Australian Government
Australian Transport Safety Bureau

Collision with water – Aero Commander 500S VH-WZU

26 km north-north-west of Horn Island, Queensland | 24 February 2011

Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2011-033
Final

Australian Government

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ATSB TRANSPORT SAFETY REPORT

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Collision with water 26 km north-north-west of Horn Island, Queensland 24 February 2011 VH-WZU Aero Commander 500S

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SAFETY SUMMARY

What happened

At 0445 Eastern Standard Time on 24 February 2011, the pilot of an Aero Commander 500S, registered VH-WZU, commenced a freight charter flight from Cairns to Horn Island, Queensland under the instrument flight rules. The aircraft arrived in the Horn Island area at about 0720 and the pilot advised air traffic control that he intended holding east of the island due to low cloud and rain. At about 0750 he advised pilots in the area that he was north of Horn Island and was intending to commence a visual approach. When the aircraft did not arrive a search was commenced but the pilot and aircraft were not found. On about 10 October 2011, the wreckage was located on the seabed about 26 km north-north-west of Horn Island.

What the ATSB found

The ATSB found that the aircraft had not broken up in flight and that it impacted the water at a relatively low speed and a near wings-level attitude, consistent with it being under control at impact. It is likely that the pilot encountered rain and reduced visibility when manoeuvring to commence a visual approach. However, there was insufficient evidence available to determine why the aircraft impacted the water.

Several aspects of the flight increased risk. The pilot had less than 4 hours sleep during the night before the flight and the operator did not have any procedures or guidance in place to minimise the fatigue risk associated with early starts. In addition, the pilot, who was also the operator’s chief pilot, had either not met the recency requirements or did not have an endorsement to conduct the types of instrument approaches available at Horn Island and several other locations frequently used by the operator.

What has been done as a result

Following the accident, the operator ceased operations and did not have the opportunity to enhance its processes.

Separately, and although not undertaken as a result of the accident, in May 2012 the Civil Aviation Safety Authority (CASA) issued a notice of proposed rule making relating to flight crew fatigue management. In the case of single pilot public transport operations, this included a proposal to restrict the duration of a flight duty period and the number of late night duty periods in certain circumstances. In addition, in July 2012 CASA issued draft requirements for the installation of additional equipment in small aircraft involved in passenger transport operations, such as a terrain awareness and warning system and weather radar equipment.

Safety message

Although no firm conclusions could be drawn regarding why the aircraft impacted the water, the ATSB highlights the need for pilots to ensure they have had sufficient sleep prior to conducting a flight, and that operators have processes in place to manage the potential fatigue risks, including those associated with early starts.

CONTENTS

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Figure 2: Courtesy of Google Earth
Figures 3 and 4: Courtesy of Airservices Australia
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THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

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 identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, 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 initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes appropriate, or to raise general awareness of important safety information in the industry. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

TERMINOLOGY USED IN THIS REPORT

Occurrence: accident or incident.

Safety factor: an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

Contributing safety factor: a safety factor that, had it not occurred or existed at the time of an occurrence, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

Other safety factor: a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report in the interests of improved transport safety.

Other key finding: any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which 'saved the day' or played an important role in reducing the risk associated with an occurrence.

Safety issue: a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Risk level: the ATSB's assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of safety actions taken by individuals or organisations during the course of an investigation.

Safety issues are broadly classified in terms of their level of risk as follows:

- **Critical** safety issue: associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.
- **Significant** safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.
- **Minor** safety issue: associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

Safety action: the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

FACTUAL INFORMATION

History of the flight

Pre-flight preparations

The Aero Commander 500S, registered VH-WZU (WZU, Figure 1), was scheduled to depart Cairns, Queensland (Qld) on a freight charter flight to Horn Island, Qld at 0330 Eastern Standard Time[1] on 24 February 2011. It was one of three aircraft tasked with transporting live crayfish from Horn Island back to Cairns for the same supplier that morning.

Figure 1: VH-WZU

On the afternoon of 23 February 2011, the aircraft was refuelled to its full capacity of 590 L, which equated to an endurance of over 5.2 hours.[2] The flight time for the trip from Cairns to Horn Island was normally about 2.6 hours.

At about 2010 on 23 February 2011, the rostered pilot for the flight advised the chief pilot that he was reluctant to conduct the flight because he was concerned about the weather forecast for the Horn Island area, the aircraft did not have weather radar equipment, and he had limited experience flying in the tropics. At 2114 he called the chief pilot and restated his concerns, and it was agreed that the rostered pilot would still do the flight and evaluate the weather again in the morning.

On the morning of 24 February 2011, the other two aircraft departed as planned at about 0330. The rostered pilot for WZU obtained updated weather information and conducted a pre-flight inspection of the aircraft. It was raining heavily in Cairns at the time, and at 0350 he contacted the chief pilot and restated his concerns about doing the flight. He offered to conduct the flight during daylight, but the chief pilot

1 Eastern Standard Time (EST) was Coordinated Universal Time (UTC) +10 hours.

2 The Aero Commander 500S fuel consumption was 110 L per hour during cruise and descent, slightly higher during climb, and 90 L per hour when holding.

said that would not be suitable as the crayfish supplier was expecting the aircraft at Horn Island between 0600 and 0630. The chief pilot decided to do the flight himself and arrived at Cairns airport at about 0420 to 0430 and obtained the updated weather information from the rostered pilot.

Flight to Horn Island

At 0445, the Aero Commander pilot requested a taxi clearance at Cairns from air traffic control (ATC) for the flight to Horn Island under the instrument flight rules (IFR). The aircraft departed soon after with the pilot as the only occupant and the only freight being empty plastic tubs to be used for carrying crayfish on the return flight.

At 0704, the pilot advised ATC that he was leaving 8,000 ft on descent to Horn Island with an estimated arrival time of 0720. At 0729 he told ATC that he was 'unable to get into Horn Island at the moment due low cloud and rain so we're holding out to the east till the showers clear'. He nominated an 'ops normal' time[3] of 0745 and advised that he was 'holding visual' at 1,000 ft. The controller provided him with traffic information on a Britten-Norman Islander aircraft (Islander) that was conducting an IFR flight from Murray Island[4] to Horn Island with an estimated arrival time of 0754.

At 0743, the pilot of a Cessna 208 contacted ATC and advised that he was taxiing at Horn Island for an IFR flight to Badu Island[5], and the controller provided him with information about the location of the Aero Commander and the Islander. The Aero Commander pilot advised ATC that he had received the information about the Cessna, operations were normal, he was still holding and he 'would call again on the hour'.

At 0747, the Aero Commander, Cessna and Islander pilots started discussions on the common traffic advisory frequency (CTAF)[6] about the weather conditions. The Cessna pilot stated that he did not have enough visibility at that stage to take off from Horn Island. He also advised the other pilots that the weather to the south and east looked marginally clearer and that 'you might be able to see enough' to land.

At 0749, one of the Aero Commander's owners phoned the pilot to inquire about the location of the aircraft as the crayfish supplier had told him that they were waiting for it to arrive. The owner recalled that the pilot advised him that he was holding 10 NM (18.5 km) east of Horn Island and he would make another attempt to get in. If that was not successful he would divert to Bamaga (Northern Peninsula Airport), Qld and wait for the weather to clear. The owner reported that he also advised the pilot to consider other options in the area, such as Kubin or Badu Island (Figure 2).

The Cessna and Islander pilots also recalled that the Aero Commander pilot stated on the CTAF that he would hold for a while longer and then try another approach,

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3 An 'ops normal' time is an agreed time by which a pilot will contact ATC for the purposes of search and rescue.

4 Murray Island, Queensland is 111 NM (206 km) east-north-east of Horn Island.

5 Badu Island, Queensland is 27 NM (50 km) north-north-east of Horn Island.

6 Common Traffic Advisory Frequency, the name given to the radio frequency used for aircraft-to-aircraft communication at aerodromes without a control tower.

and if that was not successful he would divert to Bamaga. The Islander pilot, and another pilot who heard the transmissions, understood that the Aero Commander pilot would be attempting a visual approach, although he mentioned also considering an instrument approach via the Horn Island NDB[7] if that was not successful.

At 0753, the Cessna pilot stated on the CTAF that the weather was clearing up at Horn Island Airport, and he departed from runway 32 soon after. He reported that he attempted to contact the Aero Commander pilot after becoming airborne but received no response. Based on the Aero Commander pilot's transmissions, the Cessna pilot understood that the Aero Commander was located north of Horn Island, and another pilot who heard the transmissions also thought it was situated to the north of Horn Island, somewhere near Kubin. The Islander pilot recalled that the Aero Commander pilot last reported being 18 NM (33.3 km) from Horn Island on a bearing of 192 °(M). That position was inconsistent with all other reports and the final location of the aircraft, and it was considered more likely that the aircraft was on a bearing of 012 °(M) from Horn Island at that time (Figure 2).

