



Australian Government

Australian Transport Safety Bureau

In-flight break-up, Stolp Acroduster II SA-750, VH-YEL

16 km north-east of Caboolture Airfield, Queensland, 18 August 2021

ATSB Transport Safety Report

Aviation Occurrence Investigation (Short)

AO-2021-032

Preliminary – 3 Nov 2021

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

Publishing information

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, ACT 2601
Telephone: 1800 020 616, from overseas +61 2 6257 2463
Accident and incident notification: 1800 011 034 (24 hours)
Email: atsbinfo@atsb.gov.au
Website: www.atsb.gov.au

© Commonwealth of Australia 2021



Ownership of intellectual property rights in this publication

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.

Creative Commons licence

With the exception of the Coat of Arms, ATSB logo, and photos and graphics in which a third party holds copyright, this publication is licensed under a Creative Commons Attribution 3.0 Australia licence.

Creative Commons Attribution 3.0 Australia Licence is a standard form licence agreement that allows you to copy, distribute, transmit and adapt this publication provided that you attribute the work.

The ATSB's preference is that you attribute this publication (and any material sourced from it) using the following wording: *Source:* Australian Transport Safety Bureau

Copyright in material obtained from other agencies, private individuals or organisations, belongs to those agencies, individuals or organisations. Where you want to use their material you will need to contact them directly.

Addendum

Page	Change	Date

Preliminary report

This preliminary report details factual information established in the investigation's early evidence collection phase, and has been prepared to provide timely information to the industry and public. Preliminary reports contain no analysis or findings, which will be detailed in the investigation's final report. The information contained in this preliminary report is released in accordance with section 25 of the *Transport Safety Investigation Act 2003*.

The occurrence

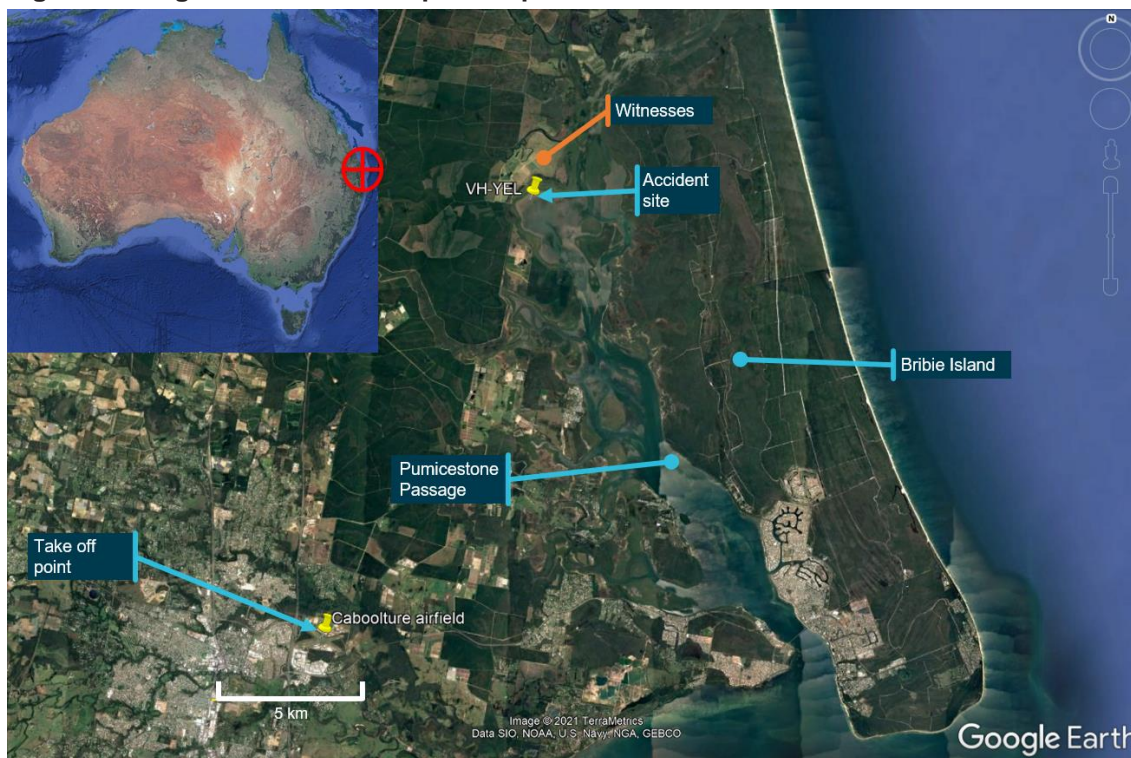
On 18 August 2021, at 0852 Eastern Standard Time,¹ an amateur built Stolp Acroduster II SA-750 registered VH-YEL, departed from Caboolture Airfield, Queensland, for a local aerobatic flight. The pilot was the sole occupant.

