No: 2/86 **Ref: EW/C944**

Aircraft type and registration:	Cessna 404 Titan G-BKTJ (Light twin engined fixed wing aircraft)	
Year of Manufacture:	1978	
Date and time (GMT):	27 November 1985 at 1744 hrs	
Location:	Birmingham Airport	
Type of flight:	Air Taxi Revenue Passenger	
Persons on board:	Crew — 1	Passengers — 11
Injuries:	Crew — 1 (serious)	Passengers — 11 (3 serious, 8 minor)
Nature of damage:	Aircraft destroyed	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	61 years	
Commander's Total Flying Experience:	24,500 hours (of which 242 hours were on type)	
Information Source:	AIB Field Investigation.	

The aircraft was engaged on a charter flight from Birmingham International Airport to Norwich Airport, with a single pilot and eleven passengers on board. It had been chartered in order to transport a group of business persons from Norwich to Birmingham to visit the Birmingham International Exhibition Centre. The accident occurred shortly after take-off on the return flight from Birmingham to Norwich.

History of the flight

On 27 November 1985 the aircraft took off from Norwich, at 0825 hrs. Prior to departure it had undergone a full pre-flight inspection, including the application of de-icing fluid to the upper surfaces, and was in a serviceable condition to make the flight. There were two 'Deferred Defects' recorded in the aircraft's Technical Log. The first referred to a malfunction within the automatic pilot control system, and the second recorded the unserviceability of a minor part of the cockpit lighting over the co-pilot's station.

Neither of these defects were of significance regarding the safe operation of the aircraft. The flight from Norwich to Birmingham was completed without incident, the aircraft landing at 0912 hrs. The passengers were then transferred to the Exhibition Centre, whilst the pilot remained at the airport to await their return for the flight back to Norwich.

At about 1500 hrs the pilot returned to the aircraft and carried out a pre-flight inspection. The weather conditions at that time were partly cloudy, although dry, and the air temperature was plus 4°C. The pilot therefore considered tht a further application of de-icing fluid was not required, and he completed the inspection, signed the Technical Log, and returned to the terminal building. At about 1615 hrs the weather deteriorated and a succession of snow and hail showers fell on the Airport. These showers cleared at 1650 hrs by which time the air temperature had fallen to zero. The passengers arrived back at the Airport and, at about 1725 hrs, together with the pilot were transported to the aircraft. The pilot reported that on arrival back at the airport he was

aware that there was a light covering of snow on the upper surfaces, but that he did not consider that the depth was sufficient to cause any problems. However some of the passengers later stated that the ground around the aircraft was very slippery, and that there appeared to be significant deposits of snow and ice on the wings. They further stated that, once inside the aircraft, they were unable to see out of the right side cabin windows, which were coated in frozen snow.

After a standard engine start the aircraft was taxyed to runway 33 and, at 1743 hrs, was cleared for take-off and departure for Norwich. The pilot has stated that the initial take-off acceleration appeared to be normal and that all engine power instruments were indicating in the green area. At an indicated airspeed of 100 knots he raised the nose and the aircraft lifted off the runway, however there was no further increase in airspeed. He retracted the landing gear and lowered the nose to attempt to gain more airspeed. At this time the airspeed had reduced to 90 kt and the pilot felt some vibration from the elevators. Realising that the aircraft would neither climb nor accelerate, the pilot selected what he hoped was a clear area in which to carry out a 'landing gear up' crash landing. The consensus of evidence from the passengers is that the take-off run had been considerably longer, and accompanied with much more vibration, than they had experienced at Norwich on the previous flight.

The take-off from Birmingham had been observed by both the Ground Controller and the Aerodrome Controller on duty in Air Traffic Control. They both report seeing the aircraft lift off from the runway, but thereafter apparently failing to climb away. This situation remained unchanged until the aircraft disappeared from view in the darkness to the left of the take-off direction. An aircraft accident procedure was immediately initiated, and the crash and rescue services were alerted. A Rapid Intervention Vehicle and three Foam Tenders were dispatched towards the accident site.

Shortly after the aircraft had come to rest, passengers who were seated towards the rear of the cabin managed to release themselves from their seats and open the rear main entry/exit door. All the occupants vacated the aircraft via this exit. The airport crash and rescue service vehicles arrived at the scene approximately five minutes after the impact. After it was established that all occupants had vacated the aircraft a mixture of 2000 gallons of water and 40 gallons of foam liquid was applied to cover possible fuel spillage.

