Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Occurrence Report – 200600256
Final

Aircraft loss of control
4 km E McArthur River Mine Aerodrome, NT
19 January 2006
VH-MNI
Beech Aircraft Corp 58

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Figure 2 - Office of the Coroner, Northern Territory

Figures 3 and 4 -The pilot of the Navajo referred to in the report

Abstract

At about 0712 Central Standard Time on 19 January 2006, a Beech Aircraft Corp 58 Baron aircraft, registered VH-MNI, departed Darwin Airport, NT, on a charter flight to McArthur River Mine Aerodrome, NT. The flight was conducted under the instrument flight rules. On board were the pilot and one passenger. During the flight, the pilot advised air traffic control that his expected arrival time at McArthur River Mine was 0915. At about 0915, the aircraft was observed to fly overhead the aerodrome at a normal circuit height (1,000 ft above ground level) and it appeared to be tracking to a mid to late downwind position for a landing on runway 24. The aircraft did not land at the aerodrome at the expected arrival time and a search was commenced.

The wreckage was located about 4 km east of the aerodrome. An examination of the wreckage indicated that the aircraft impacted the ground inverted in a steep nose-down attitude. The accident was not survivable. The wreckage was consistent with a loss of control situation, but the likely reason for the loss of control could not be determined.

Although not related to the accident, during the course of the investigation it was identified that AusSAR had initially cancelled the uncertainty phase associated with the aircraft. The Australian Maritime Safety Authority within which AusSAR is located, has advised that it is planning to review some aspects of its 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 Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

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.

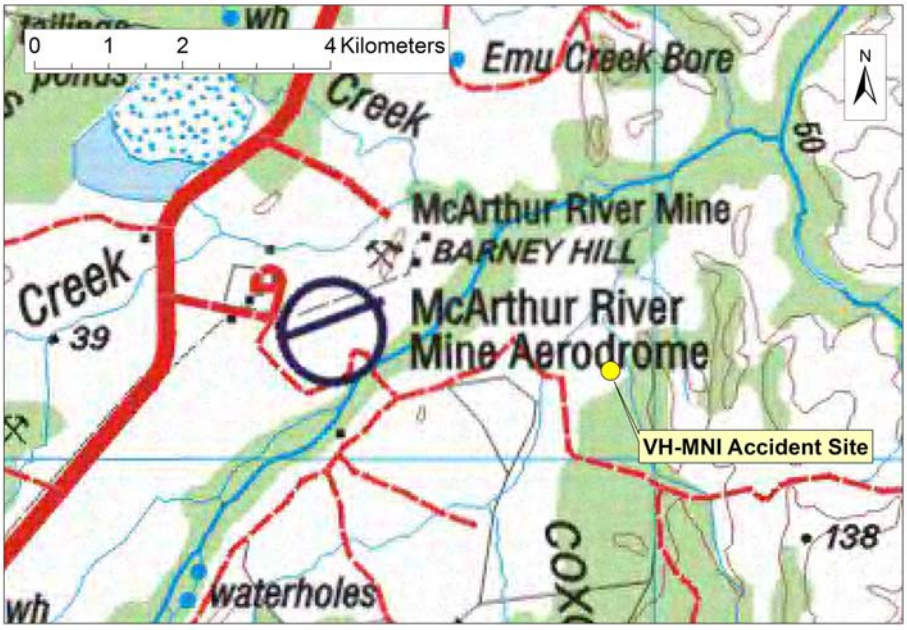
About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

History of the flight

At about 0712 Central Standard Time[1] on 19 January 2006, a Beech Aircraft Corp, 58 Baron aircraft, registered VH-MNI, departed Darwin Airport, NT, on a charter flight to McArthur River Mine Aerodrome, NT. The flight was conducted under the instrument flight rules (IFR). On board were the pilot and one passenger. The aircraft did not land at the aerodrome at the expected arrival time and a search was commenced. At about 1050, the wreckage was located about 4 km east of the aerodrome (Figure 1). On arrival at the accident site, rescue personnel found that both aircraft occupants had sustained fatal injuries. The accident was not survivable.

Figure 1: Location of accident site



The pilot had flight planned to cruise at an altitude of 9,000 ft on a direct track to McArthur River Mine Aerodrome, located 385 NM[2] south-east of Darwin. The pilot's flight plan indicated that he expected to achieve an aircraft groundspeed of 205 kts, with an estimated time of 118 minutes. The pilot was scheduled to pick up an additional passenger at McArthur River Mine and transport the two passengers on to Merlin Mine, before returning to Darwin with two other passengers.