A short time later, the crew of a helicopter operating in the same local area, at a height of about 900 ft, witnessed red and white debris falling from the sky. After searching the immediate area, the helicopter crew identified the inverted main wreckage of VH-YEL.

The wreckage was in tidal wetlands, about 30 m from the mainland shoreline of Pumicestone Passage, adjacent to Bribie Island (Figure 1). The aircraft was destroyed and the pilot was fatally injured.

The ATSB's preliminary assessment of the aircraft, in combination with the distribution of wreckage at the accident site, indicated that the aircraft sustained an in-flight break-up. The aircraft was recovered from the accident site and taken to a secure facility for a detailed examination.

Figure 1: Image of the aircraft departure point and accident location



Source: Google Earth, annotated by the ATSB

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

Context

Pilot information

The pilot held a valid Private Pilot Licence (Aeroplane) with an aerobatic endorsement. The pilot had accumulated about 670 flight hours, including 108 flight hours on VH-YEL.

Aircraft information

General information

The Stolp Acroduster II SA-750 is a two-place homebuilt aerobatic bi-plane (Figure 2), rated to +/- 9 g.² The aircraft was first introduced in 1971 as a plans-built aircraft, available from a company in the United States. The aircraft fuselage is constructed of welded steel tube and the wings incorporate wooden structure with steel tube internal supports. The majority of the aircraft is covered in fabric. It is powered with a four-cylinder piston engine.

There are several other plans-built Starduster Corporation aircraft variants developed by the same designer that share similar design features, such as the Starduster and single seat Acroduster (SA-700). However, only the Acroduster series aircraft share the same upper-wing attachment points. There were about 130 Acroduster SA-700/750 aircraft that were completed. Some components for the aircraft were able to be purchased as kits or raw materials.

Figure 2: VH-YEL Stolp Acroduster II SA-750



Source: Supplied

VH-YEL details

The aircraft's plans were supplied from the Stolp Starduster Corporation in 1976 and the aircraft was constructed in the United States with a serial number of T-02. The aircraft was first registered as N97177 and first flew in 1981. It was disassembled and shipped to Australia in 2003. At that time the aircraft had accumulated about 430 flight hours. The aircraft was re-registered in Australia in 2007 as VH-YEL and it was operated under the experimental category³ (Figure 2). It was maintained in accordance with the Civil Aviation Safety Authority (CASA) Maintenance Schedule 5⁴ and, at the time of the accident, had accumulated about 717 flight hours.

² G load: the nominal value for acceleration. In flight, g load represent the combined effects of flight manoeuvring loads and turbulence and can have a positive or negative value.

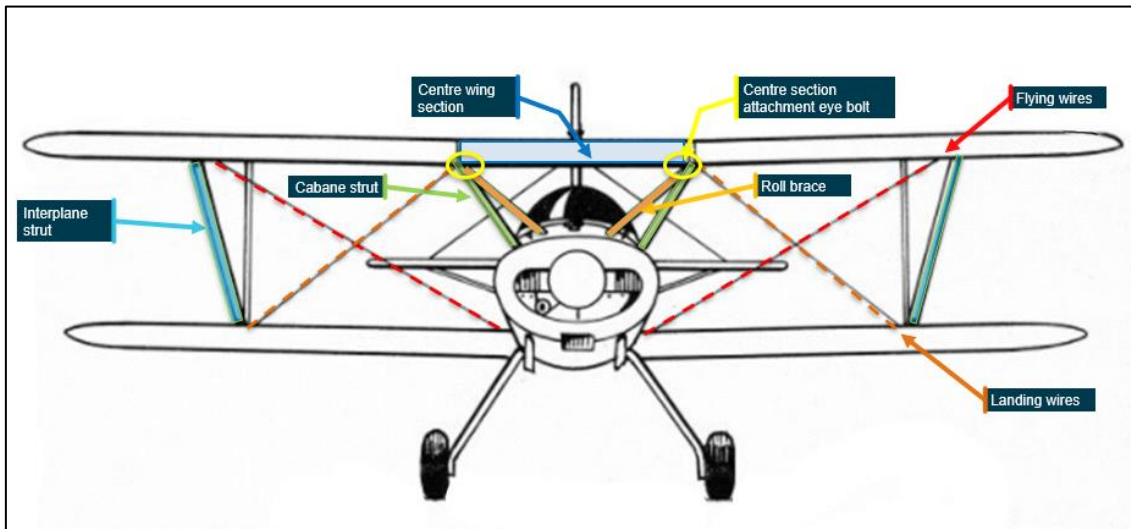
³ Experimental category aircraft include all amateur-built aircraft that are not certified designs.

