



Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT

Aviation Occurrence Investigation – 200605843

Interim Factual

**In-flight break-up
20 km NE Bathurst, NSW
BAC 167 Strikemaster, VH-AKY
5 October 2006**



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Postal address: PO Box 967, Civic Square ACT 2608
Office location: 15 Mort Street, Canberra City, Australian Capital Territory
Telephone: 1800 621 372; from overseas + 61 2 6274 6440
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117; from overseas + 61 2 6247 3117
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

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Australian Transport Safety Bureau
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Abstract

At about 1215 Eastern Standard Time on 5 October 2006, the pilot of a British Aircraft Corporation 167 Strikemaster aircraft took off from Bathurst, NSW, for a 25-minute joy flight with one passenger. The flight was intended to include high-level aerobatics followed by a low-level simulated strike mission. When the aircraft failed to return, a search was initiated and the aircraft wreckage was located in the Turon State Forest about 20 km to the NE of Bathurst. The ground impact started a fuel-fed fire that resulted in a large bushfire, which took several days to contain. The pilot and passenger were fatally injured.

On-site and laboratory examination of the wreckage revealed that:

- the engine was producing significant power at the time of impact
- the wing flaps and landing gear were retracted
- the right wing had separated from the aircraft in flight
- the tail components had separated from the aircraft in flight.

As a result of this occurrence, the ATSB briefed the Civil Aviation Safety Authority (CASA) on preliminary findings relating to the wing failure. Subsequent briefings were provided to CASA and the UK Civil Aviation Authority on the failure of the aircraft tail components. CASA has released a number of Airworthiness Bulletins to alert Australian operators of issues relating to Strikemaster and Jet Provost aircraft.

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.

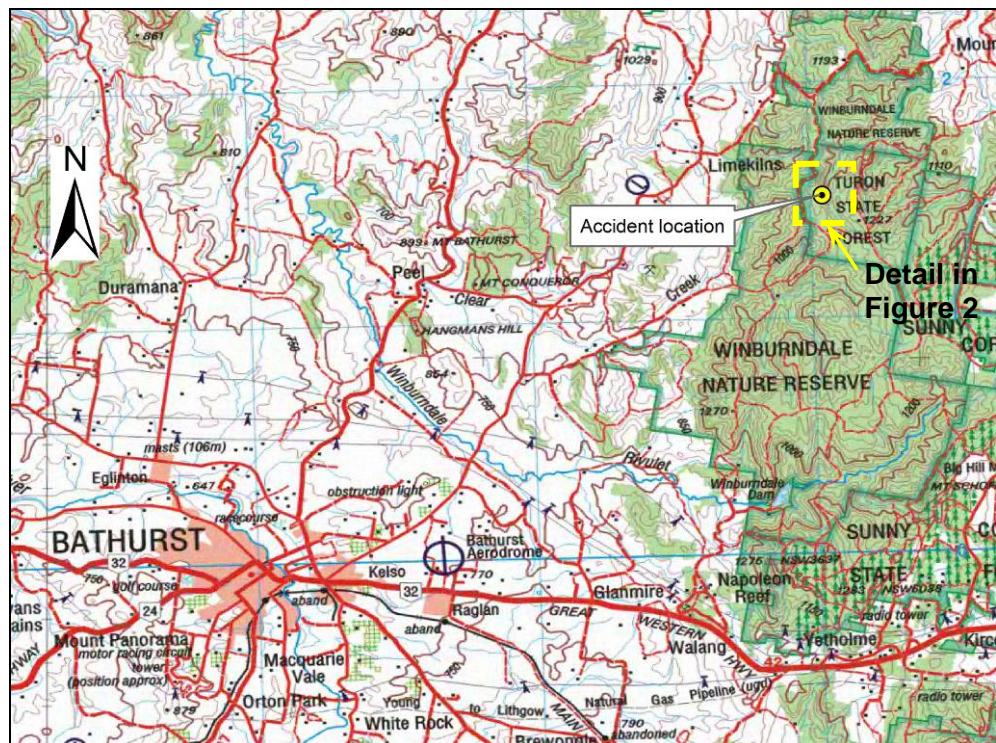
About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