At 0723, as the aircraft was climbing to 9,000 ft in controlled airspace the pilot requested a deviation of 'five miles left of track due weather'. The request was

1 The 24-hour clock is used in this report to describe the time of day. Central Standard Time (CST) was Coordinated Universal Time (UTC)+ 9.5 hours. All radio broadcasts to and from the pilot used UTC, and these have been converted to CST to enhance the readability of the report.

2 NM = nautical mile. 1 NM is equal to 1.852 kilometres.

approved by the sector controller. Radar data showed that the aircraft levelled out at 9,000 ft at 0727. The aircraft reached the limit of radar coverage at about 0840, when the aircraft was approximately 111 NM (206 km) from McArthur River Mine. Up until that time, the aircraft's heading was consistent with the planned track, the altitude was constant at 9,000 ft, and the average groundspeed at 9,000 ft was about 200 kts.

At 0843, the pilot advised the sector controller that he was estimating arrival at McArthur River Mine at 0915, and requested the latest weather information for the aerodrome. The controller provided the recorded weather observation at the aerodrome for 0800 local time (see 'Weather information' below).

At 0854, the pilot advised the sector controller that he would be at 'top of descent' for McArthur River Mine within 2 minutes and requested traffic information. The controller reported that there was no IFR traffic relevant to the Baron aircraft's flight. Assuming the aircraft's track and groundspeed remained constant up to that point, the aircraft would have commenced descent at about 60 NM from McArthur River Mine, which was consistent with normal operating practice.

A Piper PA-31, Navajo aircraft, registered VH-BTD, was in the circuit area at McArthur River Mine in preparation for landing on runway 06. The pilot of the Navajo reported that he heard a transmission on the common traffic advisory frequency (CTAF) from the pilot of the Baron. In that transmission, the Baron pilot advised that he was inbound to McArthur River Mine and requested information on the weather conditions at the aerodrome. The pilot of the Navajo replied that there was scattered cloud at 800 ft, good visibility and scattered rain showers in the area. He suggested that runway 24 was the most appropriate runway, given the arrival track of the Baron and the location of the rain showers south-west of the aerodrome. The pilot of the Baron acknowledged the Navajo pilot's transmission.

In addition to the pilot, another crew member on board the Navajo, reported hearing the communications between the two pilots. Both the pilot and the crew member reported that the content and tone of the Baron pilot's transmissions did not indicate that he was experiencing any difficulties or problems.

After landing, the pilot of the Navajo had disembarked his aircraft when he subsequently observed the Baron overfly the aerodrome. He estimated that it directly overflew the aerodrome manager's building, located near the threshold of runway 06. He stated that the aircraft appeared to be at a normal circuit height (1,000 ft above ground level) and that it appeared to be tracking to a mid to late downwind position for a landing on runway 24. He also stated that the aircraft appeared to be operating normally with normal sounds from both engines. Both the crew member of the Navajo and the manager of the aerodrome also saw and heard the Baron fly overhead, and noted nothing unusual regarding the aircraft's operation.

The pilot of the Navajo was uncertain about the time that he saw the Baron fly overhead, or the time that the pilot of the Baron made the transmission on the CTAF. However, the crew member on board the Navajo had taken some digital photographs while his aircraft was in the circuit area and after it landed. The pilot estimated that the photographs on the ground were taken up to 5 minutes before the Baron flew overhead. Examination of the digital image files indicated that the photographs taken on the ground were taken at about 0915.

Transmissions on the McArthur River Mine CTAF were not recorded. However, a person in the terminal building reported that he could hear the aerodrome manager's VHF radio, which was selected to the McArthur River Mine CTAF. That witness heard the Baron fly over the aerodrome and did not recall hearing any subsequent transmissions from the pilot of the Baron.

At 0926, the sector controller advised the Flightwatch[3] operator that the pilot of the Baron had not reported his arrival at McArthur River Mine. The Flightwatch operator unsuccessfully attempted to contact the pilot, and then, at 0932, notified AusSAR[4], which assumed coordination responsibility for locating the aircraft. At 0936, an AusSAR officer contacted the aircraft operator, which reported that it had not had any contact with the pilot. The aircraft operator advised that it would try and contact the pilot and call back.

