Aviation Safety Investigation Report 199702649

Cessna Aircraft Company Cardinal

19 August 1997

Readers are advised that the Australian Transport Safety Bureau investigates for the sole purpose of enhancing transport safety. Consequently, Bureau reports are confined to matters of safety significance and may be misleading if used for any other purposes.

Investigations commenced on or before 30 June 2003, including the publication of reports as a result of those investigations, are authorised by the Executive Director of the Bureau in accordance with Part 2A of the Air Navigation Act 1920.

Investigations commenced after 1 July 2003, including the publication of reports as a result of those investigations, are authorised by the Executive Director of the Bureau in accordance with the Transport Safety Investigation Act 2003 (TSI Act). Reports released under the TSI Act are not admissible as evidence in any civil or criminal proceedings.

NOTE: All air safety occurrences reported to the ATSB are categorised and recorded. For a detailed explanation on Category definitions please refer to the ATSB website at www.atsb.gov.au.

Occurrence Number:	199702649Occurrence Type: Accident					
Location:	4 km NNW Ca	airns, Airpo	ort			
State:	QLD		Inv Cat	egory:	4	
Date:	Tuesday 19 Au	igust 1997				
Time:	1330 hoursTime Zone		EST			
<b>Highest Injury Level:</b>	Serious					
Injuries:						
		Fatal	Serious	Minor	None	Total
	Crew	0	1	0	0	1
	Ground	0	0	0	0	0
	Passenger	0	0	2	0	2
	Total	0	1	2	0	3
Aircraft Manufacture	r: Cessna Airc	raft Compa	iny			
Aircraft Model:	177		•			
Aircraft Registration:	VH-DZJ		Serial 2	Number:	17700142	
Type of Operation:	Charter	Passenger				
Damage to Aircraft:	Destroyed					
<b>Departure Point:</b>	Cairns QLD					
<b>Departure Time:</b>	1330 EST					
Destination:	Cairns QLD					

**Crew Details:** 

	Hours on				
Role	<b>Class of Licence</b>	<b>Type Hours</b>	Total		
Pilot-In-Command	Commercial	38.4	747		

Approved for Release: Friday, September 10, 1999

# FACTUAL INFORMATION

## Circumstances

The company's primary source of revenue was from scenic flights over the Great Barrier Reef. The flights were usually conducted in single-engine aircraft and at an altitude of 1,500 ft AMSL.

The planned one hour scenic flight was the third in a series of similar flights undertaken by the pilot in the aircraft that day. The pilot reported that, after a normal take-off, he was instructed by air traffic control to make a left turn, maintain 1,000ft, and track to a position abeam the control tower before proceeding to Green Island. When the aircraft was approximately abeam the control tower, the engine began to run roughly. This was followed by a significant power loss. The pilot immediately transmitted a mayday broadcast on the Cairns Approach frequency, advising that the engine had failed and that he would be returning to the runway. However, a short time later, the pilot assessed that the aircraft did not have sufficient altitude to reach the runway and he decided to land in a cleared area a short distance inland from the coast.

The pilot reported that he changed the position of the fuel selector soon after the engine lost power. He did this without looking down at the selector which was positioned on the floor of the aircraft. A short time later, when there was no apparent response from the engine, he moved the selector back to its original position, again without looking at the selector.

In the subsequent forced landing, the aircraft landed heavily in a left wing low, nose down attitude. It slewed left and hit a road sign before crossing a narrow sealed road and coming to rest against the gutter. There was no fire.

## Communications

The pilot's distress call was his first transmission after changing to the Cairns Approach frequency. The approach controller acknowledged the call and then asked the pilot to report his altitude and confirm the aircraft's registration. Later, the controller requested that the pilot change to the tower frequency. The pilot subsequently advised that these requests increased his workload and distracted him from the primary task of flying the aircraft.

The Manual of Air Traffic Services, page 17-2-1, stated in part; `Distress or urgency communications should be maintained on the frequency on which it was initiated until it is considered that better assistance can be provided by transferring to another frequency'. It also stated that `Staff shall be conscious of the distracting effect that information requests may have on the aircrew'. The investigation could not determine whether, or to what extent, the pilot's performance was affected by the requests from the approach controller.

Wreckage examination

The impact marks and the nature of the damage indicated that the aircraft struck the ground at low forward speed, but with a high descent rate. The aircraft sustained major structural damage to the forward fuselage area. The main spar of the left wing was broken at about the mid-span position and the nose and left main landing gear assembly had separated from the airframe. The engine/cockpit firewall and cockpit floor on the pilot's side was compressed rearward and upward into the cockpit area. The flaps were up.

The right wing fuel tank, the fuel filter, and the carburettor bowl were empty. The left wing tank contained approximately 60 lt of fuel. Distortion of the cockpit floor had locked the cockpit fuel selector control in the right tank position, confirming that it was in this position at impact. All fuel lines were clear of obstructions. The nature of the damage to the propeller indicated that it was either stationary or rotating slowly at impact. The magnetos and carburettor were undamaged. These were retained and the engine was removed from the wreckage and test run. It started and operated normally.

# The aircraft fuel system

Two integral tanks, one in each wing supplied fuel to the engine. Fuel from these tanks flowed through the fuel selector to a reservoir tank under the cockpit floor, then through a fuel shutoff valve and fuel strainer to the engine driven fuel pump. The fuel selector had three positions - LEFT, RIGHT and BOTH. Useable fuel in each wing tank was 91 lt. The aircraft was refuelled to approximately 60 lt per tank (120 lt total) prior to the first flight on the day of the accident. Recent fuel consumption tests conducted by the operator confirmed a usage rate of about 30 lt per hour.