At 0755, just prior to landing on runway 26, the Islander pilot advised the Aero Commander pilot that the conditions at Horn Island were 'not too bad, I broke visual about 2 miles [from the threshold of] runway 26 and to the west it looks like its clearing up'. The last reported transmission heard from the Aero Commander pilot at about this time was that he was joining a 15 NM (27.7 km) final approach to runway 14.

Search for the aircraft

At 0803, ATC attempted to contact the Aero Commander pilot to establish whether operations were normal and there was no reply to this or several other attempts by ATC and other pilots to contact him. It was subsequently established that the aircraft had not landed at Horn Island or any other location in the vicinity.

At 0815, ATC declared an uncertainty phase.[8] At 0824, ATC transferred the situation to Australian Search and Rescue (AusSAR)[9], who elevated it to an alert phase.[10] At 0904, AusSAR further elevated the situation to a distress phase[11] and an air and sea search was commenced.

On 1 March 2011, searchers located the aircraft's current maintenance release and several plastic tubs floating near Dugong Islet, Qld about 88 km east of Horn Island. The tubs were labelled with the details of the crayfish supplier, and were therefore considered likely to have been on board the missing aircraft. AusSAR subsequently handed over control of the search effort to the Queensland Police

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7 A non-directional (radio) beacon (NDB) is a radio transmitter at a known location, used as a navigational aid. The signal transmitted does not include inherent directional information.

8 INCERFA is a phase where uncertainty exists as to the safety of an aircraft and its occupants.

9 Australian Search and Rescue operates a 24-hour rescue coordination centre and is responsible for the national coordination of search and rescue.

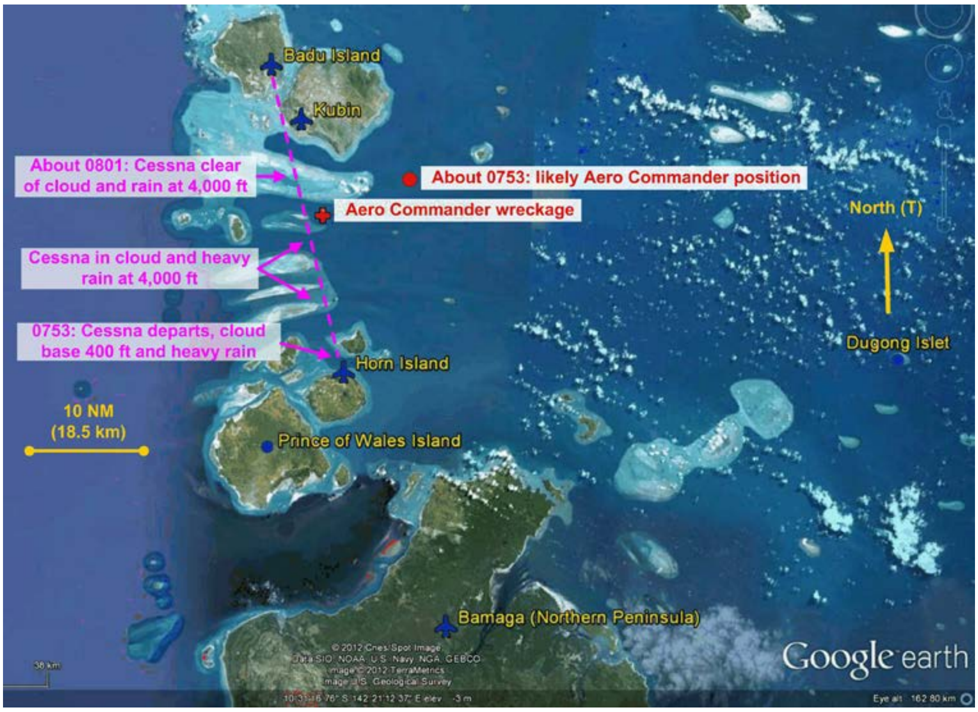
10 ALERFA is a phase where apprehension exists as to the safety of an aircraft and its occupants.

11 DETRESFA is a phase where there is reasonable certainty that an aircraft and its occupants are threatened by grave and imminent danger or require immediate assistance.

Service. The police conducted side-scan sonar[12] searches of several areas, but the aircraft was not found and the search was discontinued.

On about 10 October 2011, a crayfish diver located aircraft wreckage on the seabed 14 NM (26 km) north-north-west of Horn Island in about 15 m of water (Figure 2), and he reported the matter to police on 20 October. Due to weather conditions and local tides, a police dive team was unable to examine the site for several weeks. On 12 November 2011, police divers confirmed that the aircraft was the missing Aero Commander. They found no evidence of the pilot.

Figure 2: Location of the wreckage



Pilot information

Qualifications and experience

The pilot held an Air Transport Pilot (Aeroplane) Licence that was issued on 24 June 2003. Prior to the accident flight, he had accumulated 4,154 hours total flight experience[13], including 2,026 hours in command of multi-engine aircraft.

After obtaining his Aero Commander 500S endorsement in October 2007, the pilot started flying the aircraft type regularly in December 2009. He had over 209 hours experience on the type, with a significant proportion conducted in WZU.

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12 Side-scan sonar is a marine geophysical technique that is used to image or ‘see’ the ocean floor.

13 The last entry in the pilot’s logbook was on 13 January 2011. Additional details were obtained from his duty, flight times and recency record, which had entries up to 17 February 2011, and from aircraft records.

The pilot had about 10 years' experience flying in northern Queensland. He had conducted well over 100 flights to Horn Island during this period, including eight flights in February 2011.

The pilot obtained his initial multi-engine command instrument rating in May 1996 and he had about 270 hours of instrument flight experience. His rating was last renewed on 15 September 2010, and he was endorsed for NDB, VOR, ILS, LLZ and DGA instrument approaches.[14] In accordance with Civil Aviation Order (CAO) 40.2.1 – *Instrument ratings*, this rating remained valid until the end of September 2011. The authorised delegate who conducted the test recalled that the pilot met the required standard and no deficiencies in his performance were noted. The pilot failed his first attempt at renewing his instrument rating in October 2009 when he made errors during NDB and LLZ approaches. He successfully passed a retest on 16 October 2009.

The pilot's duty, flight times and recency record showed that he did not meet the 90-day recency requirements for NDB and DGA approaches, which were specified in CAO 40.2.1. His last recorded NDB and DGA approaches were conducted during his instrument rating renewal on 15 September 2010. Prior to that, his last NDB approach was on 16 October 2009. Although he rarely logged NDB or DGA approaches during the period from January 2009 to February 2011, he regularly logged ILS approaches and occasionally logged LLZ and VOR approaches. His most recent instrument approach was an ILS approach on 15 February 2011.

Other than his annual command instrument rating renewals, the pilot's flying performance had not been checked in recent years, nor were any additional checks required by aviation regulation in the intervening period. However, pilots who had flown with him in recent months did not report any concerns about his flying skills.

Some of the operator's pilots reported that the Aero Commander pilot adhered to rules and procedures and was not inclined to take risks, whereas others reported that he was prepared to enter instrument meteorological conditions (IMC) when operating under the visual flight rules (VFR). One pilot reported observing the Aero Commander pilot attempt an RNAV (GNSS) approach[15] in cloud at Horn Island even though he did not have the appropriate endorsement.

Medical information

The pilot held a current Civil Aviation Safety Authority (CASA) Class 1 Medical Certificate that was valid until 23 July 2011. There were no medical restrictions on the pilot exercising the privileges of his licence, and no problems were noted on his last three annual aviation medical assessments. Several people who knew the pilot reported that he was a regular smoker but appeared to be in good health and had no known medical problems.

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14 Non-directional beacon (NDB), very high frequency omnidirectional radio range (VOR), instrument landing system (ILS), localiser approach (LLZ), and DME or GPS arrival (DGA). DME refers to 'distance measuring equipment' and GPS refers to 'global positioning system'. An ILS is a precision approach that provides glidepath azimuth information and the others are types of non-precision approach, which provide azimuth information only.

15 RNAV (GNSS) is an area navigation (global navigation satellite system) non-precision instrument approach, which uses GPS data rather than a ground-based navigation aid.

Recent history

Prior to 24 February 2011, the pilot had completed 6.3 hours flying in the last 7 days and 61.8 hours flying in the last 30 days. His last flight was on 21 February.

