No. 11

Air Taxi Company, Aero Commander 500, EP-ABA, accident in mountainous terrain 21 km from Zafarkand Village, Iran, 17 April 1961. Report released by the Department General of Civil Aviation, Iran.

Circumstances

On 16 April the aircraft departed Mehrabad Airport at 0228 Z on a charter flight to Yazd and Bandar Abbas. On the same day the first stage of the return flight was made to Shiraz where an overnight stop was made. Next day EP-ABA left Shiraz at 0245 Z to pick up four passengers at Marvdasht. At 0515 Z it departed Marvdasht on a direct flight to Mehrabad Airport, Tehran, ETA 0800 Z. A last contact was made with Esfahan at 0630 Z reporting its position as 20 miles east of Esfahan - VFR, flight level 150, ETA Mehrabad 0800 Z. This was the last message received from the aircraft.

On 19 April word was received at Mehrabad Airport that the aircraft had crashed on the mountains 40 km south of Ardestan and 18 km west of Zafarkand Village. The pilot and four passengers were killed in the accident, and the aircraft was destroyed.

Investigation and Evidence

The Aircraft

The aircraft's certificate of airworthiness was valid until 27 May 1961. The actual gross weight of EP-ABA at take-off was approximately 5 802 lb - the maximum allowable being 6 000 lb. It was assumed that the position of the aircraft's centre of gravity was within limits at the time of the accident. All log books and maintenance records of the aircraft were found to be satisfactory.

The Crew

The pilot, the sole crew member, held a commercial pilot's licence issued on 27 April 1957 and ratings for DC-3, DC-4 and Aero Commander aircraft. He had satisfactorily completed the U. S. A. F. Instrument Pilot Instructor School Course and was last checked on 16 September 1960. He had flown T28, B-25-NA, T-29B, CV-240, DC-3, DC-4, Aero Commander and IL-14 aircraft. On the Aero Commander he had flown 26 hours as co-pilot and 477 hours as captain. His total in flying hours was 2 866 hours, night flying 51 hours and blind flying 156 hours. Besides these recorded times he had flown (after 21 March 1961) a further 32 to 40 hours. In addition to his normal duties as a pilot in the Air Force he was commander on the Russian IL-14 aircraft owned by H. I. M. The Shahanshah. His commercial pilot duties with Air Taxi Company were supplementary to those with the I. I. A. F. and his satisfactory medical, training standards etc. are assured from this source.

Weather conditions

From various reports and statements of persons living in the accident area it was determined that the aircraft, during its flight from Marvdasht to the accident site encountered the following weather:

wind : South of Esfahan 245° - 18 kt
North of Esfahan 325° - 20 kt
clouds: South of Esfahan: CU, SC and AS clouds with tops at 14 000 ft
North of Esfahan: 4/8 SC and AS tops at 15 000 ft and 4/8 CB with tops at over 20 000 ft
general: North of Esfahan: moderate to severe icing and turbulence.

The site of the accident and its surroundings

EP-ABA crashed approximately 21 km WSW of Zafarkand Village at a height

of 6 996 ft. The wreckage was located in a narrow gorge. The aircraft came to rest approximately 80 ft below the crest of the gorge, between the steep slope of two mountain peaks. The centreline of the narrow gorge runs in a direction 068° -248° M whereas the aircraft came to rest in a direction of 225°M. The centreline of the gorge shows an average up-slope of 40°, whereas the enclosing mountain walls show up-slope of 35-15°. The entire gorge is covered with large and small rocks, rendering vegetation extremely scarce. The crest opens a passage of approximately 100 ft wide at the bottom and 1 000 ft wide at the enclosing mountain peaks. During the investigation at the site of the crash it was found that a moderate wind from a westerly direction caused a strong venturi effect over the crest, with an extremely strong downdraft into the gorge.

Approximately 1 500 ft to the east, the northern wall of the gorge is interrupted by a pinnacle of isolated rock formation, rising vertically up from its base. The top of this formation reaches to a height of about 7 140 ft or 144 ft higher than the location of the wreckage. An investigation of this rock formation revealed that protruding pieces have recently been broken off from the extreme top and, furthermore, that traces of paint similar to the type of paint applied to the aircraft wings, were present.

Analysis of the flight

The aircraft had departed Marvdasht at 0515 Z and had reported its position to Esfahan as 20 miles east of that station, cruising at flight level 150. From the time of its last departure to the time of position reporting, 1 hour and 15 minutes had elapsed during which time a straightline distance of 169 NM was covered. In accordance with the instructions of the operator, a true airspeed of 150 kt was to be maintained at the normal cruising level of 15 000 ft. Allowing 9 minutes additional time for take-off and reaching cruising level, an average groundspeed of 154 kt between Marvdasht and the position 20 miles east of Esfahan was maintained. This groundspeed indicated an average wind component of plus 4 kt.

