Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Aviation Occurrence Investigation AO-2007-037

Final

Controlled flight into terrain - 24 km S Tully, Qld 16 August 2007

VH- XMN

Pacific Aerospace Corporation Cresco 08-600

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Aviation Occurrence Investigation
AO-2007-037

Final

Controlled flight into terrain
24 km S Tully, Qld – 16 August 2007
VH-XMN
Pacific Aerospace Corporation Cresco 08-600

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office location: 62 Northbourne Avenue, Canberra City, Australian Capital Territory
Telephone: 1800 020 616; from overseas + 61 2 6257 4150
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117; from overseas + 61 2 6247 3117
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

ISBN and formal report title: see 'Document retrieval information' on page iv.

CONTENTS

DOCUMENT RETRIEVAL INFORMATION

Report No.	Publication date	No. of pages	ISBN
AO-2007-037	3 February 2009	41	**978-1-921602-08-5**

Publication title

Controlled flight into terrain – 24 km S Tully, Qld, 16 August 2007, VH-XMN, Pacific Aerospace Corporation Cresco 08-600

Prepared by

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608 Australia
www.atsb.gov.au

Reference No.

Jan2009/INFRA 08386

Acknowledgements

Google Earth (Figure 1)

Nick Dean (Figure 2)

Airservices Australia (Figure 3)

Bureau of Meteorology (Figure 5)

Abstract

On 16 August 2007 at 1454 Eastern Standard Time, the pilot of a Pacific Aerospace Corporation Cresco 08-600 aircraft, registered VH-XMN, departed from Ingham, Qld on a ferry flight under the visual flight rules (VFR) to Tully. The aircraft did not arrive at Tully and the next day the pilot and aircraft were reported missing.

Australian Search and Rescue (AusSAR) was notified and a search, based on the last radar observed position of an unidentified aircraft from a replay of recorded radar data, together with witness reports from the area, was initiated. Searchers located the aircraft wreckage on the morning of 18 August 2007. The aircraft had impacted mountainous terrain in a state forest 24 km south of Tully. The pilot was fatally injured and the aircraft was destroyed.

The circumstances of this occurrence were consistent with controlled flight into terrain resulting from visual flight rules into instrument meteorological conditions. The pilot did not provide a flight notification or SARTIME for the trip required for flight in a designated remote area. As a consequence, there was a delayed search and rescue response.

Following the investigation, the aircraft operator reviewed the company operations manual and added search and rescue procedures.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government. ATSB investigations are independent of regulatory, operator or other external organisations.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

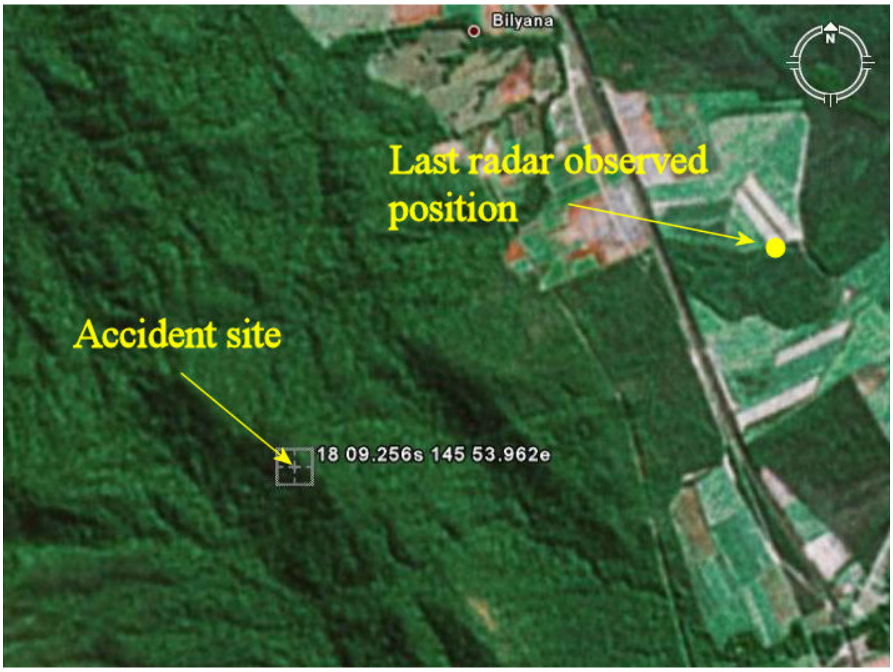
History of the flight

On 16 August 2007, the pilot of a Pacific Aerospace Corporation Cresco 08-600 aircraft, registered VH-XMN, was ferrying the aircraft under the visual flight rules (VFR) from the operator's base at Tully, Qld to Ingham and return. The flights, conducted in the private category without passengers, were to allow aircraft maintenance to be conducted at Ingham.

The flight from Tully to Ingham was conducted in the morning, with no reported difficulties. At 1454 Eastern Standard Time[1], the pilot departed Ingham on the return flight to Tully. The aircraft did not arrive at Tully.

It was not until the next day that the pilot and aircraft were reported missing. Australian Search and Rescue[2] (AusSAR) was notified and a search, based on the last air traffic control radar observed position of an unidentified aircraft from a replay of recorded radar data together with witness reports from the area, was initiated. Searchers located the aircraft wreckage on the morning of 18 August. The aircraft had impacted mountainous terrain in a state forest 24 km south of Tully (Figure 1). The pilot was fatally injured and the aircraft was destroyed.

Figure 1: Satellite image of accident location



1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

2 In general terms, AusSAR coordinates the Search and Rescue (SAR) response to aviation incidents across Australia.

Aircraft information

The aircraft, serial number 036, was manufactured in New Zealand in 2002 and was first registered in Australia in July 2004. The aircraft was of a low wing, fixed tricycle undercarriage design (Figure 2). It was powered by a single Pratt and Whitney Canada PT6A-34 750 horsepower turboprop engine and was fitted with a constant-speed, reversible, three-bladed Hartzell propeller. The total time in service for both the airframe and engine prior to the accident flight was 2,617 hours.

Figure 2: VH-XMN

The maintenance records indicated that the aircraft had been maintained in accordance with the aircraft manufacturer’s specifications and there were no outstanding or overdue maintenance requirements. It was reported that the aircraft was equipped with instrument flight rules (IFR) instrumentation. However, the aircraft had only been certified to operate under the VFR in Australia. The aircraft had a valid maintenance release that permitted day VFR operations only.

The maintenance carried out at Ingham on the day of the accident consisted of work to service and replace parts to correct a reported nose wheel shimmy. Also completed at that time was a scheduled dynamic propeller balance, which was found to be within specified limits.

The aircraft was refuelled at Tully prior to the flight, reportedly to a total of 422L of fuel on board. The aircraft had a maximum usable fuel capacity of 499L.

Information downloaded from an on-board fuel instrument indicated that 245L of fuel remained at the time of the accident. Estimations of fuel usage, based on approximate flight times and ground running of the engine during maintenance, confirmed that approximately 239L of fuel should have remained at the time of the accident.

The aircraft had a valid weight and balance certificate and the specified maximum take-off weight (MTOW) was 2,925 kg. Post accident weight and balance calculations indicated that the aircraft was 1,363 kg below the MTOW and within the required forward and aft centre of gravity limits at the approximate time of the accident.

A number of pilots endorsed on the Cresco 08-600 offered the following opinions to the investigation about the aircraft's handling characteristics:

- The aircraft was easy to control and it flew very well.
- The aircraft could climb at 3,000 feet per minute (fpm) at 80 kts. It could descend at 6,000 fpm at 160 kts and at a normal speed of about 140 kts would descend at 4,000 fpm.
- It could be a bit heavy on the rudder in climb and descent because there was no rudder trim.
- The cruise setting would normally provide an indicated airspeed (IAS) of about 135 kts.
- The aircraft was manoeuvrable and could be slowed to 45 kts IAS with full flap and idle power. Ten and 20 degrees of flap would normally have been able to be extended below 100 kts, and full flap could have been extended below 80 kts. In conditions of poor visibility, an optimal speed may have been about 80-90 kts.

