

No. 24

Aerolíneas Argentinas, Douglas DC-6, LV-ADW, accident at "La Maria Eugenia" field, Azul, Province of Buenos Aires, Argentina on 19 July 1961. Accident Investigation Report No. 1526 dated 2 February 1962, released by the National Director of Civil Aviation, Argentina.

Circumstances

LV-ADW departed Ezeiza Airport (Buenos Aires) at 0731 hours* on a scheduled non-stop flight to Comodoro Rivadavia carrying a crew of 7 and 60 passengers. The trip was being made on an approved instrument flight rules flight plan. Routine communications were exchanged with the airport control tower and with the control of Baires terminal. When over Gorchs the aircraft made its last contact. Having been authorized to leave the Baires control frequency and change to the route frequency, it acknowledged the message. No further information was received concerning the flight until it was learned that the aircraft had crashed 12 km west of Pardo Station (General Roca Railway) in the Province of Buenos Aires. All persons aboard were killed, and the aircraft was totally destroyed by the impact and ensuing fire. The accident occurred at 0800 hours.

Investigation and EvidenceThe Aircraft

The aircraft's certificate of airworthiness was valid until 13 December 1961. At the time of the accident it had flown a total of 20 211 hours.

Gross weight at take-off was 38 682 kg, i. e. within permissible limits.

The Crew

The crew of seven was made up of the following: the captain, a co-pilot, a flight engineer, a radio operator, a flight attendant and two stewardesses.

The captain held a valid airline transport pilot's licence and had flown a total of 17 705 hours with Aerolíneas Argentinas. Of this total he had flown 3 320 hours as DC-6 captain and 1 532 hours on instruments.

The co-pilot also held a valid airline transport pilot's licence and had flown 9 724 hours including 2 113 hours as co-pilot on DC-6's.

Neither the captain nor the co-pilot had exceeded the flight time limitations prior to the accident.

Reconstruction of the flight

Having acquainted himself with detailed weather information and all documents relative to the clearance having been approved, the captain took off at 0731 hours. From Ezeiza to Azul he was to climb to the maximum altitude of 4 800 m. This altitude was to be maintained until arrival in the Comodoro Rivadavia Airport control zone. The airway to be used was Amber 45 with the following contact points: Lobos, Azul, Bahia Blanca, San Antonio, Trelew and Comodoro Rivadavia. At 0733 he called on VHF to say that he "estimated Lobos at 0745 hours". The Baires terminal area control authorized him to climb to 4 800 m, in accordance with his flight plan and requested him to give his position over Lobos. He acknowledged this and added that he was flying between cloud layers. At 0742 hours he notified his position as over Lobos at 2 200 m, climbing in visual flight, over layers of cloud; he estimated Gorchs at 0750 hours. At 0750 hours he sent another message on VHF, stating that he was leaving the terminal area, adding that he was

* all times are local unless otherwise specified.

over Gorchs at 3 400 m, climbing to 4 800 m and expected to reach that altitude at 0757 hours and would call when over Azul at 0819 hours. Following authorization to leave the Baires terminal radio frequency and to switch to the route frequency, he acknowledged the message and switched off VHF. The aircraft crashed shortly thereafter.

Wreckage - General

The accident site was at an altitude of 128 m above sea level, and the terrain was flat and swampy. The total area covered by the aircraft wreckage was plotted on a survey map and was 3 km long by 1.5 km wide.

Inspection of the wreckage was made by helicopter the day after the accident. The right wing had separated from the aircraft and had fallen 850 m away from the main wreckage. Its structure was destroyed in various places. The tail surfaces were missing from the fuselage. Engine and propeller No. 3 with the engine mounting had separated from the right wing. These main elements were spread over an area not wider than 1 000 m, and the complete power plant was found 900 m from the right wing.

Wreckage - detailed inspection

An impact had torn the skin on the right side of the fin, near its base, where it joins the fuselage cone. On the right half of the horizontal stabilizer there was a large hole, also due to impact. The leading edge was torn, as well as the attachments to the fuselage cone. The damage extended as far as the structure of the longerons. The separation of these two surfaces, as well as that of the movable surfaces was apparently simultaneous, since the heavier elements among them were found in a relatively small area.

The right wing had multiple fractures between the fuselage and engine No. 3 due to the break-up. Power plant No. 3 must have separated from the wing at the same

time the wing separated from the fuselage for the following reason: examination of the break which followed the front spar and the two longitudinal ruptures at either end of this break, showed that the latter two correspond to the longitudinal beams which support the engine.