History of the flight

At about 1215 Eastern Standard Time¹ on 5 October 2006, the pilot of a British Aircraft Corporation 167 Strikemaster aircraft took off from Bathurst, NSW, for a 25-minute joy flight with one passenger. The pilot briefed the passenger for the intended flight, which was to include high-level aerobatics followed by a low-level simulated strike mission on a ground feature located on a ridge line at the end of a deep valley in the Turon State Forest, before returning to Bathurst. When the aircraft failed to return, a search was initiated and the aircraft wreckage was located in the Turon State Forest about 20 km to the NE of Bathurst (Figure 1). The ground impact started a fuel-fed fire that resulted in a large bushfire, which took several days to contain. The pilot and passenger were fatally injured.

Figure 1: Accident location



Pilot information

The pilot held a Commercial Pilot (Aeroplane) Licence endorsed for the Strikemaster aircraft type and was approved for low-level aerobatic flight to a minimum height of 500 ft above ground level. He held a Class 1 civil aviation medical certificate and, according to his *Pilot's Logbook*, he had accumulated about

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

2,220 hours total aeronautical experience, about 835 hours on the aircraft type and about 2 hours in the last 30 days.

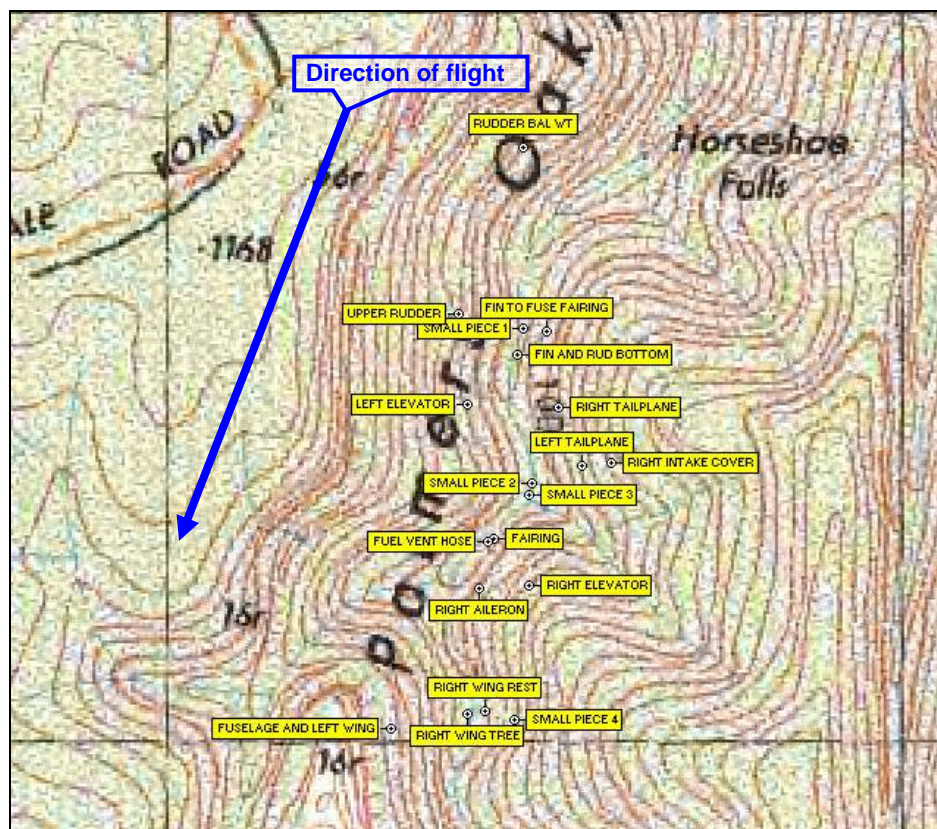
Meteorological information

The Bureau of Meteorology reported fine and mostly sunny weather conditions for the Bathurst region on the day of the accident. Recorded meteorological observations indicated temperatures of a minimum of 3.5 degrees Celsius and a maximum of 27 degrees Celsius. The wind was recorded from the north-west at 13 to 31 kph with maximum wind gusts of 52 kph. There were reports of moderate air turbulence below 5,000 ft in the Bathurst region.