At 0937, the McArthur River Mine Aerodrome manager contacted the aircraft operator to confirm the registration of the aircraft. The aerodrome manager informed the operator that the aircraft had passed overhead but not landed, and that he had tried unsuccessfully to contact the pilot via radio. The AusSAR officer contacted the aerodrome at 0938, and was advised that the aircraft had flown overhead. The AusSAR officer asked the aerodrome to get the pilot to contact air traffic control when he was on the ground, and then cancelled the uncertainty phase at 0940.

At 1003, the aircraft operator advised AusSAR that the Baron had not landed at McArthur River Mine and that it could not contact the pilot. AusSAR reactivated the uncertainty phase, and shortly thereafter, at 1006, declared a distress phase. The pilot of the Navajo was tasked by AusSAR to look for the missing aircraft. Shortly after, observers on board the Navajo sighted the wreckage of the Baron (Figure 2).

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3 Flightwatch provides on-request services to the aviation industry, including the provision of operational information and SARTIME management and alerting.

4 Australian Search and Rescue (AusSAR) was a business unit of the Australian Maritime Safety Authority. AusSAR coordinated the response to aviation and maritime search and rescue occurrences.

Figure 2: Accident site

Personnel information

The pilot in command was appropriately qualified and licensed to undertake the flight. He had a total flying experience of 3,559.3 hours, and had flown 555.4 hours on multi-engine aircraft, most of which was conducted in 2005. He obtained an endorsement for the Baron aircraft in 2001 and had completed 166.8 hours in that aircraft type, most of which were also conducted in 2005. He was issued with a commercial pilot (aeroplane) licence in 1997 and also held a Grade 1 instructor rating.

The pilot's last multi-engine command instrument rating was completed on 31 May 2005. His last competency check was completed on 13 December 2005, and his last competency check in the Baron (11 November 2005) was a proficiency check to conduct supervisory pilot duties from the right seat. The previous competency check in a Baron was conducted in April 2005, that check included practicing recovery from stalls. The pilot also conducted stall recovery practice when obtaining another multi-engine aircraft endorsement in August 2005. No problems were noted on any of the pilot's training or checking records. The pilot was described by the operator's training and checking personnel as conscientious, well-prepared and knowledgeable about the aircraft he flew.

In the previous 90 days, the pilot had flown 141.9 hours, including 38.7 hours on Barons. His logbook indicated that he had flown into McArthur River Mine on at least two previous occasions, the last being on 29 November 2005.

On 16 January 2006, the pilot's duty time was recorded as starting at 0645 and ending at 2030, with a flight time of 4.8 hours. It was reported that when he returned home, he had a headache and body ache. On 17 January, he telephoned the operator and stated that he was unable to work due to sickness. He continued to feel unwell on 18 January and again reported in sick. However, after lunch that day, he contacted the operator and reported that he was feeling better and available for any urgent tasking if required. He went into work to conduct a flight, but the job was

later cancelled. That evening he conducted some preparatory work for the flights the next day.

It was reported that the pilot went to sleep each night between 2100 and 2130. He normally woke between 0530 and 0600, though had extra sleep on 17 January. On 19 January, he awoke at about 0400 and did some yoga exercises before going to work.

Aircraft information

The aircraft was manufactured in 1978 and imported into Australia the same year. It had a total time in service of 9,826.4 hours.

The operator purchased the aircraft in November 2004. The aircraft underwent regular maintenance and non-scheduled repairs over the 713.4 hours flying service with the operator. The approved system of maintenance included Check 2 inspections every 200 hours, with Check 1 inspections conducted at the 100-hour intervals between the Check 2 inspections. The aircraft had a valid maintenance release, issued on 9 November 2005 following the last Check 2 inspection. The last Check 1 inspection was conducted on 6 January 2006. On 13 January, the Civil Aviation Safety Authority issued a permissible unserviceability to allow the aircraft to be operated with the combustion cabin heater unserviceable until 13 February 2006. There were no other outstanding maintenance items. Pilots who had flown the aircraft in the days prior to the accident reported no problems or concerns regarding the aircraft.

The weight of the aircraft at the time of the accident was estimated to be approximately 2,276 kg, which was less than the maximum landing weight specified for the aircraft (2,449 kg). The centre of gravity was also estimated to be within the specified limits.