The aircraft was configured for parachuting operations, with the only seats being two located in the cockpit. The pilot in command normally flew the aircraft from the right seat. It was reported that a pilot's view from the cockpit was very good and included the ability to look almost directly downwards.

There were two global positioning system (GPS) receivers on board the aircraft. One was a panel mounted receiver located on the far left side of the instrument panel and the other was a portable receiver, which was found in the pilot's bag. The panel mounted GPS receiver had a colour moving map display that did not provide any terrain information, but did display basic items such as major highways, train lines and the coastline. This basic information was able to be turned off to de-clutter the display. The unit did not have a ground proximity warning function and did not retain data in memory for later download and review. It was reported that the location of the unit made it difficult for the pilot to monitor or read the display when seated in the right seat.

While there had been previous faults with this unit's display, it was reported to have been fully serviceable prior to the accident and had last been repaired and inspected on 31 May 2007. The GPS receiver in the operating company's other Cresco aircraft was unserviceable at the time of the accident, and the portable GPS unit that was found in the pilot's bag was often used as a replacement for that unit. Previous faults with the panel mounted GPS units were reported to have included a 'no navigational data' message, an active screen with no figures, white lines across the screen and a totally blank screen.

The pilot was reported to have been very familiar with the use of both the panel mounted and portable GPS units. They had been used routinely whenever parachuting operations were conducted in the area because of the need for a high level of accuracy, especially when dropping parachutists over water to land back on the beach.

Pilot information

The pilot originally commenced working for the Cairns based operator as a parachute instructor and was reported to have made over 10,000 jumps. At the time of the accident, the pilot's weekly routine was 2 days flying and then parachute jump instructing for the remaining 5 days.

The pilot commenced flying training in March 2003 and was issued a Private Pilot (Aeroplane) Licence (PPL) in November 2003. In 2005, he commenced flying parachute sorties for the operator in a Cessna 182, and in October 2006 obtained an endorsement on the Cresco. The Cresco endorsement satisfied the requirement for a flight review at intervals no greater than 2 years.

The pilot had logged a total of 397.1 hours aeronautical experience, with 138.9 hours in Cresco aircraft, including 24.9 hours in the accident aircraft. The logged Cresco hours also included 54.8 hours under supervision. The majority of the pilot's flying hours had been gained while conducting local parachute jumping operations.

The pilot's licence allowed for day VFR operations only. The only entry in the pilot's log book for any instrument flying training was for 2.4 hours conducted during PPL training in 2003.

The pilot was held in high regard within the operating company, who considered him 'very professional in all that he did'. Others involved in the parachuting and flying operations also considered him to be a cautious and careful pilot.

The day before the accident, the pilot confided to a friend that he was a 'little concerned' about flying to Ingham the next day as he considered it 'a bit tricky' and that he might speak to some of the other pilots about it. The investigation was unable to discover any evidence of subsequent discussions with other pilots relating to this issue. The pilot's logbook indicated that he had flown the Ingham to Tully route once before, in the Cessna 182 in November 2006.

On the day of the accident, the pilot travelled for 2 hours by motor vehicle from Cairns to Tully, arriving at about 0830. He left his vehicle to be serviced at a local workshop in Tully, with the intention of collecting it that afternoon between 1500 and 1600. The pilot departed Tully for Ingham at about 0930.

The pilot held a current Class 2 medical certificate and was reported to have appeared fit, healthy and well rested on the day of the accident flight.

A post-mortem examination concluded that the pilot died of multiple injuries as a consequence of the aircraft accident. A toxicological examination did not detect any evidence of prescription or non-prescription drugs.

Flight planning

The *Aeronautical Information Publication* (AIP)[3] required that before beginning a flight, a pilot in command must study all available information appropriate to the intended operation. In the case of flights away from the vicinity of the aerodrome, that included a careful study of current weather reports and forecasts for the route to be flown and the aerodromes to be used.

3 AIP ENR 1.10.1, effective 7 June 2007.

The operator's pilots at Tully reported that weather reports, forecasts and other relevant information were normally obtained by using NAIPS[4]. The pilot had a valid NAIPS user identification that permitted access to the system. A search of recorded NAIPS data using this identification and alternative criteria did not discover any evidence of system access by the pilot on the day of the accident. Access may have been achieved by other means, but this was not recorded by NAIPS or not discovered by the search.

The AIP[5] stated that:

> When preflight briefing is obtained more than one hour prior to ETD [estimated time of departure], pilots should obtain an update before each departure to ensure that the latest information available can be used for the flight. The update should be obtained by NAIPS pilot access, telephone, or, when this is impracticable, by radio.

The pilot did not submit a flight plan for the flight and the AIP[6] did not require him to do so. There was also no record of the pilot having provided any other flight notification such as a SARTIME[7] or Flight Note (Appendix A). The AIP required pilots of VFR flights operating within a Designated Remote Area (DRA) to submit one of those two forms of notification. A flight from Ingham to Tully was within a DRA (Figure 3).

---

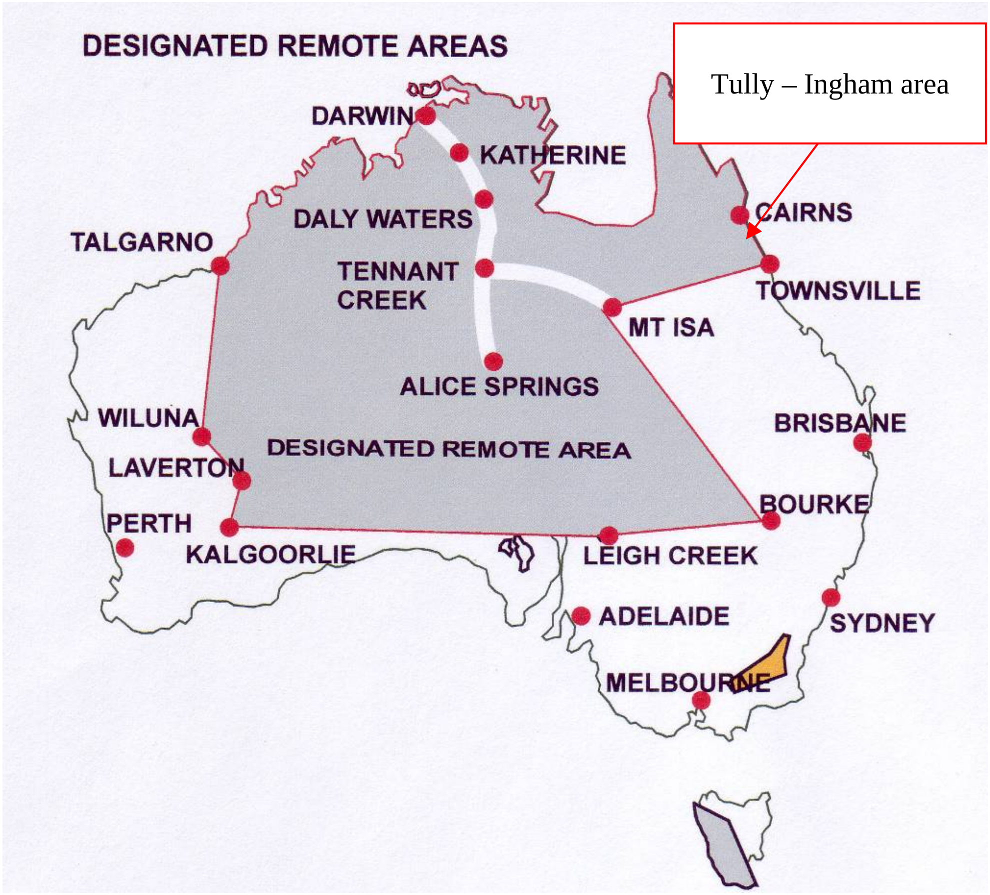
4 The Airservices Australia National Aeronautical Information Processing System (NAIPS) is a multi-function, computerised, aeronautical information system. The services available via electronic medium include pre-flight briefing, area briefing, general meteorological forecasts and flight notification.