⁴ A generic maintenance schedule designed by the Civil Aviation Safety Authority for aircraft that either had no manufacturer's maintenance schedule, or had an inadequate maintenance schedule.

Wing attachment and bracing description

The lower wings of the Acroduster SA-700/750 were directly attached to the lower fuselage at two wing root attachment points on each side. The upper wings incorporated the left, right and centre sections. The centre section was attached to the fuselage by eye bolts that then connected to the cabane struts and roll braces. The wings were externally braced against each other using flying wires, landing wires, and interplane struts (Figure 3). In flight, the lower wing outboard sections were supported by the upper-wing outboard sections through the interplane struts and flying wires.

Figure 3: Wing bracing and attachment

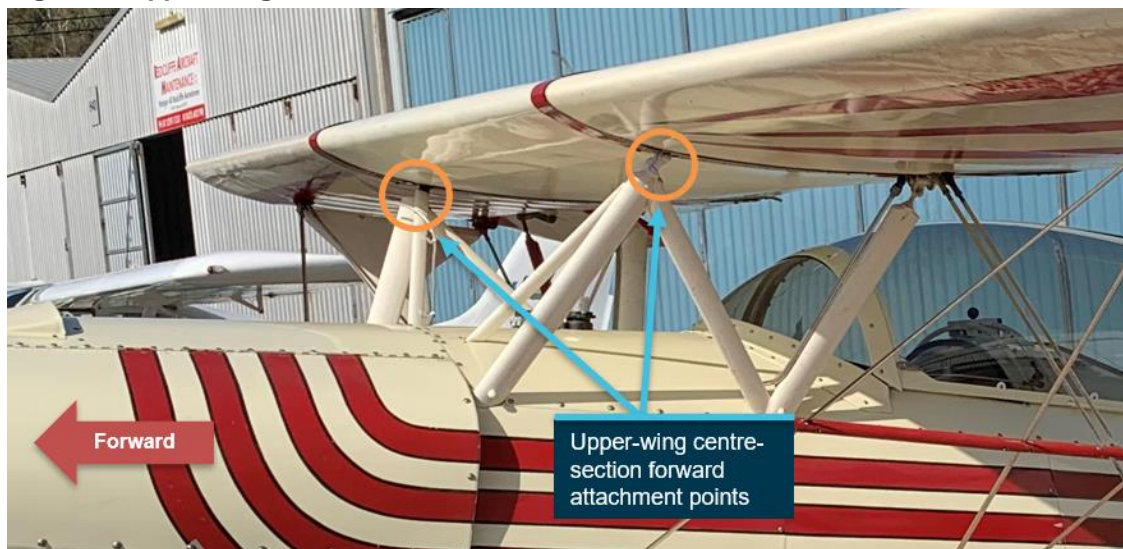


Source: Starduster, annotated by the ATSB

Upper wing to fuselage attachment

Cabane struts and roll braces were provided to support and attach the centre-section of the upper wing to the fuselage. Eye bolts had been manufactured to thread into the upper portion of each cabane strut and completed the attachment between the upper-wing centre section and the cabane struts. The eye bolts were adjustable in length through their threaded section (Figure 4).