The aircraft was fitted with dual controls and an emergency locator transmitter.

Wreckage examination

An examination of the wreckage indicated that the aircraft impacted the ground inverted in a steep nose-down attitude (Figure 3). The wreckage was contained in the immediate area of the impact crater, suggesting a predominantly vertical component to the direction of flight at impact. The wreckage had been disturbed by rescue personnel prior to examination by Australian Transport Safety Bureau (ATSB) investigators.

Figure 3: Aircraft wreckage

Further information obtained from the wreckage examination included the following:

- The cockpit and aircraft cabin, to just rear of the main cabin utility door, were destroyed by extreme vertical impact forces, experienced during the accident sequence. The rear fuselage and tail section also showed evidence of impact damage with the ground. The pattern of damage to the aircraft was consistent with impacting terrain at a high speed.
- Both engines, nacelles and propellers had detached from the airframe and were located in the impact crater.
- Both wings were intact, but separated from the fuselage. The forward structures of both wings were crushed back to their rear spars and the wing fuel tanks were breached during the impact sequence, preventing the retrieval of fuel for sampling. Each of the wing fuel tank bays showed evidence of skin attachment failure on the rivet lines. First response personnel at the accident site reported a strong smell of aviation gasoline.
- The ailerons, rudder and elevator flight control surfaces, with their associated trim tabs, were located within the main wreckage area. The pilot's control column and yoke were destroyed, and the rudder pedals had separated from the vertical posts. Due to the level of damage, it was not possible to trace all of the control systems. The nature of the damage showed that the aileron controls were intact prior to impact. The rudder and elevator control cables were severed during the post-accident recovery activities. However, the cable turnbarrels were observed intact and lockwired. In summary, a detailed examination of the wreckage did not identify any manual control system anomalies that would have prevented controlled flight of the aircraft prior to impact. However, due to the severe impact damage and post-accident recovery activities, it was not possible to confirm the integrity of some parts of the elevator or rudder control systems.

- The landing gear was extended.
- The wing flaps were extended in the approach (15 degrees) position.
- The fuel selector for each engine was in the ON position.
- Due to the extent of impact damage, no reliable evidence of control settings in the cockpit could be obtained.
- The emergency locator transmitter was found in the wreckage, however it was destroyed by impact forces and would have been incapable of transmitting any signal.

Examination of aircraft components

The following components were removed for further examination. The results of those examinations are as follows.

Engines

The aircraft was fitted with two Teledyne Continental Model IO-520C engines. Both engines were extensively damaged by impact forces. Although all components of the engines could not be functionally tested, a detailed examination found no mechanical anomalies within either engine that would have prevented them from operating.

Propellers

The aircraft was fitted with Hartzell three-bladed, constant-speed, feathering propellers (Model PHC-J3YF-2UF). The blades of both propellers showed very little chord-wise scoring or distress on either surface, which implied a rapid cessation of rotation upon ground impact. Dominant blade distortion of both propellers was heavy out-of-plane bending to the rear. The absence of any prominent evidence of in-plane reactive bending or torsional distortion indicated that the propellers were rotating, rather than feathered, at impact. The rapid stoppage of the propellers and the pattern of blade bending was consistent with both engines producing low power at impact. Witness marks on the blade preload plates of the left propeller provided some indication that this propeller was operating in the governed speed range at impact. The damage to the right propeller pitch change mechanism prevented similar evidence being observable for that propeller. No evidence of any pre-existing unserviceability or anomalous condition was found within either of the propeller units.

Dual engine tachometer

The speed of both engines was indicated on a single tachometer gauge with two indicator needles, one for each engine. The indicator needles were found stuck in a position indicating about 2,100 RPM. Witness marks on the back of the rear needle indicated that the two needles were providing the same reading at impact.

Autopilot system

The aircraft was fitted with an S-Tec System 50 Autopilot (Model ST-224-50) on 9 November 2005. Components of the system were identified and removed from the wreckage for detailed examination. Not all of the components were able to be functionally tested. However, no evidence was found to indicate that there were any problems with the functioning of the system. The filament of the 'ready' light globe was examined and exhibited signs of filament stretch, indicating that the filament had stretched while hot and that the light bulb was illuminated at the time of impact.[5] There was no evidence of filament stretch found in any of the other autopilot system light globes.