The pilot advised that he normally operated the aircraft with the fuel selector in the BOTH position, as it was his experience that the tanks emptied at about the same rate during normal operations. Another company pilot advised that, because of an earlier indication of fuel imbalance, he had returned from the last flight on the previous day with the right tank selected. He did not move the selector from that position at the conclusion of the flight.

The aircraft operating handbook called for the fuel selector to be in the BOTH position for engine start and for it to be selected to BOTH during the pre-landing checks. A note in the handbook stated that the purpose of this check was to prevent engine failure due to one tank running empty.

## Survival aspects

Whilst the outcome of this occurrence was not a ditching event, it was considered relevant to investigate aspects of survivability given that the majority of flights conducted by the company were overwater scenic flights at an altitude of 1,500 ft AMSL. The single-engine land aircraft used by the company to conduct these flights were therefore operated beyond gliding distance of a suitable landing area in the event of an engine failure for a significant proportion of each flight.

The company provided waistpack type life jackets for passengers and pilots. The normal procedure was for passengers to wear the waistpacks, but to not undo the pack or don the jacket. Pilots usually stowed their life jackets under the cockpit seat. The expectation was that, in the event of an emergency occurring while the aircraft was over water, there would be sufficient time for the passengers and the pilot to don their life jackets before the aircraft ditched.

The pilot of DZJ reported that, when the emergency situation developed, he had insufficient time to consider the passengers, or to instruct them on the use of life jackets, had that been necessary. A similar situation existed concerning his life jacket.

## Recorded radar information

The recorded radar data showed that the aircraft's groundspeed for the last 20 seconds of flight was 49 kts. The aircraft handbook stated that the power off, flaps up stalling speed of the aircraft was 54 kts.

### ANALYSIS

The evidence indicated that the engine failed because of fuel starvation that occurred when the right tank contents were exhausted. Given the reported contents of each tank at the start of flying on the day of the accident, and the contents of the left tank when the aircraft impacted the ground, it is likely that the fuel selector was not moved from the RIGHT position after the aircraft was refuelled the day before the accident. This conclusion is supported by the evidence that, in the two-hour period the aircraft had operated that day, the engine would have used about 60 lt fuel.

The reserve fuel tank below the cockpit floor would have emptied after the right tank ran dry, causing the engine power loss. When the pilot moved the fuel selector during the emergency (probably to either BOTH or LEFT), fuel would have begun to flow to the reserve tank. However, it is probable that pilot reselected the empty right tank before there was sufficient fuel in the reserve tank to restore engine power.

The recorded radar data indicated that the aircraft speed in the latter stages of the flight was close to, if not below, the stalling speed. The aircraft impact attitude, and the extent and nature of the damage, supports this conclusion. This evidence, along with the fact that the flaps were in the UP position at impact, indicates that the pilot had mismanaged the aircraft during the forced landing.

#### SIGNIFICANT FACTORS

- 1. The pilot did not select the fuel system to the BOTH position prior to takeoff.
- 2. The engine ceased operation due to fuel starvation.
- 3. The pilot did not configure the aircraft appropriately for the forced landing.
- 4. The pilot did not maintain proper control of the aircraft.

#### SAFETY ACTION

While it was determined not to be a contributing factor in this occurrence, the Bureau believed that the safety implications of overwater operations in single-engine land aircraft carrying fare-paying passengers, required further investigation.

The Bureau considers that overwater operations in single-engine land aircraft carrying fare-paying passengers, at altitudes that will not allow the aircraft to glide to land (suitable for an emergency landing) in the event of an engine failure, is a high-risk practice. In particular, the outcome of a ditching event in a high-wing aircraft similar to the accident type presents obvious exit problems. The fact that this aircraft was equipped with fixed landing gear further reduces the survivability of a ditching event.

As a result, the Bureau of Air Safety Investigation issued the following interim recommendation to the Civil Aviation Safety Authority on 28 Jan 1998:

### R970176

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority reconsider the conditions of the current exemption to CAR 258 as it applies to passenger-carrying charter operations in single-engine land aircraft with a view to:

(a) minimising the likelihood of a ditching event; and

(b) minimising the risks associated with the outcome of a ditching event.

notitle Previous safety action

A previous fatal accident highlighted the safety implications of the practice of not correctly "donning" waistpack type life jackets during operations at or below 2,000 ft AMSL.

As a result of the investigation of that occurrence, the Bureau issued the following interim investigation to the Civil Aviation Safety Authority on 9 December 1997 (only the relevant parts of the interim recommendation have been reported below):

## "IR960138

The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority:

(i) review the current orders and regulations to ensure that the intention of Civil Aviation Order 20.11 part 5, governing the wearing of a life jacket is clear and unambiguous, and that jackets worn in accordance with the order afford the wearer the maximum safety benefit; and

(ii) educate the industry on the need to have life jackets worn in such a manner that they afford the wearer the maximum safety benefits."

The following response was received from the Civil Aviation Safety Authority on 21 May 1996 (only the relevant part of the response has been reproduced below):

"Interim recommendation (i)

It is CASA's opinion that the current provisions of CAO 20.11.5 are essentially adequate. However, this issue will be referred to the relevant Technical Committee under the Regulatory Review Program for its review.

Interim recommendation (ii)

CASA supports this proposal and is considering the best means to give effect on this recommendation."

Ongoing safety action

As a result of this and other similar occurrences, the Bureau of Air Safety Investigation intends to conduct a review of Australian aviation occurrences involving fuel starvation and exhaustion. This study is due to be completed prior to July 1999. Any recommendations issued as a result of this safety study will be published in the Bureau's Quarterly Safety Deficiency Report.