Figure 4: Upper-wing centre-section attachment

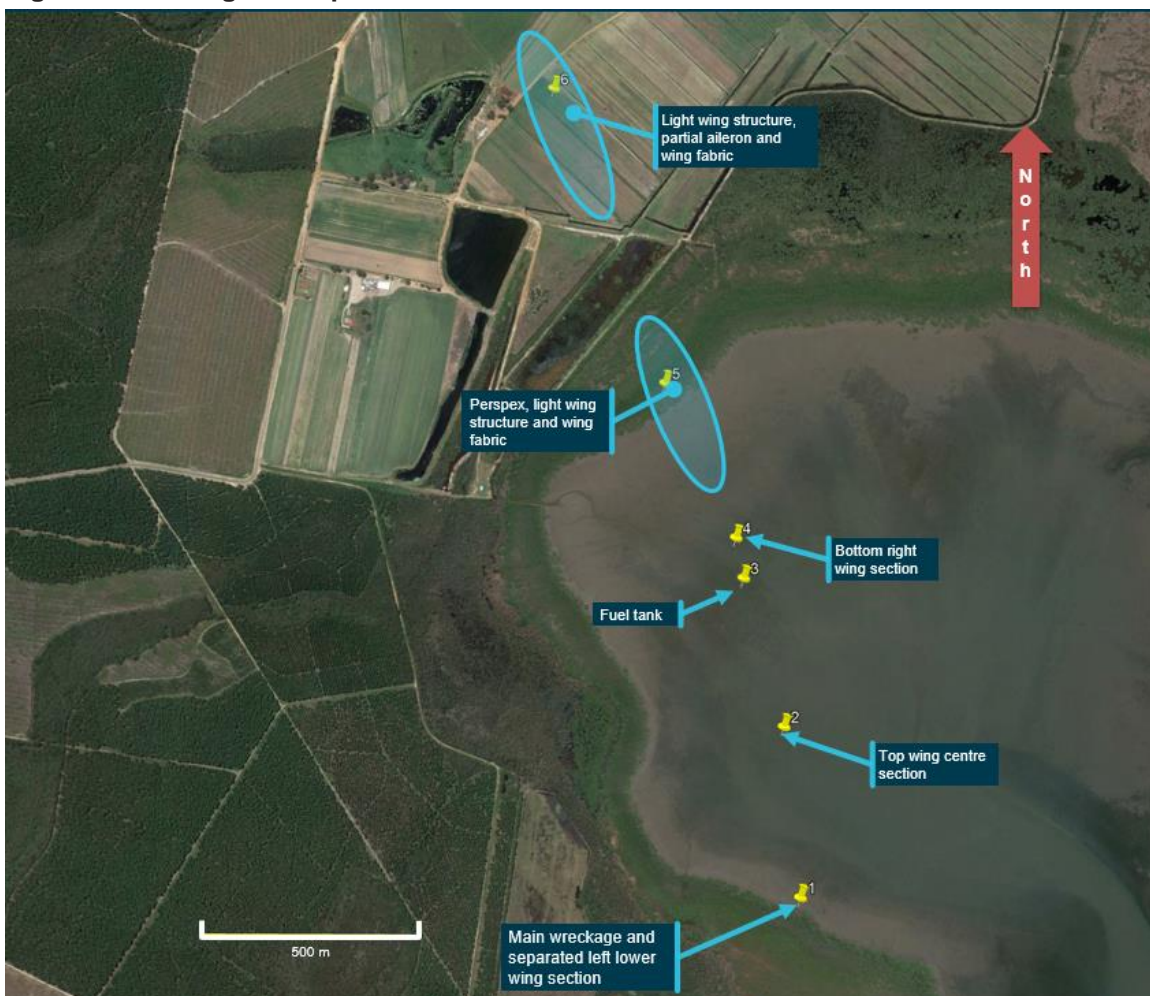


Source: Supplied, annotated by the ATSB

Site and wreckage information

The wreckage of VH-YEL was distributed over a distance of about 2.4 km, oriented in a north-west to south-east direction. The main wreckage consisted of the fuselage, tail section, and outer-wing sections, attached to the fuselage by the flying wires. The majority of the scattered debris consisted of wooden sections of wing structures, fabric from the wing skins, panels and perspex from the windshield. The largest sections that had separated from the fuselage were the left lower wing outboard section and the upper-wing centre section (Figure 5).