5 AIP ENR 1.10.1.2.8, effective 7 June 2007.

6 AIP ENR 1.10.2.11, effective 7 June 2007.

7 The time nominated by a pilot to Air Traffic Services staff for the initiation of search and rescue action if a report has not been received by the nominated unit. An alternative is to leave a Flight Note containing relevant flight information with a responsible person, to alert search and rescue staff if the flight is overdue.

Figure 3: Designated Remote Areas[8]

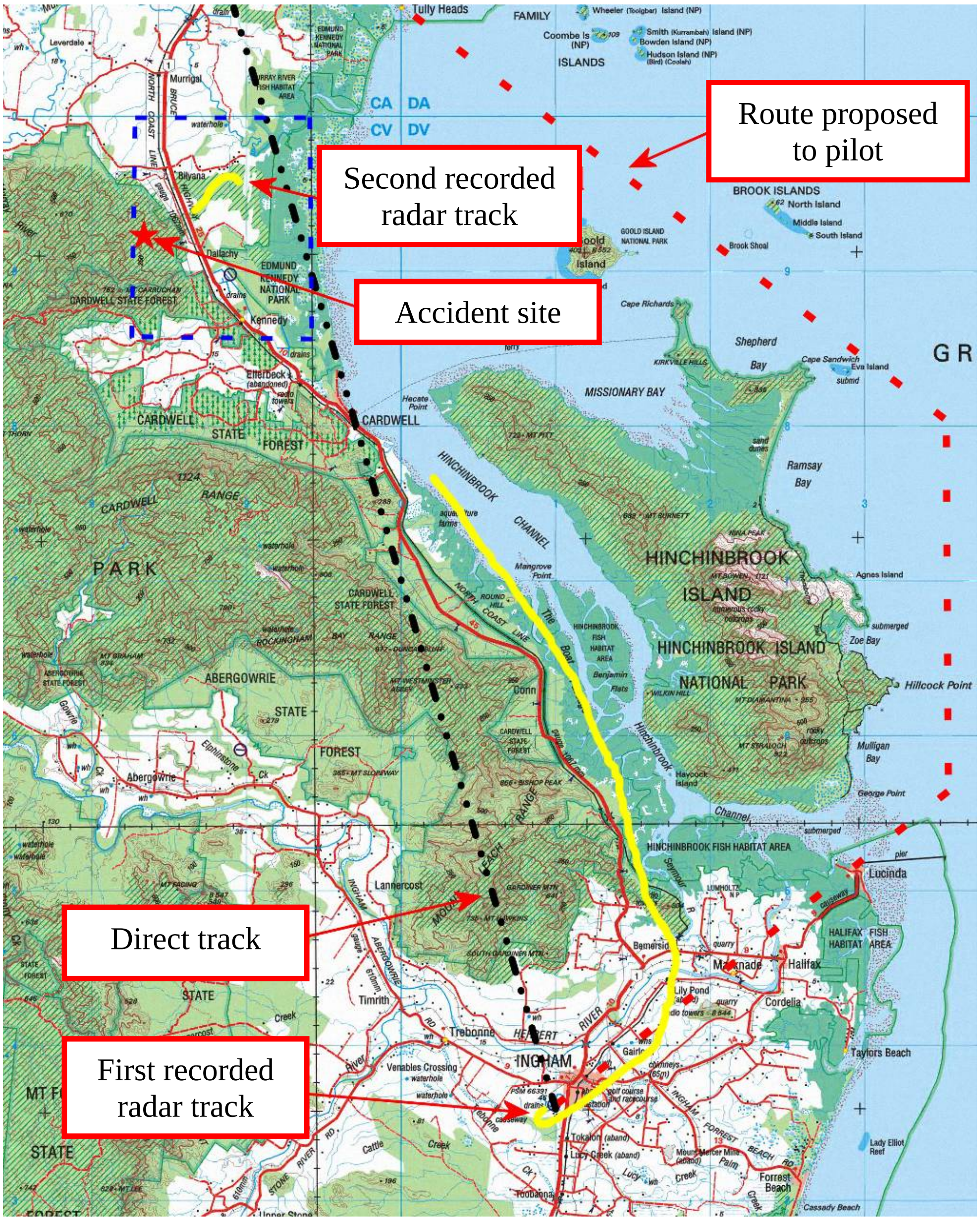


The aircraft maintainer at Ingham reported that while conducting part of the aircraft's maintenance he observed a world aeronautical chart (WAC) on the aircraft passenger's seat that showed a direct line drawn between Tully and Ingham (Figure 4). He discussed this with the pilot, who confirmed that he had flown that direct route from Tully to Ingham and planned to return the same way. The maintainer, who was also an experienced pilot, reported that they then discussed the significant hazards of flying that route over mountainous terrain in poor weather. They discussed other options for the return flight to Tully and the maintainer strongly suggested that the pilot should climb to either 8,000 or 10,000 ft and track east of Hinchinbrook Island, and then when approaching Tully descend visually over water. The pilot was reported to have considered that course of action to be a good idea and indicated that he planned to follow that route on departure. The aircraft maintainer later reported that at the time the weather to the north was poor, but with almost clear skies around Ingham and to the south.

The mountainous terrain in the area had included peaks of 3,677 ft on Hinchinbrook Island and 3,963 ft in the Cardwell Ranges on the mainland.

8 AIP ERSA GEN- FIS – 8, effective 7 June 2007.

Figure 4: Direct track, proposed route and recorded radar tracks



The maintainer indicated that there appeared to be no operational urgency for the flight. The aircraft was not required in Tully until mid-morning the next day. He had offered the pilot the free use of Ingham Airport facilities (bedroom, bathroom and motor vehicle) if the pilot wished to stay. The pilot declined the use of those facilities and indicated that because he had his vehicle in for a service at Tully, he wanted to get back before the end of the business day to pick it up.

After completion of the aircraft maintenance, the pilot had telephoned the Tully-based operations manager at about 1430 to discuss the Tully weather before departing. The operations manager reported that at that time he was not at Tully, but on the coast at Mission Beach (17 km to the east). He advised the pilot that from his location he could see west towards Tully and estimated the cloud base to be between 2,000 and 3,000 ft, and that the cloud appeared ‘fairly thin’, but that there were no ‘blue holes’. He told the pilot that it may have been a bit lower at Tully because he could not see the whole of the nearby mountain. While he had been unable to view the area to the south towards Ingham because of his location, visibility was good and there had been no rain in the area.

The pilot is reported to have advised the operations manager that he ‘was happy to give it a go’. He apparently informed the operations manager that he ‘might try to get up and above it’ and his most likely route was ‘coming around Hinchinbrook Island and through Tully Heads over the ocean’.

The maintenance staff observed the pilot completing pre-flight checks before he departed Ingham shortly before 1500. They did not sight the aircraft on departure, but they recalled that the sound of the engine indicated the pilot may have been climbing ‘straight up for height’.

A Tully-based company pilot had not discussed any tracking details with the pilot prior to the flight but later expressed an opinion that the pilot would probably have intended to go up the Hinchinbrook Channel, using the coastline as a reference and then follow the Tully River inland. Alternatively, he may have chosen to track as far as Cardwell and then follow the main highway north.

Visual Meteorological Conditions (VMC)

The *Aeronautical Information Publication*, section ENR 1.2, contained the specific requirements for VFR flight, including that it may only be conducted in visual meteorological conditions (VMC). The VMC requirements applicable to the pilot’s flight below 3,000 ft above mean sea level (AMSL) were:

- minimum flight visibility of 5,000 m
- clear of cloud and in sight of ground or water

Meteorological information

A large high pressure system was located offshore from New South Wales with fresh to strong south-east winds and generally cloudy conditions with some showers along the Queensland coast. A trough was situated over inland Queensland, well to the west of the area in which the accident occurred. The weather conditions were noted by the Bureau of Meteorology (BoM) to present a ‘low cloud issue’ for aviation during the morning (Figure 5)

At 1343, the BoM issued an amended area forecast for area 45 (Appendix B). That forecast covered an area north of the approximate mid-point position of the flight (abeam Cardwell) and included the following information:

> Cloud: Broken stratus with a base of 800 ft and tops of 2,000 ft at sea and on the coastal ranges, associated with precipitation. Scattered cumulus base 1,800 ft tops 12,000 ft at sea and on the coastal ranges. Broken stratocumulus base 3,500 ft tops 12,000 ft.
>
> Weather: Showers of rain, rain, drizzle.
>
> Visibility: 2,000 m associated with the showers of rain and drizzle, 4,000 m associated with the rain.

