Aviation Safety Investigation Report 199802140

Cessna Aircraft Company Super Skymaster

07 June 1998

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Occurrence Number:	199802140			Occurrence Type: Accident		
Location:	1km WSW Bund					
State:	QLD			Inv Category: 4		
Date:	Sunday 07 June 1998					
Time:	1355 hours			Time Zone EST		
Highest Injury Level:	Fatal					
Injuries:						
		Fatal	Serious	Minor	None	Total
	Crew	1	0	0	0	1
	Ground	0	0	0	0	0
	Passenger	0	0	0	0	0
	Total	1	0	0	0	1
Aircraft Manufacture	r: Cessna Aircrat	ft Comp	any			
Aircraft Model:	337A		•			
Aircraft Registration:	VH-YGM			Serial Num	iber: 337()401
Type of Operation:	Non-commerc	ial Plea	sure/Travel			
Damage to Aircraft:	Destroyed					
Departure Point:	Bundaberg Ql	d				
Departure Time:	1355 EST					
Destination:	Ballina NSW					

Approved for Release: Tuesday, March 9, 1999

History of flight

The twin-engine aircraft was of a `centreline thrust' design. This design located one engine and propeller assembly at the front and the other at the rear of the fuselage, immediately behind the passenger cabin.

The pilot had recently purchased the aircraft. On 5 June 1998, it underwent a 100 hourly inspection at Mareeba and was then ferried from Mareeba to Mackay by another pilot. On 6 June, the ferry pilot endorsed the owner-pilot on the aircraft. Later that day, the owner-pilot flew the aircraft to Raglan, near Rockhampton where he remained overnight. He planned to fly the aircraft to Ballina via a refuelling stop at Bundaberg the following day.

VH-YGM arrived at Bundaberg at about 1100 EST on 7 June. At the time, an airshow that had been organised by the local aero club was in progress. The pilot sought from the airshow organisers the assistance of an aircraft engineer, indicating that the aircraft flaps were not retracting normally. A licensed aircraft maintenance engineer at the aerodrome subsequently cleaned the flap position micro-switch and checked the flaps for normal operation. The pilot informed the engineer that he intended to take off with the flaps retracted to ensure that there was no further problem as he wished to reach his destination that afternoon. The pilot then refuelled the aircraft tanks to full.

At about 1339, the pilot reported by radio on the airshow frequency that he was taxiing for departure. He commenced taxiing for runway 14 but was unable to continue because other aircraft congested the tarmac. He then taxied for runway 25.

A number of witnesses observed the aircraft during this period. They reported that the rear engine started first. After the aircraft commenced taxiing, the front engine was started. Both engines were operating as the aircraft taxied for runway 14 and then turned around to taxi for runway 25. Other witnesses nearer runway 25 saw the aircraft taxiing with the front engine operating and the rear propeller stationary. The aircraft lined up on the runway in this configuration and held there for a few minutes, apparently because of airshow traffic. The aircraft then commenced the takeoff roll with the rear propeller stationary. It became airborne after a ground roll that appeared excessively long and commenced a shallow climb. Witnesses on the other side of the airport beyond the departure end of runway 25 reported that the rear propeller commenced rotating slowly as the aircraft flew low over a line of trees about 300 m beyond the boundary fence. A short time later, the aircraft banked left and descended steeply to the ground. It was destroyed by impact forces and fire.

Some spectators who were at the airshow made available video recordings taken of the aircraft during its arrival and departure. The recordings showed the aircraft, apparently taxiing for departure, initially with the rear engine operating, then with both engines operating, and then with only the front engine operating. During these sequences, the flaps appeared to be fully retracted. A recording of the initial and later segments of the takeoff did not provide sufficient definition to determine whether the rear propeller was rotating. Retraction of the landing gear was evident as the aircraft climbed at a shallow angle. It then banked sharply left, and disappeared in a steep descent behind trees.

Wreckage examination

Examination of the wreckage revealed the following:

a. The landing gear and flaps were retracted at impact.

b. There was evidence of ample fuel in all tanks.

c. The front engine propeller drive shaft had failed in torsional overload, indicative of high rotational forces at impact.

d. The rear propeller was still attached to the drive shaft and showed no evidence of rotation at impact. The rear propeller was not feathered.

The engines were removed from the wreckage and disassembled. No abnormality was found in either engine that would have prevented normal operation. However, heat damage to some of the engine systems, such as the fuel and ignition systems, precluded determination of their status prior to the accident.

Pilot information

YGM was the first multi-engine aircraft the pilot had been endorsed to fly. The pilot who conducted the endorsement said that he stressed during the endorsement training the importance of advancing first the rear engine throttle at the commencement of the takeoff roll as confirmation that the rear engine was operating. He said that flying time for the endorsement was about 1 hour 40 minutes and had included general and low speed handling (including stalling) and normal and single engine circuits. The pilot had operated the aircraft satisfactorily during the training. The aircraft had operated normally throughout the flight.

The pilots flying log book was destroyed in the post-accident fire. Although associates of the pilot were unable to provide details of the pilot's flying experience, they reported that he had been flying for many years and had extensive experience in conventional single engine and ultra-light aircraft.

The Director of Aviation Medicine, Civil Aviation Safety Authority (CASA), advised that the pilot's medical certificate required him to wear corrective lenses while flying. The Director indicated that the pilot may have had difficulty reading the cockpit instruments without corrective lenses. The endorsing pilot said that the pilot was not wearing spectacles during the endorsement training. It could not be established whether he was wearing spectacles during the accident flight.