Figure 5: Wreckage trail spread over mud flats and farmland



Source: Google Earth, annotated by the ATSB

Wreckage examination

The main wreckage was recovered by barge at the changing of the tide and was transported to a secure storage facility for examination. The aircraft parts were reconstructed for the examination (Figure 6). The examination revealed:

- The majority of the parts were accounted for with the exception of the right interplane strut.
- The aircraft flight controls had no pre-impact defects identified.
- The fuselage, wings, flying and landing wires had no pre-impact defects identified.
- The forward cabane strut upper-wing attachment point eye bolts to the centre-wing structure were examined and fatigue cracks were identified in the fracture surfaces.

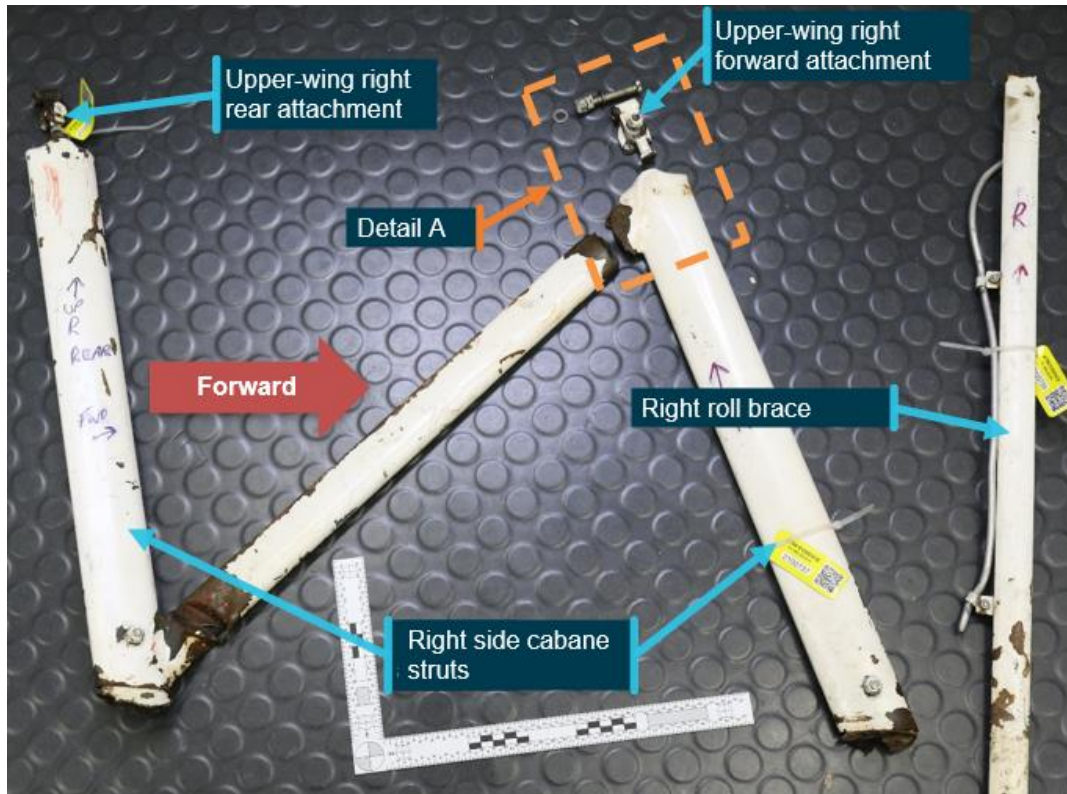
Figure 6: VH-YEL as recovered and partially reassembled



Source: ATSB

All of the cabane struts, roll braces and attaching hardware were retained for more detailed examination. Figure 7 shows the right-side cabane struts and roll brace, and the area notated as Detail A (also see Figure 8) shows the fractured upper-wing attachment point.