There were no aerodrome forecasts (TAFs) prepared for Tully and Ingham. The closest TAF available was that prepared for Innisfail Airport (YIFL), which was located approximately 45 km north-north-east of Tully (Appendix B).

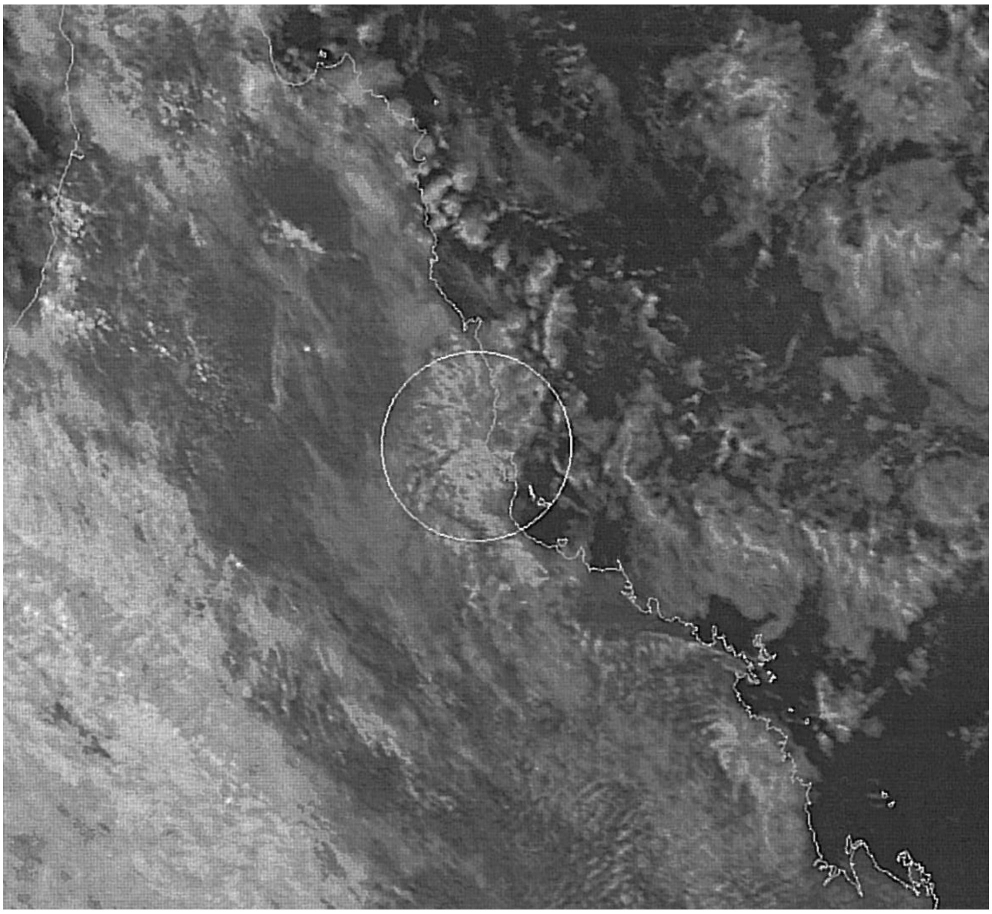
A meteorological observation at Cardwell, located approximately 17 km south-east of the accident site, recorded the following at 1500:

> Temperature 22.4 degrees Celsius, relative humidity 93%, mean sea level pressure 1016.6 hectopascals, wind east north-east at 22 km/h, weather slight rain, horizontal visibility 4000 m, cloud cover 8 oktas at 240 m [787 ft], cloud type cumulus of moderate or strong vertical extent.

Post accident, the BoM analysed all available weather information and provided advice that it considered that the weather conditions in the area at about 1500 were most likely to have been:

> …generally cloudy along the coast with isolated, predominantly coastal, showers and intermittent drizzle. Broken to overcast low cloud (5 to 8 oktas) with a base between 700 ft (coastal) and 1,000 ft (near ranges) above mean sea level depending on whether a shower was passing through at the time or not. South-east winds averaging about 10 kts.

Figure 5: BoM visible satellite image at 1501 showing considerable cloud in the local area (circled)



Witness and pilot reports

The investigation interviewed four witnesses located in the area to the east of the accident site. Witness recollections were generally consistent in describing the aircraft at low level, somewhere between 300 and 1,000 ft. Descriptions of weather in the area at the time varied from cloud with a 1,000 ft base and visibility of 8 km to heavy wet fog and rain. There were no witness reports of any aircraft abnormality.

A VFR pilot reported flying past Ingham, enroute to Tully and Innisfail, between 1400 and 1430 on the day of the accident. This pilot reported tracking via the Hinchinbrook Channel between the coast and the island, while maintaining an altitude of 500 ft to remain clear of cloud. Light rain showers encountered had been moving on to the coast ‘in waves’, but that towards Tully the weather improved and he recalled that the hills to the east of Tully were clearly visible with some ‘patchy sunshine’. After passing to the east of Mission Beach, the pilot was able to maintain 700 or 800 ft, and further to the north was able to climb to 1,500 ft.

Recorded information

A review of Airservices Australia (Airservices) recorded air traffic services audio data found no record of any radio transmissions relating to the accident flight. Air traffic services staff reported that two-way communications were available almost to ground level at Ingham. They considered that the lowest level for two-way communications between Ingham and Tully varied between an altitude of 1,000 and 2,000 ft, depending on an aircraft’s location.

The aircraft had been fitted with a Mode 3A and Mode 3C secondary surveillance radar (SSR) transponder. A review of the Airservices recorded radar data showed that two separate unidentified radar tracks closely matched the information about the accident flight provided by witnesses (Figure 4). These code 1200[9] radar tracks were almost certainly two portions of the same flight by VH-XMN and were consistent with the expected limited low-level radar coverage between Ingham and Tully. Full details of the recorded radar data are included in Appendix C.

The first radar returns showed that after the aircraft had become airborne at Ingham, the pilot had commenced a left turn to track in a north-easterly direction. That track was consistent with the proposed route to track to the east of Hinchinbrook Island. Although the aircraft’s Mode C altitude had not been verified[10], the radar indicated that the pilot had climbed to and maintained an altitude of 2,100 ft for about 30 seconds. The pilot then commenced a turn initially to the north-north-east and then a short time later onto a north-north-westerly heading. That track roughly followed both the main highway and coastline through the Hinchinbrook Channel. At the same time the radar observed altitude decreased to between 1,100 ft and 800 ft AMSL.

---

9 SSR code for aircraft operating VFR in Class G airspace.

10 Verification is the process of Air Traffic Services staff checking the observed Mode C pressure altitude-derived level information with a pilot report of the altimeter-derived level information to ensure its accuracy.

The last radar return of that first portion of the flight was recorded at 1505:56. The aircraft had been just to the south of Cardwell maintaining an altitude of 800 ft, on a heading of 330 degrees true and with a groundspeed of approximately 140 kts.