Aircraft operation and performance

The Owner's Manual for the aircraft type contained the following information relevant to the accident:

a. The checklist stated that the wing flaps should be set to one third for both normal and maximum performance take-offs.

b. A note in the section titled ENGINE-OUT ON TAKE-OFF stated: 'Airplane drag with the landing gear doors opened and the gear partially extended is greater than the drag with the landing gear fully extended. Corresponding rate-of-climb penalties are -240 ft/min and -110 ft/min respectively.'

c. The manual contained an addendum titled ENGINE OPERATING TECHNIQUES - TAXI AND TAKEOFF. It stated that 'since the rear engine propeller is out of the normal field of view of the pilot and no asymmetric thrust is experienced with a failed engine, it is doubly important that operating techniques be developed to assure that the rear engine is operating normally prior to and during takeoff'.

The addendum included the following information concerning taxying:

'The airplane should be taxied using the rear engine, followed by applying power to the front engine. Power adjustments should then me made with the rear engine only. The characteristic change in sound of the rear engine with variations in power will provide assurance that the rear engine is operating normally.'

The addendum contained the following information concerning takeoff:

'Application of rear engine power should be made prior to front engine power to provide an aural check on rear engine operation. In addition to an aural check, the acceleration characteristics of the airplane should verify that the rear engine is operating satisfactorily. Once satisfactory rear engine operation is apparent, front engine power should be applied. Again, proper operation of the front engine can be verified.

In the early portion of the takeoff run, the fuel flow indication and tachometer of each engine should be checked to ensure that these gauges indicate normal operation.'

The aircraft manufacturer advised that:

a. With one engine inoperative, and with the landing gear and flaps retracted, the aircraft should achieve a climb rate of 500 feet per minute.

b. The airflow provided by the forward propeller and the airflow over the wings was not sufficient to rotate the rear propeller or cause it to windmill.

CASA issued Airworthiness Directive AD/CESSNA 337/9 `Rear Engine Idle RPM - Adjustment and Placard Installation' in August 1971. The AD followed advice from the manufacturer that some pilots had experienced difficulty in detecting partial power loss on the rear engine of Cessna Model 337 aircraft and contained two requirements:

a. 'Readjust the rear engine idle setting from 600+25 RPM to 650+25 RPM and readjust the mixture accordingly.'

b. Install a permanent placard adjacent to the tachometer as follows:

TAXI AND TAKEOFF LEAD WITH REAR ENGINE POWER CHECK RPM AND FUEL FLOW

The Cessna 337 Service Manual has since been updated to include the increased rear engine idle RPM. Compliance with this non-recurring AD was required within 10 operating hours.

AD CESSNA 337/9 was listed in the AD section of aircraft logbook for YGM. However, fire damage to the logbook precluded verification of compliance with the AD. Discussions with the personnel who performed the 100 hour periodic inspection indicated that they were aware of the requirements of the AD and that they recalled the placard being present next to the aircraft tachometer. They also reported that the engine idle speeds did not require adjustment and that both engines ran normally at ground idle for an extended period of time during an aircraft compass swing procedure.

The approximate weight of the aircraft at takeoff was 1905 kg. According to the Approved Flight Manual for the aircraft the stalling speed at this weight with flaps up was 68 kts indicated airspeed. The stalling speed with 1/3 flaps was 65 kts.

Other aircraft documentation indicated that the aircraft was operating with a permissible unserviceability at the time of the accident. This was issued by CASA on 4 June 1998 and permitted the aircraft to be ferried from Mareeba to Lismore via Mackay and additional refuelling stops as required with the left main fuel tank quantity indicator unserviceabl

Analysis

There were a number of observations and facts that supported the conclusion that the pilot conducted the takeoff with the rear engine not operating. These included the witness observations that the rear propeller was not rotating at the commencement of the takeoff roll, the recorded video evidence that the rear propeller was not rotating as the aircraft taxied for takeoff, and the takeoff ground roll distance. The already limited (single engine) climb performance of the aircraft would have been reduced further because the rear propeller was not feathered. An additional climb penalty would have arisen as the landing gear doors opened during the retraction cycle. At this stage, the position of the aircraft was probably such that the line of trees beyond the end of the runway precluded the pilot initiating a descent to maintain aircraft speed or conducting an emergency landing straight ahead. The witness observation that the rear propeller commenced rotating at this stage of the flight could indicate that the pilot was attempting to start the rear engine. A possible consequence of such an action was that he was unable to devote his full attention to flying the aircraft at that critical stage of the flight.

The left wing drop and sudden descent of the aircraft evident on the video recording, along with the impact attitude, indicated that the aircraft had aerodynamically stalled. The altitude at which this occurred was too low for the pilot to recover the aircraft to normal flight before ground impact, particularly with only the front engine operating. Had the recommended 1/3 flaps been set for takeoff, the resultant lower stalling speed would have provided a slightly greater safety margin than was available with flaps up. However, it is difficult to assess whether this would have changed the final outcome.

The pilot's low experience on type may have contributed to him failing to recognise that the rear engine was not operating during the takeoff. However, the cues provided by the recommended engine throttle handling technique and the engine instruments at the commencement of the takeoff roll should have been sufficient to alert him to such a situation. If the pilot was not wearing his required corrective lenses during take-off, he may have had difficulty reading the cockpit instruments.

No evidence was found to explain why the rear engine was not operating. It is possible that there was some fault with the engine that was masked by the fire damage and could not be identified during the engine examination. Alternatively, the pilot may have deliberately shut down the engine to prevent it overheating during delays before takeoff and forgotten to restart it again at the time of takeoff.

Factors

The following factors were considered relevant to the development of the accident:

1 The pilot conducted the takeoff with the rear engine not operating and the flaps up.

2 The pilot retracted the landing gear.

3 The aircraft aerodynamically stalled at an altitude from which the pilot was unable to recover to normal flight before ground impact.