Elevator pitch system

Elevator trim and rudder trim tabs were found to have been run to one end of their respective travel limits. It was likely that had occurred when the rescue personnel cut the tail free of the aircraft and dragged it rearward before the smaller trim control cables had been completely separated during the rescue/recovery effort disassembly. Aileron trim was estimated to be set at or close to neutral.

Autopilot and elevator trim servos

The elevator pitch trim servo was not an integral component of the autopilot system and was not controlled by it. The pilot's pitch trim inputs were by either the electric trim servo or manually moving the trim wheel on the centre console. The autopilot and elevator trim servos were tested, with clutch torque breakaway figures found to be slightly below the manufacturer's specifications.[6] It was considered that, had a malfunction occurred within the autopilot involving any axis servo runaway, or with the electric elevator trim, that the breakaway clutch settings would have enabled the pilot to manually override any such erroneous control inputs to maintain control of the aircraft.

Stall warning switch

The stall warning switch was substantially damaged during the impact and could not be functionally tested.

Weather information

The Bureau of Meteorology (BoM) reported that, on the day of the accident en-route from Darwin to McArthur River Mine, the aircraft would have encountered scattered showers and possibly isolated storms, embedded in extensive areas of cloud. Upper level winds were favourable for the development of moderate

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5 The 'ready' indicator light illuminates when the autopilot has completed a self check and verified that the turn and bank gyro was up to speed and the system was ready for mode selection. After a mode has been selected, the 'ready' globe extinguishes.

6 A figure lower than the manufacturer's specification meant that, had there been a malfunction resulting in an electric trim 'runaway', it would have been easier than normal for the pilot to physically overcome.

turbulence, as stated in area forecasts. The area forecast for the period 0230 to 1530 stated that the freezing level was expected to be at 16,000 ft.

The Terminal Aerodrome Forecast for McArthur River Mine, issued at 0348 on 19 January 2006, forecast broken[7] stratus cloud at 1,000 ft above aerodrome level, light rain, and light north-east winds. The forecast had a temporary holding (TEMPO)[8] for operational requirements due to storms for the whole day. However, a review of satellite and radar pictures by the BoM concluded that there did not appear to be any storms in the area at the time of the accident. Computer generated upper air charts for 0930 indicated that there was less than 5 kts of wind at 10,000 ft, 5,000 ft and 3,000 ft in the area around McArthur River Mine.

The McArthur River Mine automatic weather station recorded the following observations on the day of the accident:

- 0800 local time: wind from 070 degrees at 4 kts, temperature 25.6 degrees, QNH 1006.8 hectopascals (hPa), no rainfall recorded in last 10 minutes, 45.6 mm rain recorded since 0900 the previous day (0 mm rain recorded in previous hour).
- 0900 local time: wind from 050 degrees at 4 kts, temperature 25.9 degrees, QNH 1007.5 hPa, no rainfall recorded in last 10 minutes, 45.8 mm rain recorded since 0900 the previous day (0.2 mm rain recorded in previous hour).
- 1000 local time: wind from 360 degrees at 4 kts, temperature 26.4 degrees, QNH 1007.6 hPa, no rain recorded since 0900.

The automatic weather station did not have the capability to record cloud amount or type. However, the pilot of the Navajo aircraft, which landed at McArthur River Mine shortly before the Baron flew overhead, reported that, when he was in the circuit, there was scattered cloud at 800 ft, which he described as ‘very isolated’ and no potential threat to maintaining visual contact with the runway. There was no wind or turbulence, the visibility was good, and there was no rain in the circuit area, although there were showers about 5 NM south-west of the aerodrome. These showers eventually moved to the north-west of the aerodrome.

Figures 4 and 5 were photographs taken from on board the Navajo when that aircraft was in the circuit area. Figure 4 was taken when the aircraft was located to the south of the runway, above the circuit height (1,000 ft). The photograph shows scattered cloud below the aircraft looking to the west. Figure 5 was taken a few minutes later when the aircraft was in the downwind leg of a right circuit to land on runway 06. The photograph shows the terrain and sky looking towards the north, the direction from which the Baron approached the aerodrome. In both photographs, the aircraft was travelling to the left.

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7 Broken refers to 5 to 7 eights of the sky obscured by cloud.