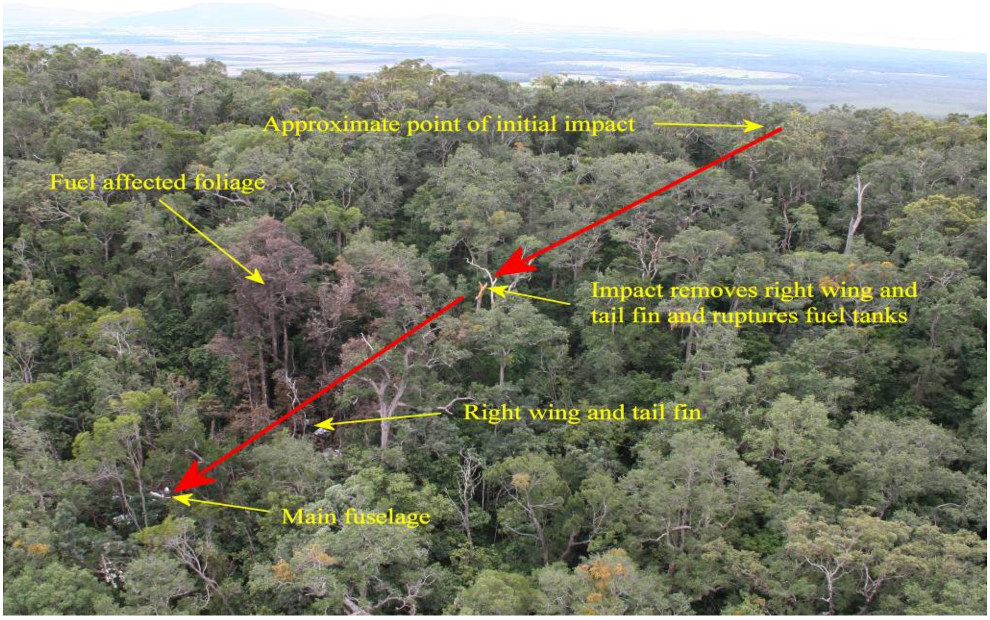
The next radar return had been recorded at 1511:21, 21.7 km (11.7 NM) south of Tully. The aircraft appeared to have been in a climbing left turn before descending and taking up a south-westerly heading. The aircraft once again disappeared from radar and the last observed radar return at 1512:26 was later calculated to be 3.3 km (1.8 NM) from the accident site (Figure 1), with a groundspeed of between 100 and 120 kts.

The final radar returns also showed that over a period of 65 seconds, the pilot had climbed from an altitude of 1,700 ft to 2,300 ft, before descending to 1,400 ft and disappearing from radar coverage. That descent rate was about 1,800 ft/min.

Wreckage and impact information

The aircraft initially impacted large trees near the top of a ridge line, at an elevation of 1,279 ft AMSL (Figure 6). The outer section of the left wing separated and the aircraft continued forward on a bearing of approximately 260 degrees magnetic. After colliding with a number of smaller trees that caused additional damage, the aircraft impacted another large tree, which resulted in the outer and middle sections of the right wing, together with the tail fin separating from the fuselage. The impact forces also ruptured the fuel tanks and distributed fuel forward over a large section of the forest.

Figure 6: Wreckage trail



The impact trajectory prior to the aircraft coming to rest was calculated to be approximately 45 degrees. The fuselage, together with the engine, inner section of both wings, horizontal stabiliser and rudder came to rest on a large rock (Figure 7).

Figure 7: Forward fuselage and engine resting on a large rock

Examination of the aircraft wreckage accounted for all major parts of the aircraft, including all flight control surfaces, at the accident site. Continuity of the flight control systems was established. All structural fracture surfaces were examined onsite and there was no evidence of any pre-existing defect with the aircraft that would have contributed to the accident.

While examination of the wreckage indicated that the flaps might have been in the fully extended position, the extensive damage to the wings and flap mechanism precluded any accurate assessment of the selection position prior to the impact.

The engine was inspected on site and there was no evidence of any pre-impact defects. Continuity of the engine controls was established. Examination of the power turbine blades indicated that they had fractured in overload due to the blade tips coming in contact with the power turbine shroud (Figure 8). Approximately two-thirds of the blades were missing and the remainder were broken at the tips. There was also evidence of rotational damage to the power turbine shroud. The damage to the power turbine and shroud were indicative of the engine producing significant power at impact.

Figure 8: Damage to power turbine blades

The propeller and forward section of the engine reduction gearbox were located approximately 15 m from the main fuselage (Figure 9). One blade had fractured in overload at the propeller hub and it was located approximately 30 m back along the wreckage trail. All of the blades exhibited significant bending due to rotation impact damage and had approximately 25 cm sections missing from their tips. These fracture surfaces showed evidence of overload due to rotational impact forces. There was no evidence of any pre-existing propeller defects. The rotational damage to the propeller indicated that the engine was producing significant power at the time of impact.

Figure 9: Propeller showing blade bending and missing tip section

There was evidence of smoke and fire damage to some parts of the wreckage and trees forward of where the second major tree impact occurred. This was consistent with small post-impact fires within the area covered by the fuel spray. No other sections of the wreckage displayed any evidence of smoke or fire damage.

The first rescuers on the scene documented that the pilot was seated in the right seat, that the four point harness had been secured and was intact, and that the pilot had been restrained by that harness during the accident sequence. The on-site investigation team noted that there had been clear evidence that the cockpit had been breached by tree branches during the accident sequence (Figure 10).

Figure 10: Damage to cockpit area

The panel mounted GPS had been damaged as a result of the impact and it could not be determined whether the unit had been selected ON at the time of the accident. The unit was not recovered from the accident site.

The aircraft's altimeter setting[11] indicated 1014 hectopascals.

A number of operational documents were recovered from the aircraft wreckage, including the chart referred to by the aircraft maintainer, but there was no evidence of any weather forecasts or pre-flight briefing material.

The aircraft was fitted with an emergency locator transmitter (ELT) as required by the Civil Aviation Regulations. No reports of ELT transmissions had been received by AusSAR as a result of the aircraft accident. Inspection of the ELT fitted to the aircraft indicated that it had been activated by the impact forces. The external ELT antenna had sustained impact damage.

---

11 When there is no official local QNH available at an airfield and the site elevation is known, the local QNH can be derived by setting the sub-scale when the aircraft is on the ground so that the altimeter indicates the known airfield elevation.

VFR into IMC occurrences

In June 2004, the Australian Transport Safety Bureau (ATSB) published an aviation research paper titled, *General Aviation Fatal Accidents: How do they happen*? *A review of general aviation accidents 1991 to 2000.* The data reported in the paper showed that there were 163 fatal aeroplane accidents in the 10 year period, of which 22 or 13.5 % were identified as VFR into IMC. Those 22 accidents resulted in 52 fatalities, which corresponded to 15.7 % of the 331 fatalities.

In 2005, the ATSB published an aviation research investigation report titled *General Aviation Pilot Behaviours in the Face of Adverse Weather*[12]. That report explained that:

> Weather-related aviation accidents remain one of the most significant causes for concern in aviation safety. This is despite over half a century of work by aviation professionals and human factors researchers aimed at understanding the reasons behind accidents such as those involving Visual Flight Rules flight into Instrument Meteorological Conditions ('VFR into IMC').

The report in part considered different pilot responses to adverse weather, discussed pilot decision making and highlighted the well known dangers associated with VFR flight into IMC.

> A VFR pilot may exhibit a range of behaviours when faced with adverse weather. For example, at the first hint that conditions are deteriorating, a pilot may decide that discretion is the better part of valour and immediately return to their point of departure and recount their brush with danger to an instructor or to fellow pilots in the clubrooms. At the other extreme, a pilot may 'press on' into deteriorating weather, either unable or unwilling to see the increasing danger of their actions, until the aircraft suddenly enters IMC and they have only minutes to rue their reckless behaviour before the flight ends in disaster. A more typical scenario might involve a pilot who, in response to deteriorating conditions, initially continues the flight as planned, but subsequently decides to return, divert, or perhaps even carry out a precautionary landing.
>
> However, whatever the pilot's response to deteriorating weather, the final outcome of a safety-related occurrence will depend on a myriad of factors, and in the final analysis chance can play a significant part.
>
> This research reinforces the significant dangers associated with VFR flight into IMC – 76% of VFR into IMC accidents involved a fatality. The chances of a VFR into IMC encounter increased as the flight progressed until they reached a maximum during the final 20% of the flight distance. This result highlights the danger of pilots 'pressing on' to reach their destination.
>
> The results emphasise that a safe pilot is a proactive pilot and that dealing with adverse weather is not a one-off decision but a continually evolving process.