No information about the pilot's sleep was available for the night of 22 February 2011, although he was engaged in phone activity up to 2147 that night and from 0700 the next morning. On 23 February he undertook various work-related administration tasks. During the night of 23 February he went out to dinner with friends, one of whom reported that the pilot did not consume any alcohol. Bank transaction records showed that the pilot later went to an entertainment venue and it was estimated that he would not have returned home prior to 2340. Accordingly, he probably had less than 4 hours sleep prior to being woken by the rostered pilot at 0350 the next morning.

The rostered pilot who met with the pilot on the morning of 24 February 2011 noted that the pilot did not take anything on board the aircraft other than his flight bag. It could not be determined whether he had eaten anything prior to the flight.

Several friends and colleagues who saw or communicated with the pilot on 23 and 24 February 2011 reported nothing unusual or concerning about his behaviour or mood. The rostered pilot reported that the pilot was not upset about having to come in at short notice to do the flight on 24 February 2011. This was confirmed by another of the operator's pilots who spoke to him by radio during the period between 0700 to 0730 and by the aircraft owner, who spoke to him on the phone at 0749. People who communicated with the pilot during the accident flight reported that he did not seem anxious about the weather conditions or the delay in landing at Horn Island.

Aircraft information

General information

The Aero Commander 500S is a high-wing, twin-engine aeroplane (Figure 1) that was designed as a business and personal aircraft with seating capacity for up to seven people including the pilot(s).

The aircraft, serial number 3060, was manufactured in the United States in 1970 and first registered in Australia in September 1978. It had accumulated 17,545.5 hours total time in service prior to the accident flight. The aircraft was equipped with two Lycoming model IO-540-E1B5 piston engines. At the time of takeoff, both engines had 614.8 hours time since overhaul.

The company that owned the aircraft leased it as required to four different operators. The operator used the aircraft for passenger charter operations and transporting crayfish. For transporting crayfish, the owner configured the aircraft as a two-seat freighter with cargo nets immediately behind the front seats and toward the rear cabin to store the plastic tubs used for holding crayfish.

For the flight to Horn Island, the aircraft was estimated to be about 610 kg below the maximum take-off weight for the flight. It was also estimated that the aircraft was within its centre of gravity limitations throughout the flight.

Aircraft systems

The aircraft was equipped for IFR flight and certified to an IFR charter standard. The autopilot was a Century III model, which had an altitude hold mode that maintained the altitude at the pressure altitude at which it was engaged. Pilots from the operator reported that they generally only used the autopilot during the cruise.

The aircraft was fitted with systems that enabled the conduct of NDB, VOR, ILS, LLZ and DGA instrument approaches. Although it was fitted with a Garmin GPS 155 unit, the installation of this unit had not been approved for the purpose of conducting RNAV (GNSS) approaches.

The aircraft was not equipped with a terrain awareness and warning system (TAWS), a radio altimeter[16] or weather radar equipment, nor were such systems required to be fitted by aviation regulation.

Airworthiness and maintenance

A company related to the owner maintained the aircraft. A review of the maintenance documents indicated that the aircraft was maintained in accordance with an approved system of maintenance, and that it had a current Certificate of Registration and Certificate of Airworthiness. The current maintenance release showed no outstanding defects or scheduled maintenance entries, and the last recorded daily inspection was on 24 February 2011.

A pilot who flew the aircraft on 10 February 2011 reported that the autopilot had failed and did not function in any axis. The unit was removed from the aircraft and repaired. A scheduled maintenance inspection of the aircraft was carried out on 11 February 2011, with no major defects identified. The last recorded maintenance was a replacement of the receiver in the automatic direction finding equipment on 18 February 2011.

Pilots who flew the aircraft after 10 February 2011 stated that it was in good condition and that all of the on-board equipment was functioning. People who communicated with the Aero Commander pilot during the accident flight stated that he did not report any concerns or problems with the aircraft.

Meteorological information

Aerodrome forecast

The aerodrome forecast[17] for Horn Island issued by the Bureau of Meteorology at 0231 on 24 February 2011 was valid from 0200 to 2200. It forecast light rain showers and scattered cloud with a base at 2,500 ft, visibility greater than 10 km,

16 A radio altimeter measures and displays the distance from the aircraft to the ground directly below the aircraft. Such a system includes the ability to provide an aural alert if the aircraft reaches a selectable minimum distance above the ground.

17 Aerodrome forecasts are a statement of meteorological conditions expected for a specific period of time, in the airspace within a radius of 5 NM (9 km) of the aerodrome.

and wind from 320° (T) at 5 kts. It also included an INTER[18] period from 0200 to 1000, which forecast intermittent reduction in visibility to 1,000 m in thunderstorms and rain, as well as intermittent periods of broken cloud with a base of 1,200 feet and scattered cumulonimbus cloud with a base of 2,000 ft.

Automated weather observations

An automatic weather station at Horn Island recorded a number of weather parameters, with reports routinely issued every 30 minutes. SPECIs[19] were also displayed to ATC in some cases at more regular intervals. Table 1 shows details of the observations recorded or displayed during the relevant period, all of which were SPECIs.

Table 1: Details of SPECIs at Horn Island

Time	Wind	Visibility	Cloud[20]	QNH[21]	Rain
0700	230 °(T) at 7 kts	> 10 km	broken at 1,300 ft, overcast 2,000 ft	1006	no rain last hour
0715	270 °(T) at 12 kts	5,000 m	broken at 1,300 ft, overcast 4,300 ft	1007	2.4 mm last 10 minutes
0730	270 °(T) at 10 kts	700 m	broken at 400 ft, overcast 1,300 ft	1007	8.2 mm last 10 minutes, 18.8 mm last hour
0800	230 °(T) at 6 kts	3,200 m	broken at 900 ft, overcast 1,300 ft	1008	1.2 mm last 10 minutes, 31.6 mm last hour
0830	190 °(T) at 2 kts	> 10 km	broken at 2,000 ft, overcast 5,700 ft	1008	0.2 mm last 10 minutes, 14.4 mm last hour

ATC broadcasted details of the 0700, 0715 and 0730 SPECIs to pilots operating in the Horn Island area. The controller also advised pilots that SPECIs were indicated at 0800 and 0815, with details available on request.

Witness observations

Witnesses on the ground at Horn Island indicated that there was low cloud and heavy rain at Horn Island in the period between 0730 and 0800, with the weather

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18 An intermittent deterioration in the forecast weather conditions, during which a significant variation in prevailing conditions is expected to last for periods of less than 30 minutes duration.

19 A SPECI is a report of actual weather conditions at a particular aerodrome at a specific time when one or more parameters meet specified criteria. A SPECI can also indicate an improvement in conditions.

20 Cloud cover is normally reported using expressions that denote the extent of the cover. The expression Few indicates that up to a quarter of the sky was covered, Scattered indicates that cloud was covering between a quarter and a half of the sky, Broken indicates that more than half to almost all the sky was covered, and Overcast means all the sky was covered.

21 Altimeter barometric pressure subscale setting to provide altimeter indication of height above mean seal level in that area.

passing from the north to the south. Some but not all of the witnesses described strong and gusting winds at ground level during this period. There were no reports of thunderstorm activity.

The pilot of the Cessna 208 that departed north to Badu Island off runway 32 reported that when he departed at 0753 the cloud was overcast with a base of 400 ft over the Horn Island area. He also encountered heavy rain during his climb to 4,000 ft and remained in the cloud and rain at 4,000 ft until he was about two thirds of the way to Badu (about 18 NM or 33 km north of Horn Island). As he departed at 0753 and arrived in the circuit area at Badu Island at 0805 (12 minutes later), it is likely that he became clear of cloud and rain at about 0801 (Figure 2).

The pilot of the Islander that flew from Murray Island and landed at Horn Island at 0756 reported that during his flight he saw a line of heavy showers about 20 to 25 NM (37 to 46 km) north of Horn Island. At about 0742, he started his descent to 500 ft to get below the cloud ahead of him. He described that cloud as overcast but broken at 500 ft and the visibility as 5 km. As he got closer, he saw a large shower over Horn Island that obscured the island. However, he reported that the weather to the east and near Bamaga was much better, with a higher cloud base and visibility significantly exceeding 10 km. After he had established his aircraft on final for runway 26, the Islander pilot entered a heavy shower that reduced visibility and he became visual with the runway quite late on the approach. He recalled that the cloud base close to Horn Island was 500 ft with ‘wisps’ of cloud at 400 ft.

Both the Cessna and Islander pilots reported that, during their flights, the wind was calm and they did not encounter any turbulence. They also stated that during the period leading up to 0800 it would not have been possible to become visual off an instrument approach at Horn Island.

Airport information

Horn Island Airport had two runways: runway 14/32, which was aligned 134/314 °(M), and runway 08/26, which was aligned 079/259 °(M) (Figure 3). Landings were not permitted on runway 32 because of terrain.