Wreckage information

The wreckage was distributed over about 800 m of sloping, treed, terrain, just to the north of the ground feature that was an intended target, as part of the low-level, simulated, strike mission (Figure 2).

Figure 2: Wreckage distribution²



² The locations of the items of wreckage were determined using Global Positioning System (GPS). Most pieces of the aircraft wreckage were located by Australian Transport Safety Bureau (ATSB) investigators during the initial on-site investigation. However, the bushfire limited the search area, and the rudder mass balance weight was later located by a third party. The location of the mass balance weight was reportedly determined using GPS. In September 2007, ATSB investigators returned to the accident site and searched the valley to the north of the accident site. No further items or aircraft components were found.

The main wreckage, which consisted of the fuselage and left wing, was mostly destroyed by the impact forces and the subsequent fires (Figure 3). Other items of wreckage were damaged to various degrees by impact with the ground and trees and by the bushfire.

Figure 3: Main aircraft wreckage



On-site and laboratory examination of the wreckage revealed that:

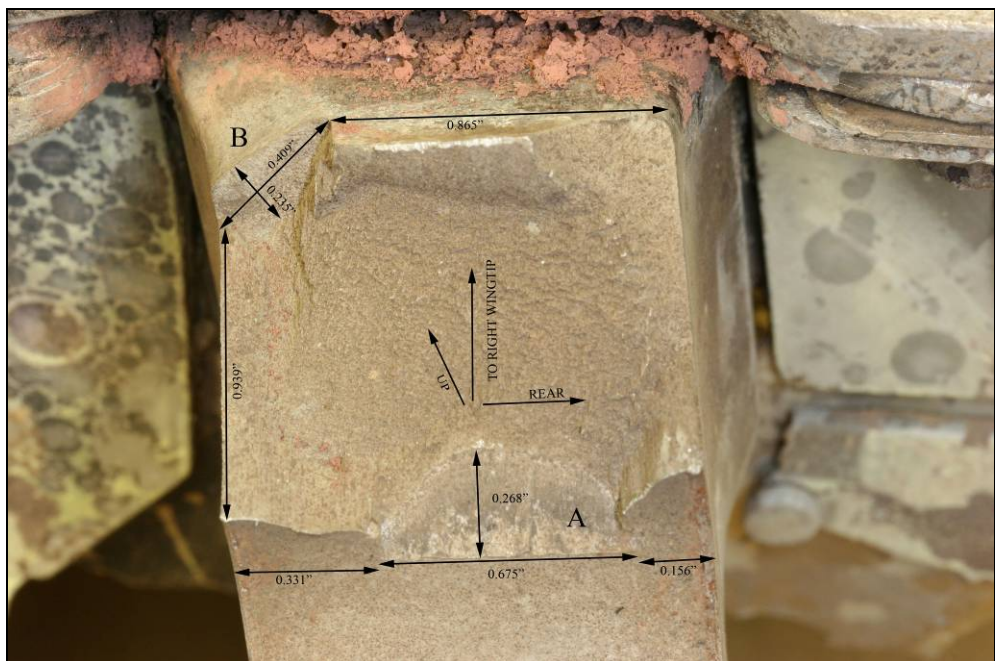
- the engine was producing significant power at the time of impact
- the wing flaps and landing gear were retracted
- the right wing had separated from the aircraft in flight
- the tail components had separated from the aircraft in flight.

The right wing separated from the aircraft under a single downward bending overload that fractured the upper main spar attachment lug (Figure 4) then progressed down through the main spar web and finally fractured the lower and rear spar attachments. The investigation identified two areas of pre-existing fatigue cracks in the upper wing attachment lug, identified as positions A and B (Figure 5). Area A was the larger of the two cracks, with an origin at the lug bore surface. Area B had initiated from an area of prior surface/corner blending, which had been carried out for previous defect removal purposes.

