No. 6

Eastern Provincial Airways Limited, Handley Page Dart Herald 202, CF-NAF, accident near Upper Musquodoboit, Nova Scotia, Canada, on 17 March 1965. Report, Serial No. 2492, released by the Department of Transport, Canada

1. - Investigation

1.1 History of the flight

Flight 102 was a scheduled domestic flight from Moncton to Torbay,Newfoundland, with scheduled stops at Summerside, Charlottetown, Prince Edward Island, New Glasgow, Halifax and Sydney, Nova Scotia, Deer Lake, Gander and Torbay, Newfoundland. It took off from Moncton, New Brunswick at 0635 hours Atlantic Standard Time. The flight was routine as far as Halifax where a 36-minute stopover was made. No aircraft unserviceabilities were reported by the crew during the stopover. The flight departed Halifax for Sydney at 0910 hours. It was cleared to depart runway 33, to turn right and climb on course to an altitude of 13 000 ft via Victor 312 Airway to the Sydney omnirange station. Following take-off, it was requested to report reaching 13 000 ft and this was acknowledged. There was no further communication between the aircraft and Air Traffic Control. At 0915 hours the aircraft contacted the airline's radio facility at Halifax and transmitted flight data as follows: time out 0908 hours and off at 0912 hours along with an estimated time of arrival at Sydney of 0959 hours. This was the last known transmission from the aircraft. No difficulty was reported by the crew.

Nineteen witnesses located about three miles north-north-east of the accident site and about 2 miles south-east the centre line of Victor 312 Airway testified that an unusual noise attracted their attention to an aircraft flying on an easterly heading and that the tail unit and, later on, the nose section separated from the aircraft, whereupon it went out of control and crashed 45 to 60 seconds after. The time of the accident was calculated to be approximately 0922 hours.

The location of the accident site was 45°05'N, 62°58'W.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	3	5	
Non-fatal			
None			

The cause of death in the case of all crew and passengers was due to multiple injuries consistent with severe impact forces.

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

None mentioned in the report.

1.5 Crew information

The pilot-in-command, aged 45, held a valid pilot's licence with valid Class I instrument flight rating. He had flown a total of 20 200 hours, including more than 1 000 hours on Dart Herald.

The co-pilot, aged 42, also held a valid pilot's licence with valid Class I instrument flight rating. He had flown a total of 11 960 hours, including more than 1 000 hours on Dart Herald.

Both pilots had flown less than 8 hours in the three-day period prior to the accident and were in good physical and mental condition at the time of take-off from Halifax.

1.6 Aircraft information

The aircraft's certificate of airworthiness was renewed on 5 March 1965 and valid at the time of the accident.

The total airframe time was 4 135 hours since manufacture.

There was no significant evidence in the maintenance history of the aircraft relating to the structure, systems or powerplants except for a history of vibration in the tail area.

The aircraft's gross weight and centre of gravity were not mentioned in the report.

The aircraft was refuelled during the stopover at Halifax but the type of fuel being used was not stated in the report. The fuel met type specifications.

1.7 Meteorological information

The weather at Halifax Airport at the time of take-off was:

Cloud:	scattered at 12 000 ft above ground
Visibility:	20 miles
Temperature:	26°F
Dew-point:	16°F
Wind:	030°/14 mph
Altimeter setting:	29.78 inches of mercury

An aftercast indicated the air was relatively stable with no strong wind shears existing. It is therefore unlikely that anything more than light turbulence would have existed at the time in the area of the accident.

1.8 Aids to navigation

Not mentioned in the report.

1.9 Communications

The aircraft was equipped with VHF, VOR and ADF sets. The last transmission from the aircraft was at 0915 hours when the flight transmitted flight data. Nothing unusual was reported at that time.

1.10 Aerodrome and ground facilities

Not pertinent to the accident.

1.11 Flight recorders

Not mentioned in the report.

1.12 Wreckage

The bulk of the wreckage was dispersed over a wide area of heavily wooded rolling terrain approximately one square mile. An estimated 98% of the wreckage was recovered. The aircraft experienced a structural failure which resulted in a break-up into three major components, i.e. (i) the forward section of the fuselage, (ii) the wing, powerplants and rear section of the fuselage and (iii) the empennage. The major section, i.e. the wing and powerplants, described at least six or seven complete turns before it came to rest on the ground on a heading of approximately 353°M.

There was an area of extensive internal skin corrosion along the bottom centre line of the aircraft. There was a hoop tension failure extending for at least 80 inches through this area which resulted in decompression.

1.13 Fire

There was no evidence of engine fire, and the fire extinguishing system had not been activated.

1.14 Survival aspects

This was a non-survivable accident.

1.15 Tests and research

Analyses of blood samples showed some evidence of carbon monoxide. However, it was concluded as a result of further tests and consultations that the level of concentration was not significant and could not have resulted in crew incapacitation.

Analyses of tissue samples showed no evidence of the presence of toxic volatile components.

As a result of tests conducted, it was calculated that the cabin differential pressure would have reached a maximum of 3.8 lb per sq. in. during the flight. This is below the maximum operating differential of 4.2 lb per sq. in. and well below the maximum design differential of 4.7 lb per sq. in.

Examination and tests of all recovered components indicated that the air conditioning system was functioning normally at the time of the accident and that cabin pressure did not exceed the design maximum as a result of any malfunction in the pressurization system.