The instrument approaches available at Horn Island included NDB approaches to runways 08 and 14, RNAV (GNSS) approaches to runways 08 and 26 and a GPS arrival. As noted in *Pilot information*, the pilot was not endorsed to conduct RNAV (GNSS) approaches and he had not met the recency requirements to conduct NDB or GPS arrival approaches.

The last transmissions from the pilot indicated that he was manoeuvring to conduct a visual approach to Horn Island from the north. In the area that the wreckage was located, the minimum height to which the pilot could descend in visual meteorological conditions (VMC) was 500 ft above the water. VMC in non-controlled airspace at or below 3,000 ft was defined as a visibility of 5,000 m, clear of cloud and within sight of ground or water.

If IMC existed, the lowest safe altitude at the location of the wreckage was 2,400 ft (see bottom left of Figure 4) unless the pilot was conducting an instrument approach procedure. The pilot reported that he may consider conducting an NDB approach if the visual approach was not successful. However, there were no transmissions reported of him commencing an NDB approach or flying overhead Horn Island. In addition, the wreckage was located well north of the track for an NDB approach to runway 14 (Figure 4), which was closer to the wreckage than any of the other approaches.

Figure 3: Horn Island Airport

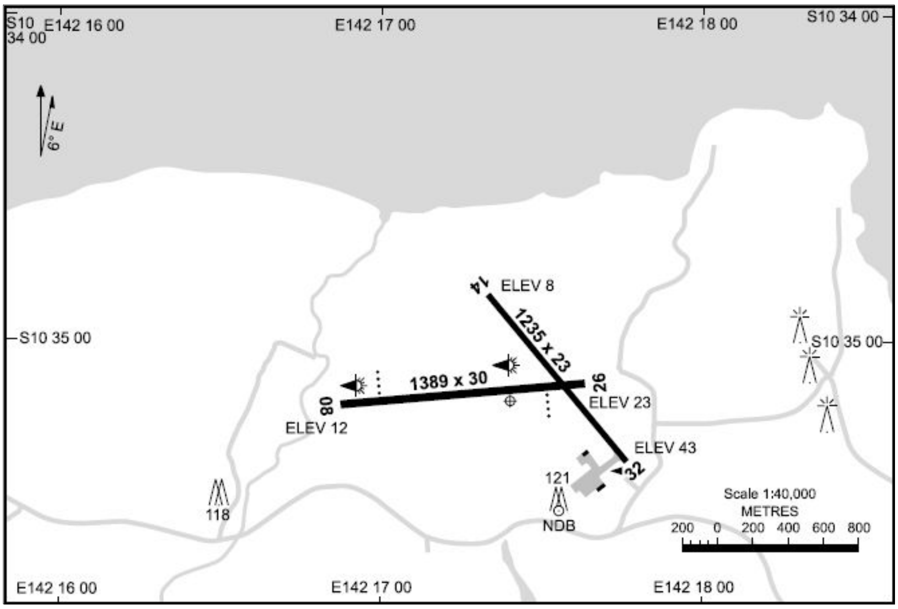
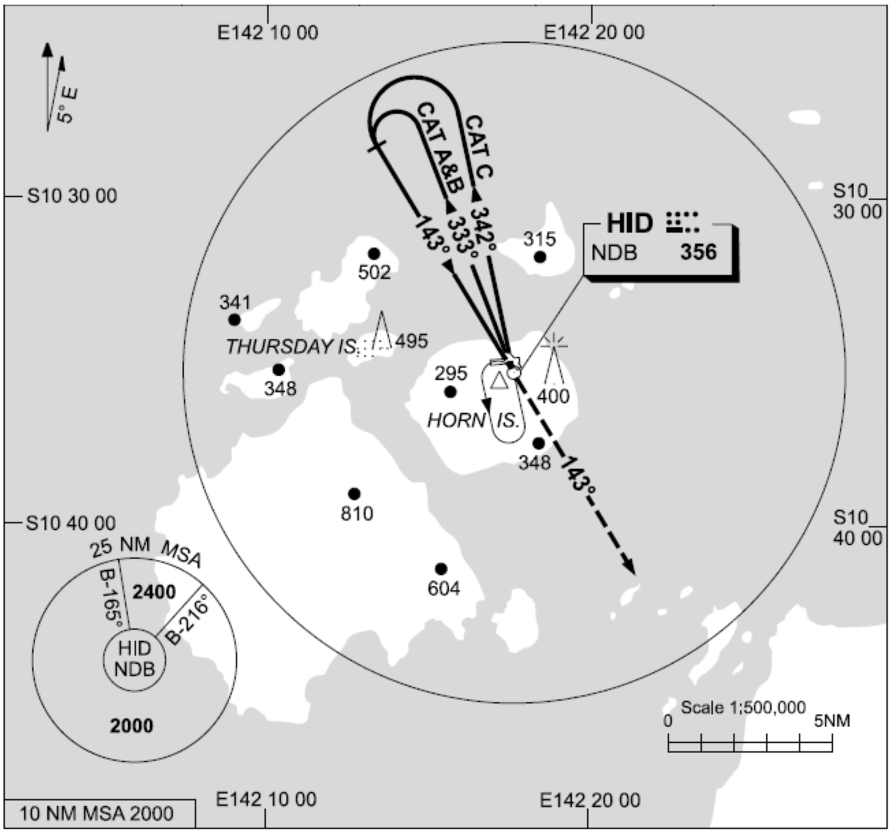


Figure 4: Excerpt from Horn Island runway 14 NDB instrument approach chart



Wreckage and impact information

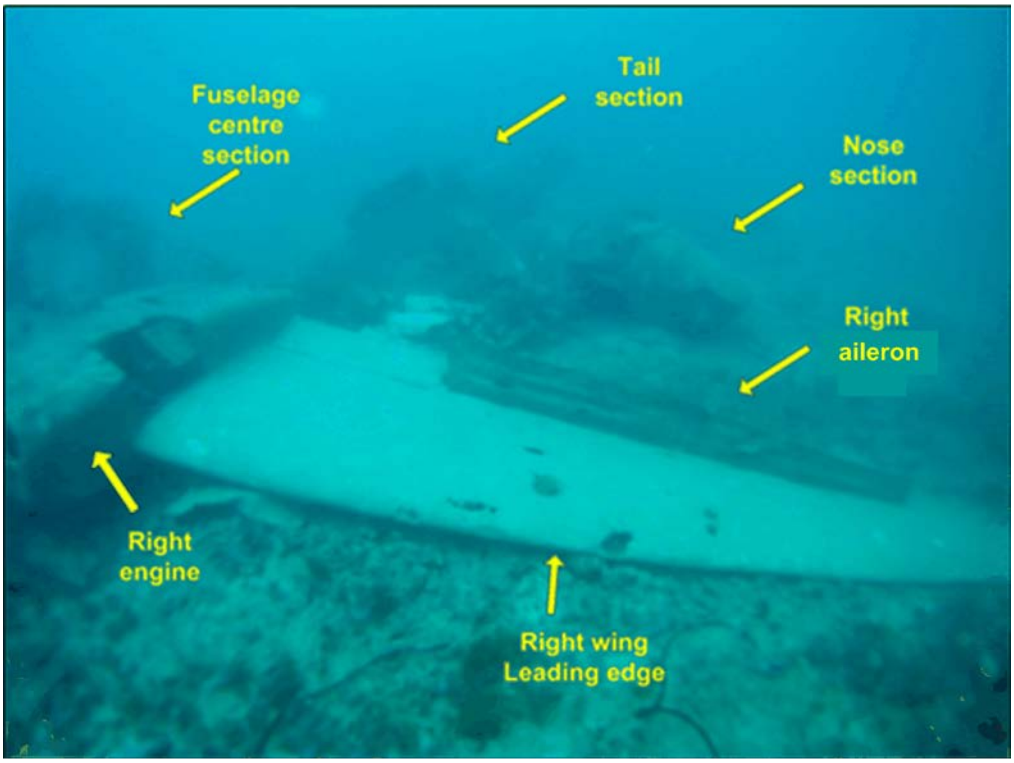
On 12 and 13 November 2011, police divers photographed and videorecorded the wreckage and provided this information to the Australian Transport Safety Bureau (ATSB). The ATSB's examination of this material was limited due to the quality of images given the depth of 15 m. In addition, the images were taken 9 months after the aircraft entered the water and there had been significant deterioration of the wreckage due to its exposure to a marine environment.

Wreckage distribution

The majority of the wreckage was confined to a small area, indicating that the aircraft impacted the water close to where the wreckage was located. All of the major components, including the control surfaces were identified, and the wing sections were intact (Figure 5 and Figure 6).[22] In summary, the wreckage evidence was not consistent with an in-flight breakup.