Examination of the engines revealed that No. 1 and 2 engines, which were still attached to the left wing, were feathered. No signs of malfunction or overheating were found, and No. 3 and 4 engines, which separated from the right wing, were in fine pitch.

Engine No. 3 showed a rupture line on the stressed panel which forms the top of the engine support. This line coincided with the front spar of the wing. The spar, in turn, showed vertical fractures on both sides of the wheel well. The beams and frames of the engine support were broken and torn off. This led to the assumption that strong engine vibrations could have torn the top panel in two and then broken the engine supports at the front spar, weakening the latter. Another assumption was that the front spar ruptured at the same time as the wing, thus freeing the power plant, which broke away while still under power.

It was not possible to find any indication of malfunction in engine No. 3 neither was there evidence of loss of parts capable of causing abnormal vibrations of the kind which could result in ruptures and separation. The breaks were caused by downward bending - resulting in traction at the top of the power plant structure. The supports broke at the junctions with the front spar. They showed folds which confirm the downward movement. This movement could have been a reaction of the structure to an upward acceleration or to a positive pitching movement of the aircraft.

Taking into consideration the resistance of the Douglas aircraft's structure, the reports of weather conditions in the area at the time of the accident and evidence from the wreckage, it is estimated that the

break-up of the aircraft was a consequence of stresses generated by a pull-out at a positive angle of incidence, combined with an upward gust. Movements of this type occur during flights in heavy turbulence.

From the shape of the wing and empennage breaks, it is estimated that the right wing broke first. It started with the underside tearing under tension, in a direction perpendicular to the span. The rupture affected all the structural elements. The wing structure was made of three spars, with stressed wing panels reinforced with omega type stringers. The top caps of the three spars showed a break due to flexion.

The lower caps of the wing spars had broken in traction. The bottom wing panels were torn along a line of rivets. All breaks were of the type which occur in static tests, and in none of them could any indication of fatigue cracks be found.

Weather information

When the dispatcher arrived at Ezeiza Airport around 0500 he learned that there was a warm front over Buenos Aires Province producing low stratus, fog, cumulonimbus and violent showers. Between Buenos Aires and Las Flores moderate to heavy turbulence existed.

The conditions at Bahia Blanca, the alternate in the flight plan, were also examined. The dispatcher was informed the the ceiling would be low there.

The captain arrived at the meteorological office at 0620 hours and was informed by the forecaster on duty that there was a warm front over the northeast of Buenos Aires Province and a cold front in the vicinity of Bahia Blanca. The forecaster added that practically the whole province would have a ceiling of 100 to 200 m, with mist and fog, and that there was instability in both warm and cold sectors. With regard to the warm front, the forecaster said that there would be 2/8 to 4/8 cumulonimbus, with light to heavy turbulence between

Ezeiza and Bahia Blanca. The captain obtained the following forecasts for Comodoro Rivadavia and Ezeiza Airport based on the 0300 hour weather map:

Comodoro Rivadavia:

partial to complete overcast at medium altitudes, cloud bases at 3 000 m; low broken clouds at 600 m good visibility.

Ezeiza:

violent showers and isolated storms with 2/8 to 3/8 cumulonimbus; visibility 6 to 8 km and ceiling at least 400 m.

(There is no regulation in Argentina which makes it compulsory for a forecaster in charge of giving weather information for a flight to advise for or against the departure of an aircraft).

As Aerolíneas Argentinas had an assistant meteorologist in Ezeiza, he was questioned concerning his role on the day of the accident. It was ascertained that the meteorologist on duty informed the dispatcher, also on the basis of the data shown on the 0300 hour weather map, that there would be no inconvenience in making the flight. For that reason, the dispatcher requested the QAM's in various locations on the route. These did not, in fact, reflect the actual weather conditions.

The QAM's were of no value in the present case 1) because of the time at which the observations were made, 2) because no observations could be made at altitude on account of a layer of fog and 3) when making a scheduled flight it is the forecast that must be taken into consideration and not the QAM's.