Figure 4: Fracture surface location

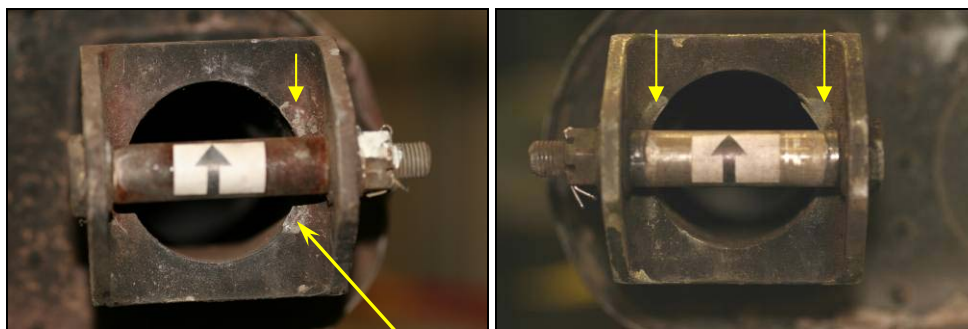


Figure 5: Fracture surface and dimensions



Both left and right horizontal stabilisers had separated from the aircraft under upward bending overload forces. Both elevator torque tube connections presented evidence indicating a large upward deflection of the left and right sections of horizontal stabiliser (Figure 6). Some structural elements of the left horizontal stabiliser also exhibited evidence of a large downward deflection. There were no pre-existing defects identified within the stabilisers or elevators.

Figure 6: Elevator torque tube connections (left and right, respectively)



Contact marks between fittings
due to large stabiliser deflections

The aircraft rudder had broken into three pieces comprising the mass balance weight, upper rudder section and lower rudder section (Figure 7). The mass balance weight had separated from the upper rudder in a manner such that the forward tip was pried over the top of the rudder (blue arrow in Figure 7), producing localised trailing edge buckling and tearing at the corners of the upper hinge cut-out. The lower surface of the mass balance weight had several marks of a shape and profile consistent with multiple impacts against the upper surface of the vertical stabiliser (Figure 8). An indentation in the lower surface of the mass balance weight, collocated with the other marks, suggested an impact with a blunt object. However, there was no corresponding mark on the vertical stabiliser to indicate that it was the origin of the impact.

Figure 7: Rudder pieces (note horizontal stabiliser in background)



Figure 8: Lower surface of rudder mass balance



The lower section of rudder included the rudder torque tube, rudder control bellcrank and elevator control bellcrank. The rudder control bellcrank contained the lower hinge pin, which normally attached it to the fuselage structure (Figure 9). The thread on the lower hinge pin contained thread remnants from the retaining nut (Figure 10). Examination of those threads indicated that the thread had failed in a

shear overload mode (stripping) and that there was only one full thread engagement below the castellated section of the nut.

Figure 9: Rudder lower hinge pin



Figure 10: Thread remnants on rudder lower hinge pin



The investigation is continuing and will include:

- the servicing history and Non-Destructive Inspection (NDI) examinations conducted on the aircraft
- the service information provided to detect wing attachment lug cracks in Strikemaster aircraft
- the system of dissemination of service information to operators of Strikemaster aircraft
- further examination and assessment of the fatigue cracking and failure of the right wing upper spar connection lug
- characterisation of the rudder lower hinge pin failure
- operational issues.

SAFETY ACTIONS

As a result of this occurrence, the Australian Transport Safety Bureau (ATSB) briefed the Civil Aviation Safety Authority (CASA) on preliminary findings relating to the wing failure. CASA released *Airworthiness Bulletin AWB 02-018 Issue 1* on 10 October 2006 and subsequently, *Airworthiness Bulletin AWB 02-018 Issue 2* on 20 October 2006 and *Airworthiness Bulletin AWB 02-018 Issue 3* on 16 November 2006. The bulletins were applicable to all BAC 167 Strikemaster and Jet Provost aircraft. Copies of the bulletins can be found on the CASA website at <http://www.casa.gov.au/airworth/awb/index.htm> or by telephoning CASA on 131 757.

In September 2007, the ATSB provided further briefings to CASA and the UK Civil Aviation Authority on the findings relating to the failure of the aircraft tail components. CASA have advised that it was developing a revised issue of the *Airworthiness Bulletin (Airworthiness Bulletin AWB 02-018 Issue 4)* that it intended to issue in the near future.