12 *General Aviation Pilot Behaviours in the Face of Adverse Weather*- Australian Transport Safety Bureau Aviation Research Investigation Report B2005/0127 Hhttp://www.atsb.gov.au/publications/2005/Pilot_behaviours_adverse_weather.aspx

VFR into IMC risk controls

The *Day VFR Syllabus - Aeroplanes*, published by the Civil Aviation Safety Authority (CASA), contains the competency standards for private and commercial aeroplane licences, including a number of competencies and elements that could be related to the management of VFR into IMC risk. Issue 4 of the syllabus, effective from 1 March 2008, contained new units of competency including threat and error management and single pilot human factors. CASA advised that assessment of the new units will commence on 1 January 2009.

Threat and error management (TEM) is a relatively new operational concept applied to flight that includes the traditional role of airmanship and provides a structured and proactive approach that pilots can apply to identify and manage threats and errors that could affect the safety of flight.

Single pilot human factors is a new competency that includes the following skills:

- maintaining effective lookout
- maintaining situational awareness
- assessing situations and making decisions
- setting priorities and managing tasks
- communications and interpersonal relationships.

Guidance regarding the new competencies was included in Civil Aviation Advisory Publication (CAAP) 5.81-1(0) *Flight Crew Licensing Flight Reviews*, dated November 2007. Essentially, the biennial assessment of a pilot’s skills and knowledge was to include discussion and application of threat and error management and single pilot human factors.

A risk control introduced on 10 March 2000 was the private IFR rating. In its most basic form, the rating allows flight under the IFR for enroute navigation, but is limited to visual conditions for climb and descent below the lowest safe altitude.

The Civil Aviation Safety Authority has produced two media discs to address weather-related decision making. *Weatherwise* is an interactive presentation to enhance the ability of pilots to identify hazardous weather conditions. The *Weather to fly* disc features interviews with senior pilots and human factors experts, and inflight footage of specific locations.

ANALYSIS

Introduction

The circumstances of this occurrence were consistent with controlled flight into terrain resulting from visual flight rules (VFR) into instrument meteorological conditions (IMC). The following analysis examines the development of the accident sequence.

Controlled flight into terrain

Based on information from witnesses in the area and the Bureau of Meteorology (BoM), it is likely that the pilot was operating in IMC immediately before and at the time of the accident. Those conditions would have presented flight control and navigation difficulties to a pilot who was not qualified to operate in IMC.

On the information available, the investigation was unable to positively determine whether the pilot was in control of the aircraft when it impacted terrain. The last radar plots that were probably generated by the accident aircraft show erratic altitude keeping and an abnormal descent rate of 1,800 ft/min. However, the likely trajectory of the aircraft during the impact sequence as derived from the onsite examination did not indicate any abnormal attitudes. Since the last radar plot was 3.3 km from the accident site the impact trajectory evidence was more proximate, so the pilot was probably in control at the time of the accident.

In visibility below 5 km, navigation by visual reference to the ground becomes very difficult unless the pilot is very familiar with the terrain. In this case, the visibility probably deteriorated to well below 5 km, the pilot was not familiar with the terrain, and the difficulty was increased somewhat by the aircraft's speed. While the pilot probably had access to global positioning system (GPS) information, the displayed speed, distance and time data likely to be referenced to Tully would have had limited value in alerting the pilot to the specific location of high terrain relative to his position. Given the circumstances, the pilot probably became unsure of his position in poor visibility and was trying to negotiate the local terrain when the aircraft impacted trees. The force of the initial impact probably slowed the aircraft, resulting in a relatively steep downwards trajectory.

There was no obvious explanation for the aircraft's track towards high terrain in the last part of the flight, when there was lower terrain along the coast to the east. It might have been a response to the local weather situation or it might have been a product of pilot disorientation generally.

VFR into IMC

It is apparent that at some point during the flight, the aircraft entered IMC from which the pilot was unable to safely escape. While the pilot's reasons for proceeding were not determined, there is value in examining the context for any lessons for other pilots.

There was no evidence that the pilot had accessed any pre-flight weather forecasts or subsequent forecast updates from the National Aeronautical Information Processing System. Those forecasts produced by the BoM correctly identified that low cloud and reduced visibility were to be expected along the route between Ingham and Tully, indicating that VFR flight would be marginal at best. Whether the pilot accessed the forecasts or not, the pilot's discussion with the maintainer and calls to the operations manager indicated that the pilot was aware that there was marginal weather between Ingham and Tully.

Given that the weather was suitable for VFR at Ingham and Tully, and that the flight was relatively short, the pilot's decision to depart was understandable. The radar information shows that the pilot tracked up the Hinchinbrook Channel, rather than around Hinchinbrook Island as he had indicated to the maintainer and operations manager before the flight. Irrespective of the pilot's intentions, it is reasonable to assume that after departure, the pilot must have considered the weather along the channel to be suitable and he tracked accordingly.

The point(s) where the pilot encountered IMC was difficult to establish. The observation at Cardwell at about the time of the aircraft's passing of 8 oktas of cloud at 787 ft, visibility of 4,000 m and slight rain showers, indicates that the conditions were probably below VMC. By the time the aircraft was observed by witnesses near the accident site, the weather had almost certainly deteriorated to IMC. The account by the VFR pilot who flew past Ingham and up the Hinchinbrook Channel about 40 minutes ahead of the pilot of the Cresco illustrated the dynamic nature of the local weather.

As is common for this type of occurrence, the investigation was unable to determine why the pilot continued into deteriorating weather conditions for which he was not qualified. However, there were a few factors that might have influenced the pilot's decision making. With a vehicle pickup planned for his return to Tully, the pilot might have been subject to the tendency often called 'get-there-itis' or 'press-on-itis', and accepted more risk than he usually would. Similarly, the pilot might have been influenced by the tendency identified in ATSB research to continue a flight into adverse weather after the half-way point of the journey.

VFR into IMC risk management

VFR into IMC is primarily a pilot decision making issue. As such, the introduction of threat and error management and single pilot human factors competencies to initial pilot training and flight reviews has the potential to reduce the frequency of VFR into IMC occurrences. Exposure of pilots to the *Weatherwise* and *Weather to fly* media discs produced by Civil Aviation Safety Authority also has the potential to reduce the frequency of weather-related occurrences.

Search and rescue

No-one, including the operator, had been awaiting the arrival of the pilot and aircraft at Tully, resulting in a delay to the initiation of the search and rescue response. While in this case the pilot had been fatally injured as a result of the aircraft impact sequence, the delay might have been of greater significance in other circumstances. The accident highlights the importance of the submission of some form of flight notification such as a SARTIME or Flight Note to ensure the minimum delay in the search and rescue response.

While there had been an approved emergency locator transmitter (ELT) fitted to the aircraft, no emergency signal was received by AusSAR. On-site inspection of the ELT determined that it had been activated as a result of the impact forces; however the external antenna had sustained impact damage preventing the radiation of a signal of sufficient strength to be detected.

FINDINGS

From the evidence available, the following findings are made with respect to the controlled flight into terrain that occurred approximately 24 km south of Tully, Qld on 16 August 2007 involving a Pacific Aerospace Corporation Cresco 08-600 aircraft, registered VH-XMN, and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The aircraft probably entered an area of weather that deteriorated below visual meteorological conditions and for which the pilot was not experienced or qualified.
- The pilot probably became unsure of his position in poor visibility, leading to controlled flight into terrain, fatally injuring the pilot and destroying the aircraft.