2. - Analysis and Conclusions

2.1 Analysis

The take-off from Halifax International Airport at 0910 hours and the climb out were known to be normal until 0915 hours, at which time the aircraft reported its take-off time on the airline's radio frequency. It was observed at an altitude of 3 000 to 5 000 ft climbing on course. Further, the climb was normal to a point 4 miles east of the airport where it intersected Victor 312 Airway, as observed by radar. Since there was no indication of any malfunction of communications equipment, it was assumed that no difficulties were experienced until the flight reached the vicinity of Upper Musquodoboit, 26 miles north-east of Halifax Airport, at approximately 0922 hours. It was then observed by eyewitnesses who reported hearing a muffled explosion at altitude followed by disintegration of the aircraft as it descended to the ground.

Evidence revealed that the mainplane, powerplants and rear fuselage structure impacted the ground with little forward speed but with considerable vertical velocity. The forward section of the fuselage struck the ground about a third of a mile north of this location and the empennage reached the ground approximately half a mile east of this location. A trajectory analysis indicated that disintegration of the aircraft began at an altitude of approximately 12 000 ft and that the wing and fuselage section descended in a series of six or seven complete turns until ground impact.

Evidence also indicated that each engine had used similar quantities of fuel, which implied that both powerplants were functioning and producing equal power up to the time of disintegration, that the auto-pilot was engaged and set for a normal climb configuration, and that the cabin pressurization system was operating normally at the time of disintegration.

Most of the flight instruments were so badly damaged that it was not possible to obtain useful information from them.

There was no evidence of fire, thermal explosion, collision or failure of the main structure from fatigue; or of failure in the systems or powerplants.

In summary, a review of all available evidence supported a structural failure and disintegration of the aircraft while in the en-route climb configuration, on course, at 11 500 to 12 000 ft above sea level at approximately 0922 hours.

Because of the level of carbon monoxide content in blood samples taken from some of the occupants of the aircraft, the possibility of crew incapacitation was explored in depth. Detailed examination of the aircraft systems failed to reveal any possible source of this contaminant. There was no evidence of fire as a possible source of carbon monoxide.

During the stopover at Halifax, a heating duct was installed in the front cabin door of the aircraft to maintain cabin temperatures. Hot air was provided from a gasoline-operated ground heating unit. This unit was subjected to exhaustive tests and the heated air showed negligible carbon monoxide. However, the exhaust gas outlet of the heater showed a high concentration of carbon monoxide. Because of its location in relation to the parked aircraft and the wind direction, some entry of this contaminant into the cabin through the open door was considered possible. Subsequent tests of blood samples for cross-comparison purposes did not reveal abnormal carbon monoxide concentrations. Blood samples from the flight crew could not be obtained. In the circumstances, it was concluded that the cabin and flight deck environment prior to disintegration of the aircraft was not in any way a contributing factor.

The history of tail vibration, as recorded in the aircraft log-book, was carefully examined. Witnesses were interviewed and considerable evidence of vibration in the tail section of the aircraft was reported. This evidence was considered significant, particularly because of the fact that the left-hand tail plane and elevator separated from the aircraft prior to the detachment of the vertical stabilizer, right-hand tail plane and the fuselage aft of the rear pressure bulkhead. The rudder also departed independently and logically; either it or the left-hand tail plane could therefore have been the primary cause of disintegration. However, to support such a hypothesis, there would have to be some indication of pressure failure at the aft end of the fuselage and the wreckage distribution should have provided corroborative evidence through the ground location of light items from the rear of the aircraft. No such evidence was found.

There was a substantial amount of factual evidence of internal corrosion and deterioration of the underfloor fuselage skin over a relatively extensive area along the underside of the aircraft. This corrosion was located along stringer 32, the bottom centre line of the aircraft. The length of the apparent hoop tension failure was well beyond the critical crack length which, when reached, would result in major disruption of the structure. Examination of the corroded area revealed that, due to the nature of the structure, it would have been extremely difficult to detect evidence of internal corrosion through normal maintenance inspection procedures.

The distribution pattern of light items of wreckage established conclusively that the initial disintegration took place in the forward fuselage between the mainplane and the flight crew compartment. The evidence indicated that the bottom skin ruptured and in fact opened sufficiently to be contacted by one of the propellers. Disruption of the structure and subsequent progressive separation of the nose and front fuselage resulted in failures of the control levers. The air load failure of the flight control surfaces in the empennage, evident in the recovered parts, can be accounted for by large movements of elevator and rudder, which could occur at moderate flight speeds. Separation of the remaining empennage and the aft section of the fuselage would have followed instantaneously or, as flight speeds increased, when control of the aircraft was lost.

2.2 Conclusions

Findings

The flight crew were qualified and competent for the flight and properly certificated.

The aircraft had a valid certificate of airworthiness and was properly loaded.

Weather was not a factor in the accident.

The aircraft and flight crew were properly despatched.

The aircraft was observed to take off normally and was further observed while climbing on course at an altitude of 3 000 to 5 000 ft. It was monitored by radar following take-off to a point 4 miles east of the Halifax omnirange station.

In the vicinity of Upper Musquodoboit, approximately 26 miles north-east of Halifax International Airport, it was observed to disintegrate in flight. It was determined that the disintegration began at an altitude of approximately 11 500 ft, and that it originated along the bottom centre line of the aircraft where evidence of extensive internal skin corrosion was found.

Cause or
Probable cause(s)

Failure of corroded skin area along the bottom centre line of the aircraft beneath stringer No. 32 which resulted in structural failure of the fuselage and aerial disintegration.

The precise nature and origin of the skin corrosion has not been determined.

3. - Recommendations

None were contained in the report.

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