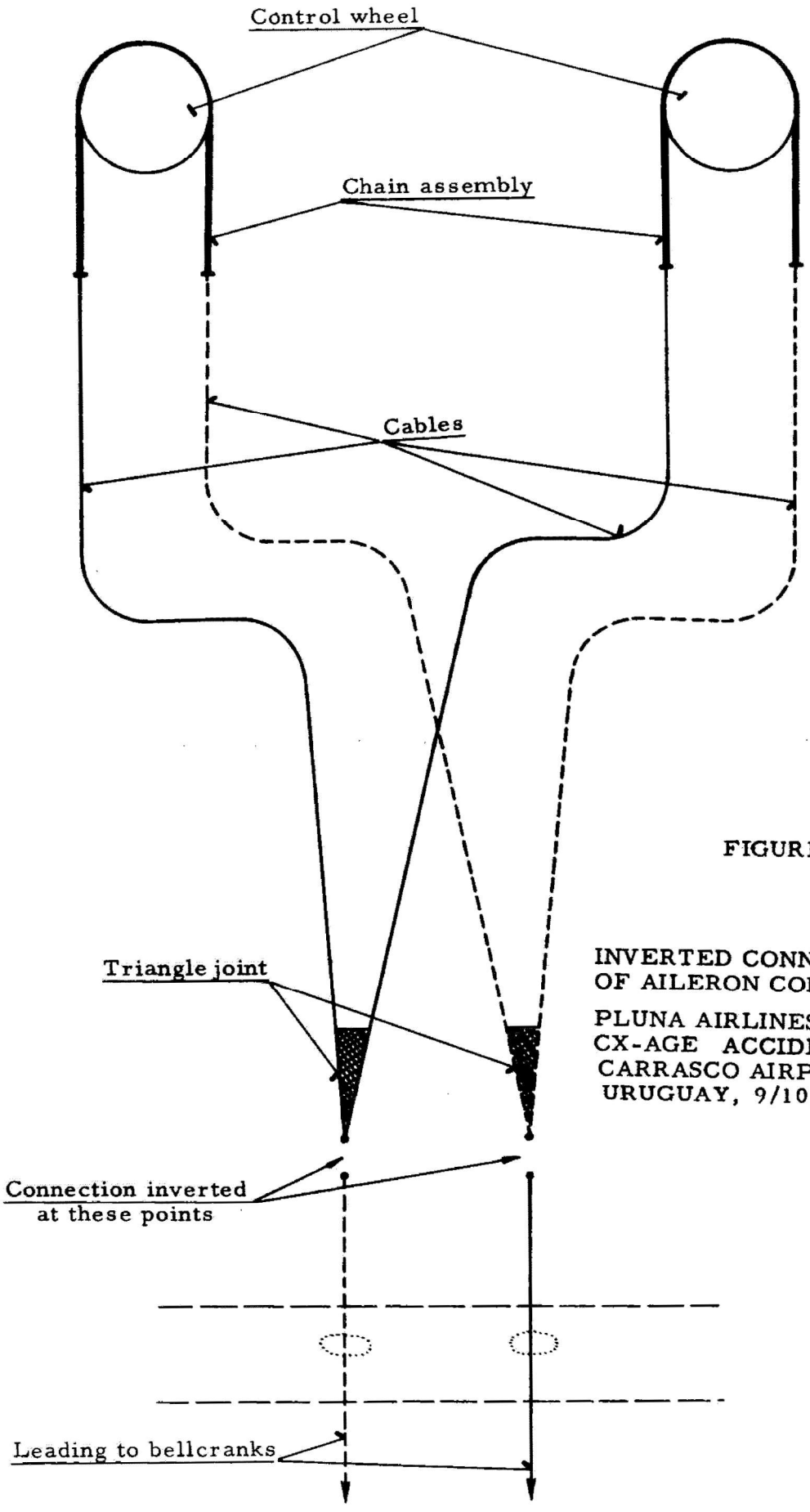

FIGURE 6

INVERTED CONNECTION OF AILERON CONTROLS

PLUNA AIRLINES, DC-3, CX-AGE ACCIDENT AT CARRASCO AIRPORT, URUGUAY, 9/10/62