Other safety factors

- The aircraft had not been configured for poor visibility operations, possibly increasing the pilot's difficulty in navigating.
- The pilot did not submit any form of flight notification such as a SARTIME or Flight Note, as required for a flight in a designated remote area, resulting in a delay to the search and rescue response.
- The operator did not have procedures to provide assurance that a search and rescue would be initiated in a timely way if one of their aircraft did not arrive at the planned destination. *[Safety issue]*
- As a result of damage to the emergency locator beacon antenna, the beacon did not alert search and rescue organisations to the aircraft accident.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Action sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Aircraft operator

Search and rescue procedures

Safety issue

The operator did not have procedures to provide assurance that a search and rescue would be initiated in a timely way if one of their aircraft did not arrive at the planned destination.

Action taken by the operator

The operating company has advised that their Airside Operations Manual has been amended to add the following search and rescue (SAR) procedures:

> SAR watch will be implemented for the following flight types:
>
> - ferry flights to/from Tully to/from Cairns
> - ferry flights to/from Ingham to/from Tully
> - any other non-operational flights, whereby the aircraft will be relocated to a different destination from the departure point.
>
> Prior to departure the Pilot in Command, (PIC) will notify the Operations Managers, (in his absence the daily DZSOs) of both his departure location and his destination advising of the following:
>
> - registration of aircraft
> - estimated time of departure
> - estimated time of arrival
> - description of intended route to be followed for flight
> - maximum duration of flight with available fuel onboard.

For flights to either the maintenance facility or another location the PIC will notify the Operations Manager at his departure point prior to departure and again on arrival at final destination. The maintenance facility will also be required to be notified of the flight details including the following information:

- registration of aircraft
- estimated time of departure estimated time of arrival
- description of intended route to be followed for flight
- maximum duration of flight with available fuel onboard.

In the event greater than 60 minutes has lapsed since the estimated arrival time at the pre-determined destination, the Operations Manager will commence the following Search and Rescue action:

- contact aircraft owner of possible SAR situation
- communicate directly with notified person at pre-determined destination as to PIC and aircraft location
- contact Airservices Australia (ASA) enquiring of PIC and aircraft whereabouts
- if unknown location of PIC and aircraft inform AusSAR on 1800 815 257 of possible SAR situation.

APPENDIX A: SOURCES AND SUBMISSIONS

Sources of information

The sources of information during the investigation included:

- pilots that had flown the aircraft previously
- the operator
- the aircraft's maintenance organisation
- the aircraft's maintenance records
- the Bureau of Meteorology
- Airservices Australia recorded information.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the Executive Director about the draft report.

A draft of this report was provided to the aircraft operator, aircraft maintainer, the engine manufacturer, the State of Manufacturer, the Civil Aviation Safety Authority and the Bureau of Meteorology.

Submissions were received from the Civil Aviation Safety Authority. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

APPENDIX B: FLIGHT NOTE

FLIGHT NOTE

Note: All times are local at that location (PRINT NEATLY)

Latest Cancellation Time at Final Destination: (Local Time)			**Date:**
Call-sign:	**Type:**	**Navaids:** (Carried & used; include GPS)	
Pilot's Name:	**Mobile Tel No:**	**Home Contact:** (Name/Tel No)	**TAS:** KT

Complete a separate line for each flight sector.

DEP AD / Point & Tel No	**ETD** (Local Time)	**Route** (Turning Points)	**DEST & Tel No**	**POB**	**Endurance** HR	MIN

Remarks: (Mobile phone number of passengers / registration if different from call-sign / any other useful information to aid Search and Rescue)

Emergency Equipment: (Tick box as appropriate)

ELT: fixed ☐ portable ☐ Insert frequency if known: ☐

First Aid ☐ **EMERG Rations** ☐ **Water** ☐ **Lifejackets** ☐ **Liferaft** ☐ capacity/colour: ☐ / ☐

Other Signalling / Life-saving Devices:

Aircraft Colour / Markings:	**Operating Company Name / Contact No:**

The holder of this Flight Note should contact AusSAR if the pilot has not arrived at the destination by the cancellation time above. Any delay could be crucial to the safety of the occupants of the aircraft.

AusSAR: 1800 815 257 (freecall)

APPENDIX C: METEOROLOGICAL INFORMATION

All times in the following forecasts, except where otherwise specified, are Coordinated Universal Time (UTC).

Area forecast area 45 issued by BoM at 152100 UTC.

AREA FORECAST 152300 TO 161100 AREA 45

OVERVIEW:

FIRM RIDGE ALONG EAST COAST. ISOLATED SHOWERS. AREAS OF RAIN SW OF CHERY TO YGTN. DRIZZLE AREAS E SEA COAST RANGES S OF YCKN. ISOLATED AREAS OF SMOKE.

SUBDIVISIONS:

A: N OF HANKY TO YMBA

B: S OF HANKY TO YMBA

WIND:

	2000	5000	7000	10000	14000	18500
A.	110/35	090/30	070/20	070/15 PS09	060/20 PS03	040/20 MS06
B.	130/20	120/15	050/10	030/10 PS09	030/10 PS02	020/15 MS07

CLOUD:

BKN ST 0800/2000 SEA COAST RANGES, BASE 1000 LAND, IN PRECIPITATION. SCT CU 1800/12000 SEA COAST RANGES, 3500/12000 INLAND.

BKN SC 3500/12000.

BKN ACAS ABOVE 9000 SW OF CHERY TO YGTN.

WEATHER:

SHRA, RA, DZ, SMOKE.

VISIBILITY:

2000M SHRA, DZ.

4000M IN RA.

8KM SMOKE REDUCING TO 2000M IN THICK SMOKE.

FREEZING LEVEL:

15500

ICING:

MOD IN ACAS.

TURBULENCE: ISOL MOD BELOW 8000 TENDING OCNL BELOW 6000. MOD LARGE CU, AC. MOD THERMALS TO 8000 LAND DURING DAYLIGHT HOURS.

Amended area forecast area 45 issued by BoM at 160343 UTC.

AMEND AREA FORECAST 160400 TO 161700 AREA 45

AMD OVERVIEW:

FIRM RIDGE ALONG EAST COAST. ISOLATED SHOWERS. AREAS OF RAIN SW OF CHERY TO YGTN. DRIZZLE AREAS E SEA COAST RANGES S OF YCKN FROM 15Z. ISOLATED AREAS OF SMOKE.

SUBDIVISIONS:

A: N OF HANKY TO YMBA

B: S OF HANKY TO YMBA

WIND:

	2000	5000	7000	10000	14000	18500
A.	110/35	090/30	070/20	070/15 PS09	060/20 PS01	040/20 MS06
B.	140/20	140/20	050/10	030/10 PS11	030/20 PS02	030/20 MS07

CLOUD:

BKN ST 0800/2000 SEA COAST RANGES, BASE 1000 LAND, IN PRECIPITATION. SCT CU 1800/12000 SEA COAST RANGES, 3500/12000 INLAND.

BKN SC 3500/12000.

BKN ACAS ABOVE 9000 SW OF CHERY TO YGTN.

WEATHER:

SHRA, RA, DZ, SMOKE.

VISIBILITY:

2000M SHRA, DZ.

4000M IN RA.

8KM SMOKE REDUCING TO 2000M IN THICK SMOKE.

FREEZING LEVEL:

15500

ICING:

MOD IN ACAS.

TURBULENCE:

ISOL MOD BELOW 8000 TENDING OCNL BELOW 6000.

MOD LARGE CU, AC.

MOD THERMALS TO 8000 LAND DURING DAYLIGHT HOURS.

Aerodrome forecast (TAF) for Innisfail Airport (YIFL) issued by BoM at 151849 UTC.

TAF YIFL 151849Z 152008

VRB05KT 9000 -DZ SCT010 BKN018

FM02 15010KT 9999 -SHRA SCT015 BKN020

TEMPO 2008 3000 SHRA BKN010

RMK

T 20 22 24 24 Q 1017 1018 1018 1016

Aerodrome forecast (TAF) for Innisfail Airport (YIFL) issued by BoM at 160606 UTC.