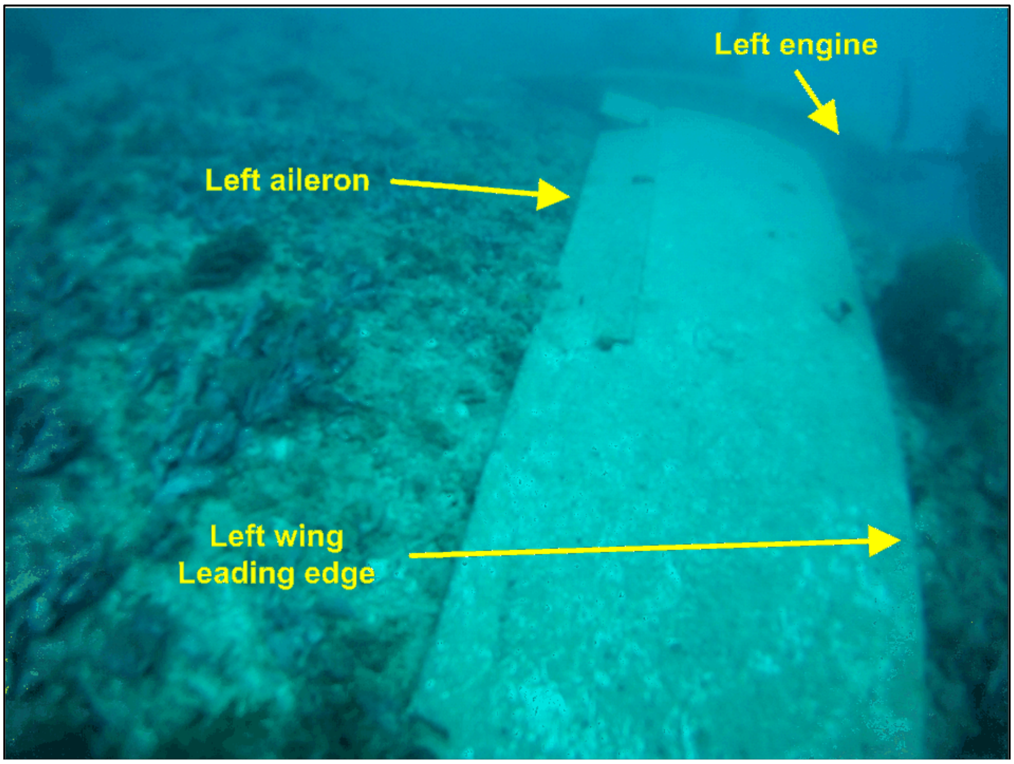
The wing sections were found inverted with the engines still attached. The majority of the nose, cabin and tail sections had all separated from the wing section but were still attached by the aircraft control cables. Overall, the aircraft had broken into large sections, which was consistent with impact at a relatively low speed.

Figure 5: Right wing



[22] The ATSB investigated Aero Commander 500S accidents in 2004 (occurrence 200400610) and 2007 (investigation AO-2007-209) that involved in-flight breakups. In both cases, the wing sections outboard of the engine nacelles detached during flight. Further details are available at www.atsb.gov.au.

Figure 6: Left wing



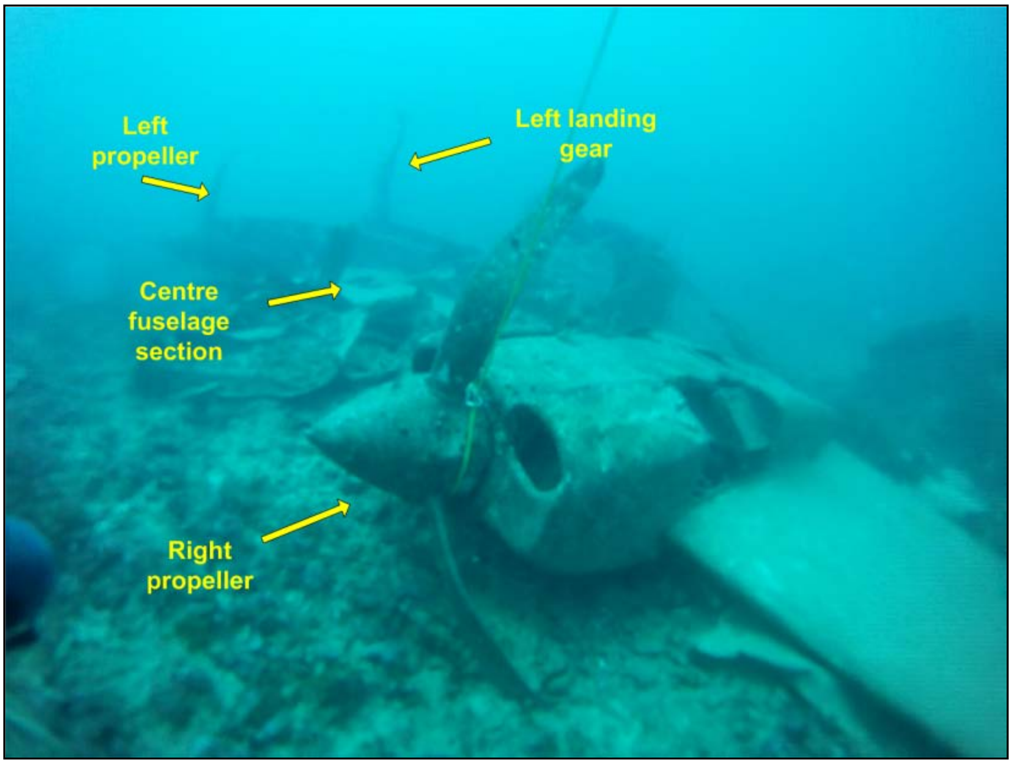
Aircraft configuration

The left main landing gear was found in the extended position (Figure 7), and the right main landing gear was retracted but the gear doors were partially open. It could not be ascertained whether the flaps were retracted or were extended to the first stage. Loss of hydraulic pressure or impact damage may have allowed the landing gear and flaps to extend after impact. There was no significant impact damage to any of the main landing gear doors or the outboard wing flaps, as would be expected if the gear and flaps had been extended prior to impact. Overall, there was insufficient evidence to conclude whether the gear or flaps were extended at impact.

Wings and control surfaces

Both wings displayed similar impact damage. There was no major crushing damage to the leading edges, and there was no significant impact damage to the undersides of the wings. Both propeller spinners and most of the engine cowls, which consisted of light fibreglass and aluminium, also displayed minimal damage. This pattern of evidence indicated that the aircraft impacted the water in a near wings-level attitude.

Figure 7: Right wing section, propellers and left landing gear



Propellers

Two of the blades of the left propeller showed clear evidence of double bending (Figure 8a) and the tip of the third blade was obscured from view. The presence of double bending showed that the left engine was delivering significant power on initial impact with the water.[23]

All three blades of the right propeller showed clear evidence of rearward bending (Figure 8b), which indicated that the propeller was rotating on initial impact. The absence of double bending did not mean that the right engine was not delivering power, as the difference between the bending signatures of the two propellers could also be explained by variations in impact dynamics or wave motion. The ATSB determined that recovering the engine was unlikely to provide any further information regarding the status of the engines at impact.

There was no indication that either propeller was feathered.[24]

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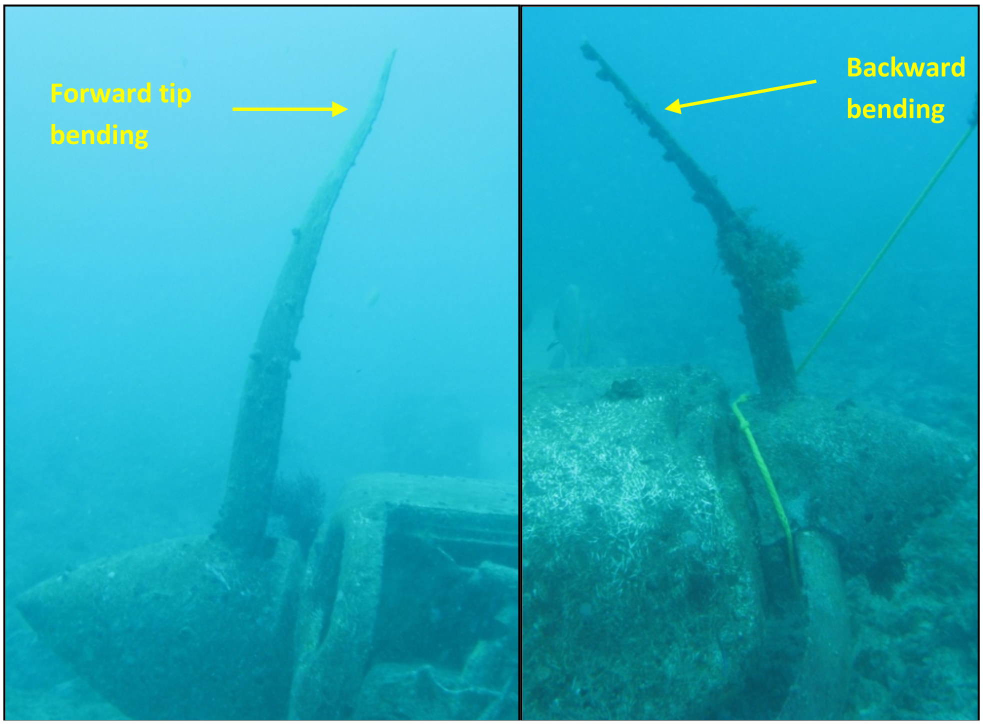
23 Double bending occurs when the propeller blade is being driven, which results in the tip bending forwards, and the aircraft's forward airspeed causes the propeller assembly to progress forward after impact, which results in the mid-span bending rearwards.