8 TEMPO is used to indicate a change in prevailing conditions expected to last for a period of less than one hour.

Figure 4: Photograph taken shortly before the Baron overflew McArthur River Mine

Figure 5: Photograph taken shortly before the Baron overflew McArthur River Mine

Medical and pathological information

Post-mortem examination and toxicological testing found no evidence to indicate a pre-existing medical or physiological factor that could have influenced the pilot's performance. However, due to the nature of the impact, there were limitations in the examinations that could be conducted. A review of aviation medical records and

interviews with the pilot's work colleagues and family also did not identify any medical conditions likely to have significantly influenced his performance.

The injuries received by both occupants were consistent with a high speed, rapidly decelerating impact. The accident was not survivable.

Passenger information

During the wreckage examination, several boxes of a common type of antidepressant medication were found. The medication was the same type and brand that had been prescribed to the passenger. Although the medication had a half life[9] of 4 to 8 days, toxicological testing of the passenger did not detect the presence of the antidepressant medication. The passenger's medical practitioner reported that the depression had existed for several years, and that the passenger's symptoms would be more significant when he was not taking the medication. He also reported that the passenger's condition was associated with a loss of interest rather than self harm, and there had been no indication of suicide risk. The passenger's friends and work colleagues reported that they had never observed any indication of self harm or intention to harm others in the passenger's behaviour.

The passenger's medical practitioner, friends and work colleagues reported that the passenger had no history of seizures, fits or panic attacks. His friends and work colleagues also reported that he had frequently flown in light aircraft and had never shown any indication of having concerns about flying in such aircraft.

Operational information

The pilot and the crew member of the Navajo, reported that they did not see any birds when they were in the circuit, after they landed, or when they undertook the search flight. However, the pilot of the Navajo reported that there had been bird activity at the aerodrome on the previous day. Another witness at the aerodrome also reported that he had not observed any birds in the vicinity at the time that the Baron overflew the aerodrome. The examination of the wreckage found no evidence that the aircraft had struck birds prior to the accident.

On the morning of 19 January 2006, 462 litres of fuel was added to the aircraft, resulting in the aircraft being fully fuelled with a total of 737 litres for the flight. There were no reports of any other aircraft experiencing problems with the quality of the fuel obtained from the same source.

The operator's pilots reported that their normal practice for operating the Baron was to have an engine speed of 2,300 RPM during the cruise. The constant speed propeller design would typically maintain that engine speed through to the final landing approach. The manifold pressure would be reduced during the descent until, when the aircraft levelled out at the circuit height of 1,000 ft above ground level, there was typically a manifold pressure of 18 inches. The first stage of flap and the landing gear would be selected during the downwind leg, with the aircraft turning on to the base leg with a speed of about 110 to 120 kts. The second (and last) stage

9 The duration of action of a drug is known as its half life. It is the period of time required for the concentration or amount of drug in the body to be reduced by one half.

of flap would be selected when the aircraft was turning on to final approach or during the final approach. The operator's pilots reported that they did not use the autopilot after they reached the circuit area.

The operator's pilots reported that, in situations where there was only one passenger, it was up to the pilot's discretion as to whether the passenger would sit in the front passenger seat or in a seat behind the front seats. No witnesses observed where the passenger was seated for the accident flight.

The Airplane Flight Manual for the aircraft indicated that the power-off stall speed for the aircraft at the estimated landing weight was approximately 80 kts with wings level and flaps UP. For the same configuration, the stall speeds were 87 kts at a 30-degree angle of bank, and 113 kts for a 60-degree angle of bank. The flight manual also indicated that there would be a maximum height loss of 350 ft when recovering from a stall. The flight manual did not provide data for the aircraft stall speed with the flaps selected in the first stage. The flap DOWN stall speed was approximately 9 kts lower than the equivalent flap UP stall speed. Engine power would also slightly reduce the aircraft stall speed.

Search and rescue information

Procedures for search and rescue tasks were contained in the National Search and Rescue Manual, produced by the Australian Maritime Safety Authority. Chapter 3 of the manual was titled 'Awareness and Initial Action'. The chapter contained procedures and guidance for AusSAR officers regarding the different phases associated with an emergency, including guidance on the evaluation of reports and information provided to AusSAR.

Section 3.4.4 (uncertainty phase) stated:

> The uncertainty phase is assigned any time doubt exists as to the safety of a craft or person because of knowledge of possible difficulties, or because of lack of information concerning progress or position. The keyword is DOUBT.