Examination of the wreckage

The aircraft had come to rest in a cultivated allotment area approximately 175 metres beyond the aerodrome boundary fence. When first examined, on the morning after the accident, the wreckage had a covering of 15 mm of damp snow. It had also clearly been widely smothered with foam which had subsequently frozen. As a result it was not possible to establish the depth of any snow or ice that may have been present prior to take-off.

From ground witness marks it was established that the aircraft was crash landed in a wings level, 10° nose up attitude on a heading of 323°M. Initial contact was made by the under side of the rear fuselage with the stranded barbed-wire top of the boundary fence. After a further 50 metres there was evidence of the propellers touching the ground, and measurements and calculations from the resulting slash marks indicate that, at that point the aircraft's ground speed was 84 kt. Shortly after this the aircraft struck a second, more substantial, fence which bounded the allotment area. At the base of this fence was a 60 cm bank of frozen earth. It appeared that this fence had caused the majority of the damage to the aircraft, and that the bank had probably propelled the aircraft temporarily back into the air. Thereafter it passed across the allotments demolishing a number of posts and various winter crops, but with no sign of firm ground contact until around 10 metres before it came to rest. It thus appears that the maximum deceleration forces did not occur until late in the accident sequence.

Examination of the cabin interior revealed that the two forward passenger seats immediately behind the pilot's position had failed, the seat bases having separated from their plinths which had remained anchored to the floor rails. A third passenger seat on the right side was found to be

70% separated from its plinth. A plastic pump spray containing de-icing fluid was found loose in the rear of the cabin; it was filled to the 'max fill' level.

The aircraft wreckage was removed from the accident site, and transported to AIB Farnborough for more detailed examination.

Detailed examination

Detailed examination of the aircraft's engines, flying controls and flight instrumentation revealed no evidence of any pre-crash failure or malfunction of any system. Strip examination of the engines and propeller systems showed that they had been in good condition, and there was no evidence that they would have produced other than maximum power under take-off conditions. All damage to the flying controls was consistant with impact forces. The airspeed indicators were removed for separate calibration and found to be accurate within approved limits. The propeller, wing, and tail de-icing systems were serviceable. The aircraft had been properly maintained in accordance with an approved maintenance schedule.

The reason for the failure of two passenger seats, and the partial failure of a third is currently under further investigation. The Civil Aviation Authority has been informed concerning these failures and the results of further investigation will be forwarded to the Authority.

Meteorological conditions

The weather forecast for the Birmingham area for the period 1200 hrs to midnight on 27 November 1985 was for a cold, unstable, northwesterly airstream with scattered showers of snow or hail. Frost and snow warnings were issued. An aftercast of the actual weather conditions, produced by the Meteorological Office Bracknell, has shown that the forecast was substantially correct. At 1500 hrs, when the pilot completed his pre-flight inspection of the aircraft, the actual weather conditions recorded at Birmingham Airport were:—

Surface wind 250/06 kt, visibility 25 kilometres, cloud 4 oktas at 2500 feet, air temperature plus 04°C, dew point minus 02°C.

Shortly after 1615 hrs, until the accident time, there was a marked deterioration in weather conditions over the Airport, accompanied by significant changes in air temperature and dew point. Pertinent details of both special and routine observations taken by the Birmingham Airport Meteorological Office during that period are as follows:—

Time	Significant weather	Air Temperature/Dew Point
1616 hrs	Snow shower	Plus 03°C/Minus 02°C
1620 hrs	Heavy hail	Plus 02°C/Minus 01°C
1625 hrs	Heavy snow shower	Plus 02°C/Minus 01°C
1645 hrs	Snow shower	Plus 02°C/Minus 01°C
1650 hrs	Nil	Plus 00°C/Plus 00°C
1720 hrs	Nil	Minus 00°C/Minus 00°C
1750 hrs	Nil	Minus 01°C/Minus 01°C

Cold weather operation

The Cessna 404 Titan aircraft, with the proper optional equipment installed, is approved for day and night IFR operation and flight into icing conditions. G-BKTJ was properly equipped and, prior to the accident, all propeller and airframe de-icing equipment was serviceable. The Operating Company's Operations Manual together with the associated Pilot's Operating Handbook, contain detailed advice concerning the operation of the aircraft when the temperature is at, or below freezing point, and there is the presence of frost, ice, or snow. The following warning is high-lighted in the Pilot's Operating Handbook:—

> WARNING
>
> The wings and tail surfaces must be clear of ice, snow and frost prior to take-off as flight characteristics can be adversely affected.