At 0600 hours the captain received the forecast from the company meteorologist which was the same as that given to the dispatcher . . . "unstable tropical air is predominant in the whole province of Buenos Aires. Warm front on the line Río Tercero-Junín-Punta de Indio, with active nimbus. Cold front, practically stationary, on the

line Neuquen-Coronel Suárez-Necochea. Scattered cumulonimbus producing heavy showers and electrical storms in the province of Buenos Aires. The segment Bahía Blanca to Comodoro Rivadavia shows overcast and stratiform nebulosity, breaking between Trelew and Comodoro Rivadavia. "

After this forecast, the captain also received the official bulletin of the General Administration of Air Traffic and Aerodromes corresponding to the forecast. "Time 0600 Greenwich Time, i. e. 0300 hours local time. "

The forecast gave the following:
"From Ezeiza to Las Flores:

visibility 5 to 6 km; nebulosity 8/8 stratus and stratocumulus, base 400 m; 8/8 altostratus and altocumulus, base 1500 m; cumulus 2/8 to 3/8 base 1 800 m. Moderate to heavy turbulence between Ezeiza and Las Flores. Cold front approximately on the line: Neuquen-Coronel Suárez-Necochea, moving towards the northeast. Warm front over Buenos Aires, with heavy showers and active cumulonimbus. Fog and low stratus with drizzle in the centre and south of Buenos Aires Province. "

The weather conditions in the area between the Miramonte and Pardo railway stations from 0600 to 0900 hours were:

overcast, 8/8 stratus, fractocumulus, fractostratus;

ceiling zero to 100 m, 8/8 nimbostratus;

ceiling 1 500 to 1 800 m, active cumulonimbi with bases between 1 500 m and 1 800 m; visibility less than 1 km; heavy showers and electrical storms; light turbulence over the area becoming heavy in areas of cumulonimbus.

Statements of witnesses

There was rain and fog. At approximately the time the aircraft crashed there was a violent storm, with rain, thunder and lightning.

The testimony of two other pilots, who flew the same route a few hours before LV-ADW revealed that although both had been assigned a flight altitude of 1 800 m, both requested a change in order to avoid an area of turbulence, presaged by the presence of cumulonimbus with intense activity. One pilot asked for a change of altitude while in flight, the other did so after examining the forecast given him before departure, which contained the same values as those given to the pilot of LV-ADW.

They both estimated that the main area of cumulonimbus was located around Gorchs and stated that they encountered only light turbulence in flying beneath those clouds.

Weather conditions on LV-ADW's route

thick layer of stratiform cloud, combined with altocumulus, situated approximately between 4 000 m and 4 500 m, inside this layer - very active cumulonimbus, 2/8 to 3/8 with bases at about 1 800 m.

The investigation endeavoured to find if the altitude assigned for LV-ADW between Ezeiza and Azul was correct, having regard to the weather data and considering that the aircraft was not equipped with weather radar to locate active clouds. The aircraft was supposed to climb to 4 800 m, following its take-off from Ezeiza. According to the flight plan, it should reach that altitude over Azul, after 48 minutes flying time. In consequence of this, the aircraft would, in the course of its climb, enter the thick layer made of a continuous overcast (8/8) of stratiform clouds. Inside that layer were 2/8 to 3/8 of active cumulonimbi. Having no radar equipment,

the aircraft had a 31% chance of flying into one of these. Approaching Gorcha, LV-ADW entered a layer of cloud which the pilot must have regarded as similar to those he had crossed previously. Unfortunately, this was not so, for, screened in that continuous and ever thickening layer of cloud were the cumulonimbi. The aircraft flew into one of these between 4 000 and 4 500 m, which is the range of altitudes of the lower part of a cumulonimbus, when it is ripe. This lower part, and the second third of such a cloud are the areas where closely grouped upward and downward air currents are to be found. This creates turbulence which, associated with gusts, makes these currents reach maximum values. Ascending and descending currents, in a ripe cumulonimbus, have variable speeds, the descending currents being slightly less intense; but the order of magnitude may be as high as 100 to 120 km/h (28 to 33 m/sec). (These figures are quoted in "Thunderstorm Project" - Byers H. Braham, R., Washington, D. C., June 1949).

The flight level assigned to the aircraft over Azul implied a climb through a warm front. The forecast showed, associ-

ated with that warm front, cumulonimbi with bases located at 1 800 m. The altitude chosen was not correct, since, in such conditions, the aircraft, having no radar, was running the risk of encountering a cloud of the type described above.

This is, in fact, what happened, and the violent turbulence caused the destruction of the aircraft in flight.

Probable Cause

The aircraft disintegrated in flight due to rupture of the right wing following the application of loads in excess of the design loads, in a zone of extremely violent turbulence. A contributing factor was insufficient evaluation of the forecast, by both the aircraft captain and by the airline dispatcher, which resulted in the choice of an inappropriate flight altitude.

Recommendation

The Aviation Accident Investigation Board recommends that the necessary steps be taken urgently by the competent organizations to study the installation of weather radar in all commercial aircraft.