Section 3.4.5 in the same section further stated:

> An uncertainty phase is said to exist when there is knowledge of a situation that may need to be monitored, or to have more information gathered, but that does not require dispatching of resources. When there is doubt about the safety of an aircraft, ship, other craft or persons, the situation should be investigated and information gathered. For aircraft, an uncertainty phase is declared when:
>
> a. no communication has been received from an aircraft within a period of fifteen (15) minutes after the time a communication should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made, whichever is the earlier; or …
>
> c. an aircraft fails to arrive within fifteen (15) minutes of the last estimated time of arrival last notified to or estimated by ATS units, whichever is the later, except when no doubt exists as to the safety of the aircraft and its occupants.

Section 3.6.2 (uncertainty phase initial action) stated that, when a SAR authority had declared an uncertainty phase, the initial response action was to verify the

information received. This provision detailed various sources of such verification, depending on the circumstances of the incident. These sources included extending inquiries to the operator of the aircraft and the aerodrome operators.

Section 3.6.4 (phase transition) stated:

> When the communications search or other information received indicates that the aircraft is not in distress, the SAR authority will close the incident and immediately inform the operating agency, the reporting source and any alerted authorities, centres, or services. However, if apprehension regarding the safety of the aircraft and its occupants continues, the Uncertainty Phase should progress to the Alert Phase.

AusSAR staff stated that it would be normal practice to wait until the aircraft landed prior to closing an uncertainty phase, but the decision was up to the discretion of the officer.

AusSAR management advised that declaration of a phase is intended specifically to alert the SAR and related systems to a possible emergency, and to provoke reaction from those systems. It is not considered appropriate to hold them in an alerted state once the uncertainty or apprehension that caused the phase has been dispelled. Management also stated that AusSAR did not have the resources to provide flight watch or flight monitoring services.

In the case of MNI, AusSAR management also reported that AusSAR had not been aware that the estimated time of arrival of MNI was 0915, and that the last report from the aircraft near top of descent was at 0854. In the absence of this information, it was dealing with an aircraft missing between Darwin and McArthur River Mine. In such a situation, the sighting of the aircraft in the circuit would relieve concern. However, had they been aware of the flight following information, they may have then focussed more on the circuit phase of the flight.

ANALYSIS

The wreckage distribution was consistent with a high speed vertical impact with terrain, due to a loss of control. Given the location of the wreckage, and witness reports of the track of the aircraft, it is likely that the loss of control occurred when the aircraft was late on the downwind leg or early on the base leg of the circuit area for landing on runway 24.

The investigation could not determine the likely reason for the aircraft's loss of control. A detailed examination of the aircraft and its components found no evidence to indicate that a technical failure or problem contributed to the loss of control, although the level of damage meant that the functionality of all components could not be conclusively determined. Given the recorded fuel quantity on board the aircraft at the beginning of the flight, the duration of the flight, and that both engines appeared to be operating at impact, there was no indication of problems regarding the quantity or quality of the fuel on board the aircraft.

The investigation did not identify any environmental factors that may have contributed to the loss of control. There was no indication that turbulence or windshear would have been present in the circuit area, and the conditions during the flight were very unlikely to have led to airframe icing. In addition, witness reports indicated that it was unlikely that there was sufficient cloud to have interfered with the pilot's ability to maintain visual reference with the ground when in the circuit area. Although birds had been observed in the aerodrome area on the previous day, none were observed by witnesses around the time of the accident, and there was no evidence that the aircraft had struck birds prior to impact.

The possibility that the passenger may have interfered with the operation of the flight, either intentionally or otherwise, was considered. However, the investigation could not determine with certainty where the passenger was seated. Even if the passenger had been seated in the front of the aircraft, there was no indication that he had a medical condition that would have led to unintentional interference with the aircraft's operation, such as a seizure. There was also no evidence to indicate that the passenger had a reason for intentionally interfering with the aircraft's operation, or that he had shown any previous indications of such behaviour.

The possibility that the pilot's handling of the aircraft inadvertently led to the loss of control situation was also considered. The pilot was experienced on the aircraft type and had no prior indication of performance problems. Other than the fact that the aircraft impacted terrain, no anomalies were noted in the planning or the conduct of the flight. The aircraft arrived in the circuit area without incident, and was observed heading towards the downwind leg of the circuit in a normal manner. The first stage of flap had been selected and the landing gear was extended, and this configuration was consistent with normal operating practice for late in the downwind leg of the circuit. In addition, the autopilot was in the ready mode but not engaged, which was consistent with normal operations within the circuit.