TAF YIFL 160606Z 160614

15010KT 9999 -SHRA SCT012 BKN020

TEMPO 0614 3000 SHRA BKN010

RMK

T 23 21 20 Q 1016 1018 1020

Meteorological Observations at Ingham Composite

Site Number 032078 • Locality: Ingham • Opened Feb 1968 • Still Open • Latitude 18°38'58"S • Longitude 146°10'37"E • Elevation 11.8m

	Air Temperature	Relative Humidity	MSL Pressure	Wind	Rainfall	Present Weather	Past Weather
	°C	%	hPa	km/h	mm	description	description
Thursday 16 August 2007							
9:00 am	22.5	99	1019.4	ESE 8	0.8	Cloud forming or developing	Cloud forming or developing
3:00 pm	24.1	81	1017.0	ESE 18	0.0	Cloud forming or developing	Cloud forming or developing

	Horizontal Visibility	Cloud Cover	Low Cloud Cover	1st Cloud Amount	1st Cloud Type	1st Cloud height	2nd Cloud Amount	2nd Cloud Type	2nd Cloud height	Mid Cloud Amount	Mid Cloud Type	High Cloud Amount	High Cloud Type
	metres	oktas	oktas	oktas	code	metres	oktas	code	metres	oktas	code	oktas	code
Thursday 16 August 2007													
9:00 am	10000	7	7	7	6	270							
3:00 pm	10000	7	7	7	6	270							

Meteorological Observations at Cardwell Marine Pde

Site Number 032004 • Locality: Cardwell • Opened Jan 1871 • Still Open • Latitude 18°15'19"S • Longitude 146°01'11"E • Elevation 5m

	Air Temperature	Relative Humidity	MSL Pressure	Wind	Rainfall	Present Weather	Past Weather
	°C	%	hPa	km/h	mm	description	description
Thursday 16 August 2007							
6:00 am	21.0	92	1017.4	SSE 5	0.6	Cloud forming or developing	Cloud not observed or not observable
9:00 am	21.9	87	1019.2	SSE 13	0.0	Cloud generally dissolving or becoming less well developed	Slight intermittent DRIZZLE
3:00 pm	22.4	93	1016.6	ENE 22	0.6	Slight RAIN SHOWER	Slight RAIN SHOWER

	Horizontal Visibility	Cloud Cover	Low Cloud Cover	1st Cloud Amount	1st Cloud Type	1st Cloud height	2nd Cloud Amount	2nd Cloud Type	2nd Cloud height	Mid Cloud Amount	Mid Cloud Type	High Cloud Amount	High Cloud Type
	metres	oktas	oktas	oktas	code	metres	oktas	code	metres	oktas	code	oktas	code
Thursday 16 August 2007													
6:00 am	20000	8	8	8	5	300							
9:00 am	30000	8	8	1	7	180	8	5	900				
3:00 pm	4000	8	8	8	2	240							

APPENDIX D: RECORDED RADAR DATA

Recorded radar data for unidentified aircraft tracks (edited)

Time (UTC)	Groundspeed (kts)	Altitude (ft)	Heading (true)
14:53:32	60	200	250
14:53:37	100	300	246
14:53:42	90	500	242
14:53:47	90	600	232
14:53:52	90	800	222
14:53:57	70	900	213
14:54:02	50	1000	196
14:54:07	40	1100	168
14:54:12	30	1200	137
14:54:17	30	1300	111
14:54:22	40	1400	092
14:54:27	50	1500	078
14:54:32	50	1500	078
14:54:37	60	1600	070
14:54:42	60	1600	070
14:54:47	60	1600	070
14:54:52	70	1800	074
14:54:57	70	1900	066
14:55:02	70	1900	066
14:55:07	80	2000	066
14:55:12	80	2000	066
14:55:17	80	2000	066
14:55:22	80	2100	058
14:55:27	110	2100	060
14:55:32	90	2100	062
14:55:37	110	2100	055
14:55:42	110	2100	055
14:55:47	120	2100	051
14:55:52	110	2100	055
14:55:57	110	2100	055
14:56:02	110	2000	055
14:56:07	110	2000	055
14:56:12	120	1900	058
14:56:17	110	1900	060

14:56:22	130	1800	054
14:56:27	130	1800	054
14:56:32	130	1700	054
14:56:37	130	1600	054
14:56:42	130	1500	050
14:56:47	130	1400	047
14:56:52	130	1400	044
14:56:57	130	1300	040
14:57:02	130	1200	033
14:57:07	140	1200	031
14:57:12	140	1200	031
14:57:17	140	1200	027
14:57:22	140	1200	027
14:57:27	140	1200	021
14:57:32	140	1100	021
14:57:37	130	1100	017
14:57:42	150	1100	019
14:57:47	150	1100	019
20 second gap in recorded data			
14:58:07	140	1000	353
14:58:12	140	900	344
14:58:17	140	900	338
14:58:22	140	900	338
14:58:27	140	900	333
14:58:32	140	900	333
14:58:37	140	900	333
14:58:42	140	900	333
14:58:47	140	900	333
14:58:52	140	900	338
14:58:57	140	900	338
14:59:02	140	900	344
14:59:07	140	900	344
14:59:12	140	900	344
14:59:17	140	900	344
14:59:22	140	900	344
14:59:27	140	900	344
14:59:32	140	900	344

14:59:37	140	900	344
14:59:42	140	900	344
14:59:47	140	900	344
14:59:52	140	900	348
14:59:57	140	900	348
15:00:02	140	900	348
15:00:07	140	900	348
15:00:12	150	900	349
15:00:17	140	900	348
15:00:22	140	900	348
15:00:27	140	900	348
15:00:32	140	900	348
15:00:37	140	900	344
15:00:42	150	900	349
15:00:47	150	900	353
15:00:52	140	900	348
15:00:52	140	900	348
15:00:57	150	900	349
15:01:02	140	900	344
15:01:07	150	900	345
15:01:12	140	900	344
15:01:17	140	900	344
15:01:22	140	900	344
15:01:27	150	900	339
15:01:32	150	900	339
15:01:37	150	900	339
15:01:42	150	900	339
15:01:46	150	900	345
15:01:51	150	800	345
15:01:56	150	800	345
15:02:01	150	900	345
15:02:06	150	900	345
15:02:11	150	900	339
15:02:16	150	900	339
15:02:21	150	900	345
15:02:26	150	900	345
15:02:31	150	900	339
15:02:36	150	900	339

15:02:41	140	900	338
15:02:46	140	1000	338
15:02:51	140	1000	333
15:02:56	140	1000	333
15:03:01	140	1000	338
15:03:06	150	1000	335
15:03:11	140	1000	333
15:03:16	150	1000	335
15:03:21	140	1000	333
15:03:27	140	1000	333
15:03:32	140	1000	330
15:03:37	140	1000	333
15:03:42	150	1000	332
15:03:47	140	1000	333
15:03:52	140	1100	330
15:03:57	140	1100	333
15:04:02	140	1100	330
15:04:07	140	1100	330
15:04:12	140	1100	330
15:04:17	140	1100	327
15:04:22	140	1000	323
15:04:27	140	1000	330
15:04:32	140	1000	327
15:04:37	140	1000	327
15:04:42	140	1000	330
15:04:47	140	1000	327
15:04:52	140	1000	327
15:04:57	140	1000	333
15:05:02	140	900	330
15:05:06	140	900	327
15:05:11	140	1000	330
15:05:16	140	1000	333
15:05:21	140	900	330
15:05:26	140	900	333
15:05:31	140	900	327
15:05:36	140	900	333
15:05:41	140	800	327
15:05:46	140	800	327

15:05:51	140	800	330
15:05:56	140	800	330
End of data for first radar track			
15:11:21	180	1700	279
15:11:26	150	1800	295
15:11:31	150	1800	295
15:11:36	130	2100	299
15:11:41	130	2100	287
15:11:46	120	2200	283
15:11:51	120	2200	277
15:11:56	110	2300	266
15:12:01	110	2100	248
15:12:06	110	1900	240
15:12:11	110	1600	240
15:12:16	120	1600	238
15:12:21	100	1400	237