During his flight from Marvdasht to a point 20 miles east of Esfahan, the pilot had ample opportunity to fix his position and, consequently, to be aware of the progress of the flight. In other words, the fact that during that portion of the flight, a tailwind component increased his groundspeed slightly, must have been known to him. Due to the fact that prior to departing from Shiraz and Marvdasht he had neither requested nor received a weather forecast, he could hardly be aware of the fact that there was a windshift from WSW to NNW after passing Esfahan, changing the tailwind component of approximately 4 kt into a headwind component of approximately 17 kt. After passing Esfahan, a closed overcast and lack of ground facilities to fix his position prevented him from obtaining a picture of the changed wind conditions. In view of this, the pilot might well have been under the impression that the groundspeed of his aircraft continued to be 154 kt instead of a now reduced groundspeed of approximately 133 kt. Apart from this, the top of the closed overcast had risen to 15 000 ft with approximately 4/8 cb with tops over 20 000 ft. At a flight level of 150 the aircraft was most probably "skimming" over the overcast or, flying in and out of protruding cloud tops.

The weather analysis prepared by the Aeronautical Forecasting Office at Mehrabad indicated moderate to severe icing conditions in the area where EP-ABA was now operating. The very character of its operation offered ideal conditions for carburettor icing.

The manufacturer of the engines installed on the aircraft gives the following instruction in its Operator's Manual:-

> "On damp days, especially cloudy, foggy, or hazy days, regardless of temperature, keep a sharp lookout for loss of power and manifold pressure. If ice begins to accumulate, it may be melted out by turning air heat on full."

There hardly exists reason to believe that the pilot was aware of prevailing icing conditions at first. Only after these conditions manifested themselves by a drop in engine power might he have taken steps to melt the ice out. By the time he had applied carburettor heat, he had probably lost some altitude which implies that he had descended into cloud. From this moment on, icing conditions became considerably worse, rendering quick melting of carburettor ice problematic. Under conditions of reduced engine power, turbulent air and instrument meteorological conditions, the pilot may have been unable to climb back into the clear sky on top of the overcast. Apart from this, the chance of flying into one of the cumulonimbus clouds surrounding him, had greatly increased. The pilot must soon have become aware of the seriousness of the situation. Having no reason to assume that his groundspeed had considerably reduced since passing abeam Esfahan, he might have supposed that a gradual descent had brought him completely clear of the high mountain range which he had to pass before entering the large plain located north of the high range. However, his considerably reduced groundspeed was the cause of this breaking cloud over the plateau of Zafarkand, only a few miles distant from the last high mountain peaks that were to be surmounted. After breaking cloud, extremely poor visibility was prevalent, due to heavy downpour and cloud patches. Immediately in front of the descending aircraft a steep mountain wall blocked its passage. The pilot, flying on a northerly heading, made a sharp turn to port to avoid this mountain, soon to be confronted again with another mountain range, running in a North-South direction. The pilot's only chance was to endeavour to force his way over this new obstruction and in doing so he attempted to pass through the narrow gorge, its centre line running in a direction of 248°M. When turning left into this gorge the undersurface of the port outer mainplane and probably the port propeller hit the isolated rock formation aforementioned. Unfortunately due to interference with the wreckage before investigation had commenced, it was not possible to determine precisely at what stage the port aileron and propeller blade tip were shed. But if perchance the aircraft remained controllable after this impact, the pilot might have banked his aircraft more sharply to the left and also tried to make a steep pull-up in order to pass over the crest of the gorge a few hundred feet ahead. Furthermore, a strong downdraft coming over the crest could have contributed greatly to a stalled position. In such a position the port wing tip area of the aircraft next hit the rocky surface of the gorge followed immediately by the final impact of the front fuselage on the steep rocky slope, and the aircraft came to rest only 45 ft from where the port wing tip hit the ground.

Discussion of the evidence

It being recognized that the cause and events leading up to the accident could chiefly only be resolved on hypothetical lines, considerable study was made of the several aspects pertaining to the following:

1) reconstruction of the flight up to the accident;

2) icing conditions and preventive processes, especially as affecting this particular type of aircraft;

3) the weather conditions that could only be assumed to have prevailed on the basis of the weather analysis prepared by the aeronautical forecasting office together with the pilot's report.