24 The term used to describe rotating the propeller blades to an edge-on angle to the airflow that minimises aircraft drag following an engine failure or shutdown in flight.

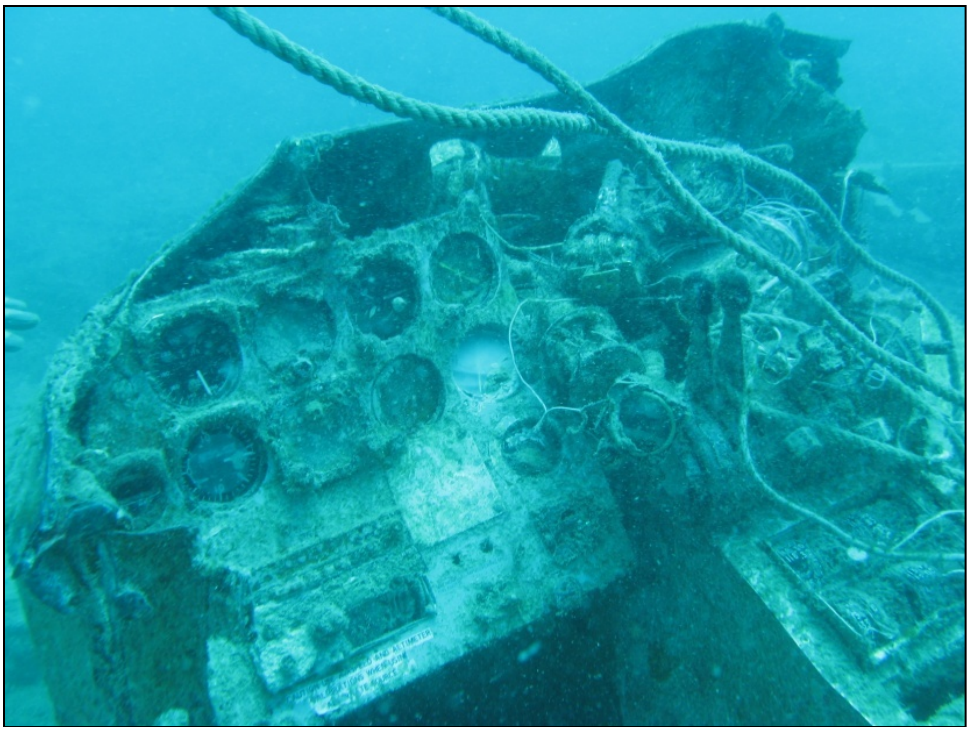
Figure 8: Left propeller blade (a) and right propeller blade (b)



Instruments, switches and controls

Due to the extent of damage to the cockpit area (Figure 9), no conclusions could be drawn as to the pre-impact position of any of the controls, switches or instruments.

Figure 9: Instrument panel



Survival factors

Due to the extent of damage to the cockpit area, it is very unlikely that the accident was survivable.

Various systems are available to assist with the search for an aircraft in the event that it goes missing, but none of these systems were effective or available in this case. More specifically:

- There was no fixed-installation emergency locator transmitter (ELT) fitted to the aircraft, nor was any required to be fitted.[25] Even if a fixed installation ELT was fitted, it was unlikely to have activated after the aircraft entered the water.
- An MT410G personal locator beacon (PLB) was reportedly carried in the pilot's door pocket. The PLB was a manually-activated, fully-buoyant waterproof unit that complied with the relevant requirements. No emergency signal was detected in the Horn Island area by AusSAR at or around the estimated time of the accident.
- The Horn Island area was not covered by ATC radar, and therefore the position of the aircraft was not able to be reliably determined when it was identified as being missing.
- At the time of the accident, Horn Island Airport was equipped with automatic dependent surveillance - broadcast (ADS-B) ground station equipment. Such equipment allows a suitably-equipped aircraft to be tracked by ATC and other pilots without the need for conventional radar. The ability of a ground station to receive ADS-B data from an aircraft depends on altitude, distance from the site and obstructing terrain. Coverage normally exists near ground level to within about 20 NM (37 km) of the ground station, and high-level coverage can exceed 250 NM (463 km). The aircraft was not equipped with ADS-B equipment, nor was it required to be fitted.[26]
- The aircraft was not fitted with any flight-following equipment, nor was it required to be fitted by aviation regulation. Such devices can transmit the GPS location of an aircraft to a base station at regular intervals.

Organisational information

Structure and personnel

The aircraft operator held an air operator's certificate (AOC) issued by CASA in November 2009 authorising passenger charter, cargo charter and aerial work (aerial spotting) operations in several types of multi-engine aircraft, including the Aero Commander 500S. The operator's main flying activities were prawn spotting in the Gulf of Carpentaria and transporting live crayfish from Horn Island to Cairns, with occasional passenger charter flights. It commenced live crayfish transport operations in mid-2010.

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25 Requirements for ELTs were specified in *Civil Aviation Regulation* 252A.

26 CASA has mandated the installation of ADS-B equipment from December 2013 for all Australian aircraft operations at, or above, flight level 290 (or 29,000 ft). This requirement would not include Aero Commander 500S aircraft. See also *Safety Action* for additional proposed requirements.

The pilot of the accident aircraft was appointed as the operator’s chief pilot in June 2006. At the time of the accident, he was the only director of the operator and a minor shareholder. He was also the only permanent employee, with other pilots used as required on a casual basis. At the time of the accident, there were about five other pilots.

The chief pilot was responsible for the safety and compliance of flight operations. He hired and inducted other pilots, which involved conducting one or more evaluation flights with them. External organisations conducted the pilots’ instrument ratings renewals and aircraft endorsements as required.

The operator leased aircraft as required from another company. One of the co-owners of these aircraft also managed the allocation of aircraft to various operators. He was also indirectly a major owner of the operator, arranged most of the operator’s tasking and managed the operator’s finances.

Some of the chief pilot’s friends reported that he had been significantly concerned about financial management aspects associated with the operator. Although he had become somewhat less concerned with these issues prior to the accident, he was still uncomfortable about the situation and was seeking other employment.

Policies and procedures

The operator’s operations manual was initially issued in 1999. Following the accident, CASA conducted a review of the manual and noted that it had only had four minor amendments since it was issued. It also noted that the manual contained a significant amount of outdated information about the operator’s organisation and processes, and outdated references to civil aviation regulations and orders. The chief pilot was reportedly in the process of converting the manual to a digital format to make it easier to modify.

The operations manual contained no specific procedures relating to crayfish operations or operations at Horn Island. The ATSB interviewed a number of the operator’s pilots who had flown to Horn Island with the chief pilot as part of their induction. According to some of them, his advice regarding Horn Island approach procedures in poor weather was to hold to the east of the island and wait for the weather to clear or divert as required. Other pilots reported that the chief pilot advised them to also consider descending through cloud over the water to the east of the island until visual and then return to land, with one reporting that the chief pilot also suggested it was safe to descend below 500 ft over the water to get visual.

Crayfish transport operations

Crayfish were initially stored in water tanks on the catcher vessel. Prior to the arrival of the aircraft at Horn Island, the supplier packed them into plastic tubs and loaded the tubs into a refrigerated van. The tubs were then transferred to the aircraft and flown to Cairns. At Cairns the crayfish were transported to a facility with monitored water tanks until they could be transported overseas. The crayfish could reportedly remain out of water for a period of up to 24 hours without adverse effects.