It is possible that the pilot inadvertently stalled the aircraft during the turn on to the base leg and did not have sufficient height to recover from the stall. To inadvertently stall the aircraft, the pilot would have needed to fail to respond to a stall warning indication, an abnormal nose attitude or bank angle, and/or a relatively low airspeed. The pilot then also needed to fail to regain control of the aircraft

during the stall recovery. Overall, a loss of control in the circuit area due to a stall was considered inconsistent with the experience and skill level of the pilot.

It is possible that the pilot's performance may have been subtly influenced by a combination of factors, such as the residual effects of his illness from the previous two days, low-level hypoxia from operating at 9,000 ft for about 2 hours, operating at a temperature of less than 10 degrees Celsius (without a functional heater) for about 2 hours, and mild fatigue due to waking up at 0400 on the morning of the accident flight. There were, however, no indications in the available evidence of any factor that would have led to pilot incapacitation.

A post-accident examination of the wreckage found that the indicator needles on the dual engine tachometer were both indicating about 2,100 RPM. These settings were considered to be a reasonable indication of both engine's speeds at impact. The normal operating procedure would have been to have both engines operating at a speed of 2,300 RPM in the circuit. The reason for the discrepancy could not be determined. It is possible that, during the descent and in response to an increasing airspeed or abnormal aircraft attitude, that the pilot had closed the throttles and consequently reduced the speed at which the propellers were rotating.

The accident was not survivable. However, during the course of the investigation, it was identified that AusSAR had initially cancelled the uncertainty phase associated with the aircraft. That decision was based on advice from the aerodrome operator, which had not spoken with the pilot directly, that the aircraft had arrived in the circuit area. Nevertheless, had further information been obtained, it would have been determined that the aircraft had flown overhead about 18 minutes prior to the phone conversation, and that the aerodrome manager had attempted to and not been able to contact the aircraft.

For the timely initiation of search and rescue activities in future situations for accidents in the circuit area which may be survivable, it would be beneficial for AusSAR procedures and guidelines to emphasise the importance of obtaining sufficient information to ensure no doubt exists regarding the safety of an aircraft prior to cancelling an uncertainty phase.

FINDINGS

Contributing safety factors

- Control of the aircraft was lost when the aircraft was on late downwind or early base leg of the circuit to land at McArthur River Mine Aerodrome. The accident was not survivable.

Other safety factors

- The uncertainty phase associated with the aircraft was cancelled without sufficient information being obtained to determine that there no longer existed any doubt in relation to the safety of the aircraft.
- AusSAR did not provide clear procedures or guidance to its officers for determining whether there was sufficient information to cancel an uncertainty phase. [Safety issue]

Other key findings

- The reason for the loss of control could not be determined.

SAFETY ACTIONS

Australian Maritime Safety Authority safety action

In response to the Australian Transport Safety Bureau's draft investigation report, the Australian Maritime Safety Authority (AMSA) advised the following:

> AMSA notes from the report that there was information available from air traffic services (ATS) which would have been beneficial to the Rescue Coordination Centre (RCC) assessment of whether there was a distress situation with the aircraft. It might have led to a different conclusion by the RCC regarding progress of the flight and the aircraft's safety at the time the uncertainty phase was declared.
>
> AMSA is seeking an opportunity to review the relevant procedures in conjunction with Airservices Australia with the aim of arranging for 'last known position and status' details to be passed to the RCC with the uncertainty phase when relevant.
>
> Additionally AMSA is reviewing its own procedures and guidelines, in conjunction with Airservices Australia as appropriate, but considers that it would not be appropriate for RCC staff to be required as an inviolable practice to confirm that an aircraft has landed safely before cancelling an uncertainty phase. Not only would that be a more stringent requirement than the air traffic management system would routinely apply to a flight, it is also not appropriate to rely on the RCC to provide the equivalent of flight watch services for aircraft at any time, or to delay the cancellation of a SAR phase when there is no longer uncertainty or apprehension for an aircraft's safety.
>
> While the RCC is prepared to establish an ad hoc arrangement for an aircraft in circuit (as it did, successfully, in the case of VH-MNI), it is important that users and providers of the air traffic management system are aware that AMSA is neither responsible nor resourced to monitor the progress of any stage of a flight, and it would be misleading to present an alternative view.