A major with the Iranian Air Force was able to contribute considerable useful information as he had made several simulated flights over the scene of the crash in a Harvard aircraft and was, therefore, able to confirm that:

1) the climb required would be too steep to get through the gorge and over the crest under the existing conditions;

2) tremendous down draughts were encountered from the venturi formation of the mountain terrain at the crest of the gorge;

3) the chipped pinnacle of isolated rock formation as mentioned previously was easily identified, and his observations were compatible with the accident pattern submitted;

4) it was determined from discussion of the available information that the EP-ABA flight route conditions were undoubtedly conducive to icing. If a pilot on this type of aircraft does not take timely application of the carburettor hot air anti-icing system as a precaution against such effects, then it is unlikely that this particular system would be efficient later for purposes of de-icing;

5) the Air Taxi Company representatives informed the Board that they had already taken expedient measures to safeguard themselves against the aforementioned in the following manner:

   a) company pilots have been fully briefed on the implication of carburettor icing and the preventive measures to be taken;

   b) carburettor air intake temperature gauges are being installed in this type aircraft;

   c) pilots have been issued strict instructions to only operate under visual meteorological conditions.

6) in studying the reports on weather conditions it became apparent that the meteorological department was not fully aware of the actual conditions over the route area at the time the aircraft departed from Shiraz; under these circumstances it was thought that even if the pilot had received a forecast which denoted VFR conditions it would not have influenced him against making this particular flight.

Probable Cause

The pilot was unexpectedly confronted with severe carburettor icing conditions. A loss of engine power resulting from this impelled him to descend through the cloud layer when possibly the icing conditions became considerably worse, thus rendering a quick melting of the carburettor ice problematic.

His already serious situation was intensified due to breaking cloud over mountainous terrain under conditions of bad visibility.

In an effort to avoid the mountain barriers confronting him, he endeavoured to fly through a narrow gorge and a visible gap at the top. Due, however, to a still greatly diminished power from the persistent effects of carburettor icing, together with the most imposing turbulence and down draught effects that he would undoubtedly encounter in the crest area, his attempt failed. Unfortunately, the protruding rock formation which he first hit presented a further great obstruction at the most critical point of his passage.

Recommendations

The attention of the manufacturer and also Iranian owners of this type of aircraft should be directed to the real icing hazards as depicted by this accident. Recommendations should at the same time be made to install some early warning device such as by the introduction of carburettor air-intake temperature gauges.

Operators should be further advised to always ensure that the co-pilot's seat is adjusted fully rearwards when it is occupied by a passenger in order to ensure that the pilot has unrestricted access to the carburettor heater controls in the area of the co-pilot's instrument panel.

Instructions should be issued to all authorities and persons that are most likely to be concerned when an aircraft accident occurs, so that no interference with the aircraft or disturbance of any wreckage is permitted until the investigation has been taken over by the Airworthiness Department of the Directorate General of Civil Aviation and clearance has been granted from the Chief of Airworthiness.

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ICAO Ref: AR/671

No. 12

LACSA, DC-3,TI-1006-C, accident at Monte Arenal, Costa Rica, 12 May 1961. Report dated 6 September 1961 released by the Directorate General of Aviation, Costa Rica.

Circumstances

Departure from La Sabana Airport, San José was at 1205 hours GMT on the route San José - Upala - San José. The last radio contact with the aircraft was made at 1220 hours, and no further reports of its position were received. The accident occurred at approximately 1225 hours GMT.

The aircraft's wreckage was found at 1620 hours the same day at Cerro del Arenal. The two crew, the sole occupants of the aircraft, died prior to the outbreak of the intense fire which followed the accident.

Investigation and Evidence

The Aircraft

At the time of the accident the aircraft had a certificate of airworthiness valid until 6 October 1961. The aircraft had logged a total of 30 385:51 hours. In August 1960 a No. 5 service was performed on the aircraft at which time the altimeter settings were tested, and the instrument panel unit was overhauled. At the same time the compass was compensated and the deviation card installed. The radio compasses were frequently checked by the airline's radio technicians.

The times shown for the engines and propellers since the last overhaul were as follows:

	starboard	port
Engines	793:32 hours	18:20 hours
Propellers	1 994:31 hours	1 120:54 hours

The weight of the aircraft at take-off was 20 768 lb, well within the maximum permissible limit, and was estimated at 20 024 lb at the time of the accident.

The Crew Members

Two crew were aboard the aircraft on the subject flight.

The pilot held an airline pilot's licence and had flown a total of 12 950 hours with this airline. His last medical examination was in April 1961.

The first officer had a commercial pilot's licence and had also obtained a flight instructor's licence on 20 April 1960. His last medical examination was in February 1961. His total flying experience amounted to 2 300 hours.

The Subject Flight

The flight to Upala was being made on a visual flight rules flight plan, and the estimated time of arrival there was 1240 hours.

The aircraft was airborne at 1206 hours. Several communications concerning the cargo to be picked up in Upala, were exchanged with the aircraft on the airline frequency. The last such message was at 1220 hours. This was the last radio contact with the flight.

As the aircraft had not arrived at Upala by 1243 hours (i.e. 3 minutes after its estimated time of arrival there) the airline attempted to obtain information concerning its whereabouts, and the weather conditions, from Upala and Los Chiles. Inquiries were also made at Canas and Liberia, two stations on the other side of