The aircraft owner reported that the operator’s pilots were normally on time in meeting the crayfish provider, but delays should not have created significant time pressure on a pilot. He stated that if there was a delay, it was normal practice for him to contact the chief pilot to determine the extent of the delay and then liaise with the client. A friend of the chief pilot reported that he was sometimes upset by such calls from the aircraft owner.

The operator's pilots reported that it was generally understood that they minimised delays where possible with live crayfish operations. However, pilots who had been required to divert to other destinations on flights to Horn Island reported that they did not receive any adverse comments from the chief pilot or aircraft owner due to the delays.

CASA oversight

Following the accident, the operator effectively ceased operations. In August 2011, CASA cancelled the operator's AOC after finding problems with its AOC organisation, operations manual and systems for keeping operational records.

Fatigue management

Fatigue and early starts

The International Civil Aviation Organization (ICAO 2011) has recently defined fatigue as:

> A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties.

Fatigue can have a range of adverse influences on human performance, such as slowed reaction time, decreased work efficiency, reduced motivational drive, increased variability in work performance, and more lapses or errors of omission (Battelle Memorial Institute 1998). A common symptom of fatigue is a change in the level of acceptable risk that a person tolerates, or a tendency to accept lower levels of performance and not correct errors.

It is generally agreed that most people need at least 7 to 8 hours of sleep each day to achieve maximum levels of alertness and performance. A review of relevant research (Dawson and McCulloch 2005) concluded:

> …there is little evidence of a clinically significant reduction in any measure of sleepiness/alertness until TIB [time in bed] is reduced below 6 h [hours]. Most measures show significant clinical levels of sleepiness once TIB is reduced to 4 h. Between 6 and 4 h there is some debate based on the measure used (i.e. psychomotor vigilance, reaction time or more complex cognitive tasks); and the degree to which the task is engaging or boring…
>
> …it is unlikely that individuals would be significantly impaired at most common work tasks until obtained sleep fell below 5 h in the preceding 24…

Thomas and Ferguson (2010) examined the effects of different amounts of sleep on the performance of Australian airline flight crews. When one of the two crewmembers had less than 5 hours sleep, there was a significant decrease in the number of threats being managed to an inconsequential outcome, and an increase in the number of errors made.

Many studies have shown that early starts decrease the amount of sleep obtained. In general, it is difficult for people to successfully go to sleep earlier than normal. A recent study of Australian airline pilots found that their amount of sleep increased as the rostered start time became later, with an average of 5.2 hours for a 0400 to 0500 start and 6.6 hours for a 0900 to 1000 start (Roach et al. 2012). Self-reported levels of fatigue were also higher with early starts.

Regulatory requirements

CAO 48.12 provided requirements for maximum hours of duty or flight time in specified periods, or minimum periods of rest between duty periods. For example, it stated that a tour of duty shall be preceded by a rest period of 10 consecutive hours or 9 consecutive hours embracing the period between 2200 and 0600.

CASA provided approved operators with a standard industry exemption to CAO 48.[27] The standard exemption included:

> 3.1.1 A flight crew member shall not knowingly operate an aircraft and an operator shall not knowingly require or knowingly permit a flight crew member to operate an aircraft unless at the start of any duty period:
>
> (a) the operator has provided opportunity for and the flight crew member has taken adequate rest;
>
> (b) the operator has provided opportunity for and the flight crew member has taken adequate sustenance; and
>
> (c) the flight crew member is free of any fatigue, illness, injury, medication or drug which could impair the safe exercise of his or her licence privileges….
>
> 3.2.1 An operator shall provide opportunity for and a flight crew member shall ensure that adequate rest is taken during the period prior to commencing or recommencing duty.

The term ‘adequate rest’ was not defined.

For single pilot charter operations, the exemption stated that flight crew could not be rostered for more than four consecutive shifts involving late night operations, or more than four nights in any seven consecutive nights. There were no specific requirements in CAO 48 or the exemption relating to early starts.

Operator’s fatigue management procedures

The operator’s operations manual stated that it would follow the flight and duty time limitations specified in CAO 48, with no additional controls or guidance. CASA issued the operator with the standard industry exemption on 8 October 2010, although the operator’s operations manual had not been updated to include the exemption.

[27] CASA issued an exemption if the operator applied in writing and CASA was satisfied that the operator was operationally capable of working at an equivalent level of safety as CAO 48.

The times of the operator's live crayfish transport operations varied significantly, with a sizeable proportion requiring early starts. The aircraft owner reported that the timing of a flight was based on the request from a crayfish provider and that it was the chief pilot's responsibility to determine whether the flight could be conducted.

Pilots reported that they were generally given 2 days advance notice of an early start, and if they were only advised the day before then there was no pressure to accept the task. They also stated that the operator did not provide any specific procedures regarding early starts, nor did it provide any guidance for minimising their potential impact on fatigue.

The chief pilot was originally scheduled to conduct a freight flight on the afternoon of 24 February 2011. When the rostered pilot for the early flight on 24 February contacted him during the previous evening and expressed concerns about doing that flight, the chief pilot asked another experienced pilot to supervise the rostered pilot. However, neither that pilot nor any other experienced pilot was available.

Fatigue risk management systems

The International Civil Aviation Organization (ICAO 2011) has recently defined a fatigue risk management system (FRMS) as:

> A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness.

ICAO also noted that:

> The traditional regulatory approach to managing crewmember fatigue has been to prescribe limits on maximum daily, monthly, and yearly flight and duty hours, and require minimum breaks within and between duty periods…
>
> Prescriptive flight and duty time limits represent a somewhat simplistic view of safety – being inside the limits is safe while being outside the limits is unsafe – and they represent a single defensive strategy. While they are adequate for some types of operations, they are a one-size-fits-all approach that does not take into account operational differences or differences among crewmembers.
>
> In contrast, an FRMS employs multi-layered defensive strategies to manage fatigue-related risks regardless of their source. It includes data-driven, ongoing adaptive processes that can identify fatigue hazards and then develop, implement and evaluate controls and mitigation strategies. These include both organizational and personal mitigation strategies.

The guide noted that early starts were one factor, among many, that increase fatigue risk in flight operations.

ANALYSIS

The aircraft probably impacted the water between 0755, the approximate time of the pilot’s last reported contact with another pilot, and 0803, when air traffic control (ATC) attempted to contact him. It is also likely that the accident occurred when the pilot was manoeuvring to commence a visual approach to Horn Island from the north, consistent with his last reported intention and the final location of the wreckage, 26 km north-north-west of Horn Island.

Images of the wreckage showed that the aircraft had not broken up in flight. They also indicated that the aircraft impacted the water at a relatively low speed and a near-wings-level attitude, consistent with it being under control at impact.

There was insufficient evidence available to determine why the aircraft impacted the water. This analysis discusses potential scenarios involving a technical problem, pilot incapacitation, an extreme weather event and flight into reduced visibility. Although the reason for the impact could not be determined, the investigation did identify a number of factors that increased the risk associated with the operation, including fatigue management and instrument approach proficiency.

Potential scenarios

Technical problem

There were no documented or reported problems with the aircraft prior to the accident flight, and the pilot did not report any concerns or problems with the aircraft during the flight. It is reasonable to expect that if he had intentionally ditched the aircraft due to a technical problem, he would have communicated that intention to other pilots or ATC. However, there were no such reports, and there were no apparent problems with the pilot’s communications throughout the flight.

Examination of the wreckage did not identify any problems with the flight control surfaces or other aircraft systems that could explain the accident. However, the examination was based on photographs and video footage taken 9 months after the accident, and some potential problems could not be excluded.

There was a difference in the damage signatures of the two propellers, with the left propeller showing clear evidence of it being under power at impact and the right propeller only showing that it was rotating at impact. However, this difference did not mean there was a problem with the right engine as the same pattern of evidence could have been produced with both engines under power.

In addition, the wreckage examination revealed no evidence of significantly unbalanced flight, which would have been more likely if the right engine had failed and the propeller had continued to windmill. Furthermore, the pilot had practiced responding to an engine failure in multi-engine aircraft on numerous occasions during aircraft endorsements and annual instrument rating renewals. Consequently, if there had been an engine problem, and the aircraft was at an appropriate altitude, the pilot should have had the skills to respond effectively and maintain height.

Pilot incapacitation

The pilot had no reported medical conditions, and pilot incapacitation is a relatively rare contributor to aircraft accidents. In addition, had incapacitation occurred, it would more likely be associated with a loss of control and a different type of impact than the one that occurred. Nevertheless, limitations in the available evidence meant that the possibility of an incapacitation could not be excluded.

Extreme weather event

The weather conditions in the area included low cloud, heavy rain showers and reduced visibility. However, there were no reports of thunderstorm activity, microburst, windshear, or other extreme weather event.

The most relevant report of the weather conditions in the area where the wreckage was found was provided by the Cessna 208 pilot who flew at 4,000 ft from Horn Island north to Badu Island from 0753 to 0805. Based on that report, the Aero Commander probably entered an area of rain and reduced visibility shortly before the accident. However, the Cessna pilot, and other pilots in the area, reported no turbulence or significant wind.

Controlled flight into water due to reduced visibility

The pilot was initially holding to the east of Horn Island due to low cloud and rain. He then moved to the north and indicated that he would attempt a visual approach. It seems likely that he was initially manoeuvring in visual conditions and attempting to maintain visual reference. As indicated above, it is also likely that he then encountered rain and reduced visibility. In such conditions, it can be difficult for a pilot to differentiate between the water and cloud.

The pilot had significant experience flying in the area and had a valid instrument rating. However, there were reports that he seemed comfortable flying through cloud when using visual flight rules and descending through cloud when over water, including descending below 500 ft to get visual if required. If he had engaged in such practices on this occasion, the risk of inadvertently flying into the water would have significantly increased. Switching from visual to instrument flight procedures takes time to do effectively, and instrument procedures also require adequate height above ground (or water) to provide a sufficient safety margin.

At the time of the accident however, there was insufficient evidence available to know what altitude the pilot was attempting to maintain or the extent that his visibility was reduced.

Factors increasing risk

Fatigue

The pilot probably had less than 4 hours sleep the night before the flight, although the actual amount he had that night or on previous nights could not be determined. Research has shown that less than 4 hours sleep affects human performance, and therefore should be avoided for safety-critical work.

The time of day of the accident (about 0800) is not associated with increased fatigue, and it is likely that the pilot had been using the autopilot during the cruise to reduce workload. However, he could have been manually flying during the descent and holding for almost an hour in some potentially challenging conditions, which may have exacerbated his fatigue level. In addition, it could not be established whether he had eaten that morning, and the absence of a meal would have exacerbated the effects of fatigue.

Fatigue can lead to increased acceptance of risk, lapses and delayed response times. In other words, it could have led to the pilot accepting a lower level of visibility during the approach, or to delayed response times in recognising an impending collision. However, without knowing the immediate reasons for the collision, it could not be concluded that fatigue contributed to the accident.

The operator did not have any procedures or guidance for its pilots to manage the potential adverse effects of early starts. On this occasion, the chief pilot also did not demonstrate good fatigue management practices. Given that the rostered pilot had expressed concerns about doing the flight and no other experienced pilots were available, he would have been aware that he may have had to conduct the flight but he did not maximise his potential for sleep. Having been woken at 0350, he then elected to conduct the flight with significantly less than a normal amount of sleep rather than delay the flight. Having commenced the flight, it would have been prudent to recognise the potential effects of fatigue and be very conservative, such as diverting to another location when it became clear that an approach to Horn Island was not immediately possible, rather than hold for an extended period.

Commercial pressure

At the time of the accident, the aircraft had a significant amount of fuel and other nearby aerodromes were not experiencing significant weather conditions. Therefore, there was no operational urgency to land at Horn Island.

The pilot’s decision to undertake the flight as soon as practicable, at short notice and with minimal sleep when the rostered pilot was no longer available, was consistent with a degree of commercial pressure to conduct the flight. The flight departed 75 minutes late, and then was further delayed by the weather at Horn Island. Although such delays should not have threatened the quality of the live crayfish cargo, it would have inconvenienced the crayfish supplier and may thus have provided subtle pressure on the pilot to land as soon as possible. Research has shown that a range of subtle pressures can affect pilot decision making (Bearman, Paletz and Orasanu 2009).

On this occasion however, there was no obvious evidence that the pilot’s manoeuvring in visual conditions or his assessment of risk was being adversely influenced by any commercial pressures. People who communicated with the pilot stated that he seemed normal and did not seem anxious about the delays.

Instrument approach proficiency

Although it is unlikely the pilot was conducting an instrument approach at the time of the accident, it is worth noting that he was not legally able to conduct any of the instrument approaches available at Horn Island. He did not hold an area navigation global navigation satellite system (RNAV (GNSS)) endorsement, and he did not meet the 90-day recency requirements for conducting non-directional beacon (NDB) and distance measuring equipment or global positioning system arrival approaches.

Horn Island was a common destination for the operator, and the type of instrument approaches available there were also the only ones available in most of the destinations in the north Queensland area that the operator used, except Cairns. NDB approaches are generally recognised as being the most difficult (ATSB 2006), and therefore conducting regular practice and maintaining recency is important.

By not having the appropriate endorsements and recency, the pilot was minimising his available options for safely conducting operations when instrument meteorological conditions existed.

Aircraft systems

A range of aircraft systems that can enhance the safety of flight operations are available for aircraft such as the Aero Commander 500S. These include a terrain awareness and warning system, weather radar equipment and automatic dependent surveillance - broadcast equipment. None of these systems were fitted or required to be fitted to the aircraft at the time of the accident.

Although installing new systems obviously involves some cost, aircraft owners need to consider the significant safety benefits of installing such equipment, particularly for aircraft that are used in passenger transport operations, as was the case for the accident aircraft. In addition, there have been a number of regulatory reforms proposed that will require a larger number of aircraft to install these types of systems in the future (see *Safety action*).

FINDINGS

From the evidence available, the following findings are made with respect to the collision with water involving the Aero Commander 500S, registered VH-WZU, that occurred 26 km north-north-west of Horn Island, Queensland on 24 February 2011. The findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

Based on the available evidence, the investigation could not identify with sufficient certainty that any specific safety factors had contributed to the collision with water.

Other safety factors

- The pilot probably encountered rain and reduced visibility shortly before the collision with water.
- The pilot probably had less than 4 hours of sleep in the previous 24 hours, and therefore was probably experiencing fatigue at a level known to have at least minor to moderate effects on performance.
- The operator had limited controls in place to manage the fatigue risk associated with early starts. *[Minor safety issue]*
- The pilot either did not meet the recency requirements or did not have an endorsement to conduct any of the instrument approaches that were available at many of the locations commonly used by the operator, including Horn Island.

Other key findings

- The pilot was probably experiencing some commercial pressure to conduct the flight. However, there was no operational urgency to land the aircraft, and the extent to which commercial pressure affected the pilot’s decision-making after arriving in the Horn Island area could not be determined.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Actions 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.

Following the accident, the operator ceased operations and did not have the opportunity to enhance its processes. Although not undertaken as a result of the accident, the Civil Aviation Safety Authority (CASA) has commenced a number of initiatives to enhance the safety of operations in areas potentially related to the circumstances of the accident. The following discussion highlights the progress of those initiatives.

CASA initiatives

As part of its extensive review of aviation regulatory requirements, CASA issued a consultation draft of Civil Aviation Safety Regulation Part 135 (Australian air transport operations – small aeroplanes) in July 2012. The proposed regulations included a requirement for aircraft with more than five passenger seats engaged in passenger transport operations to have a terrain awareness and warning system. They also included a requirement for such aircraft engaged in passenger transport operations on an instrument flight rules (IFR) flight to have weather radar equipment.

In January 2012, CASA issued a Notice of Proposal Rulemaking (NPRM) regarding the fitment of automatic dependent surveillance – broadcast equipment. The NPRM proposed that all IFR capable aircraft be installed with such equipment by February 2017, with some types of operations requiring fitment earlier.

In May 2012, CASA issued an NPRM relating to fatigue management requirements for flight crew members. For single pilot public transport operations, the NPRM proposed restricting a flight duty period to 9 hours if it commenced between 1500 and 0459, and it also proposed restricting the number of late night duty periods that could be conducted in a week. The NPRM included a draft Civil Aviation Advisory Publication (CAAP) that provided detailed guidance material on fatigue management to operators and flight crew. The draft CAAP included an alertness assessment tool that recognised the risk associated with many factors, including having 5 or less hours sleep in the last 24 hours (with the risk increasing as the amount of sleep reduced) and conducting duty in the period between 0200 and 0600.

APPENDIX A: SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included:

- the operator and pilots who flew for the operator
- aircraft documentation
- the owner and maintainer of the aircraft
- the flight crew of other aircraft operating in the vicinity of Horn Island at the time of the accident
- Airservices Australia
- the Bureau of Meteorology
- the Civil Aviation Safety Authority (CASA)
- the Queensland Police Service
- Australian Search and Rescue.

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Submissions

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

A draft of this report was provided to the aircraft operator, the aircraft owner, the aircraft maintainer, the Bureau of Meteorology (BoM) and CASA.

Submissions were received from the BoM and CASA. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

Collision with water, Aero Commander 500S, VH-WZU, 26 km north-north-west of Horn Island, Queensland, 24 February 2011

AO-2011-033
Final