Figure 7: Right side cabane struts, roll brace and upper-wing attachment points



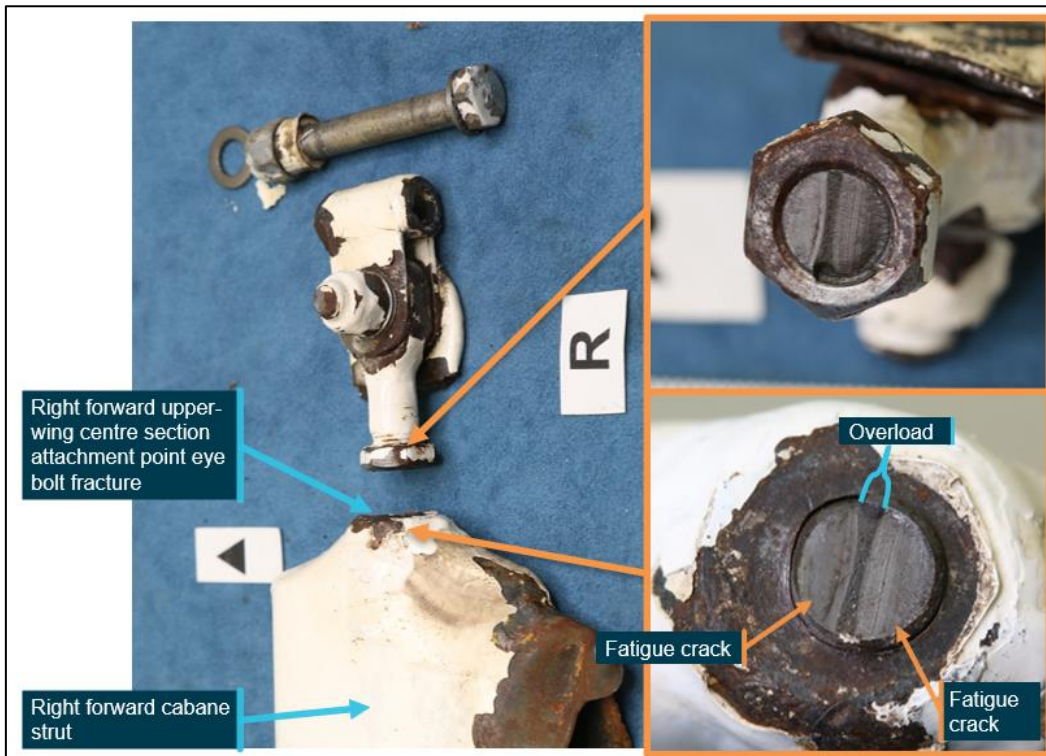
Source: ATSB

Preliminary technical examination of retained components

Technical examination of the cabane struts from the centre-wing structure of the aircraft confirmed that there was fatigue cracking on the fracture surfaces of the eye bolts that had been fitted in the upper-wing forward position on the left and right cabane struts. The fatigue cracking had initiated in the thread root of each eye bolt at its termination into the cabane strut.

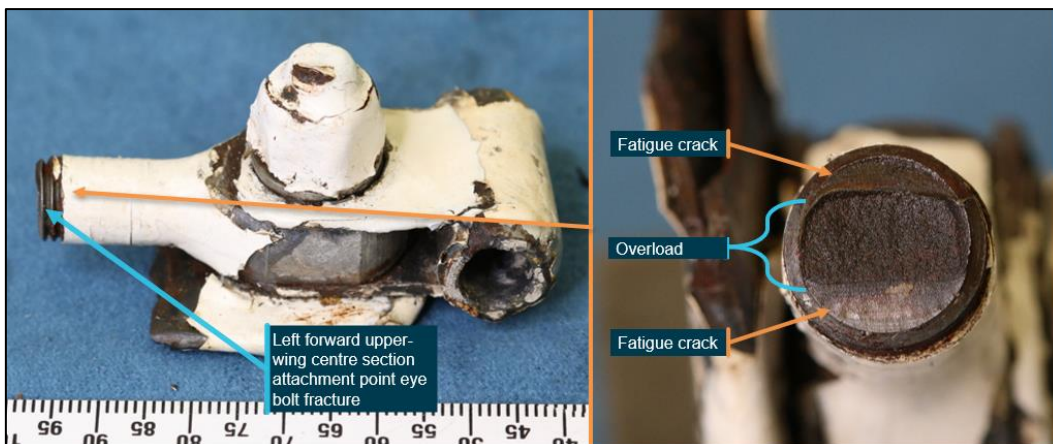
The right eye bolt had sustained fatigue cracking through about 90 per cent of the cross-section, and the left eye bolt had sustained about 40 per cent fatigue cracking through its cross-section. Final fracture of the eye bolts had occurred instantaneously by overstress due to a reduction in overall tensile strength (Figure 8 and Figure 9).

Figure 8: Right-side cabane strut forward upper-wing attachment eye bolt showing evidence of significant fatigue cracking through the threaded portion (Detail A from Figure 7)



Source: ATSB

Figure 9: Left-side cabane strut forward upper-wing attachment eye bolt showing evidence of fatigue cracking through the threaded portion



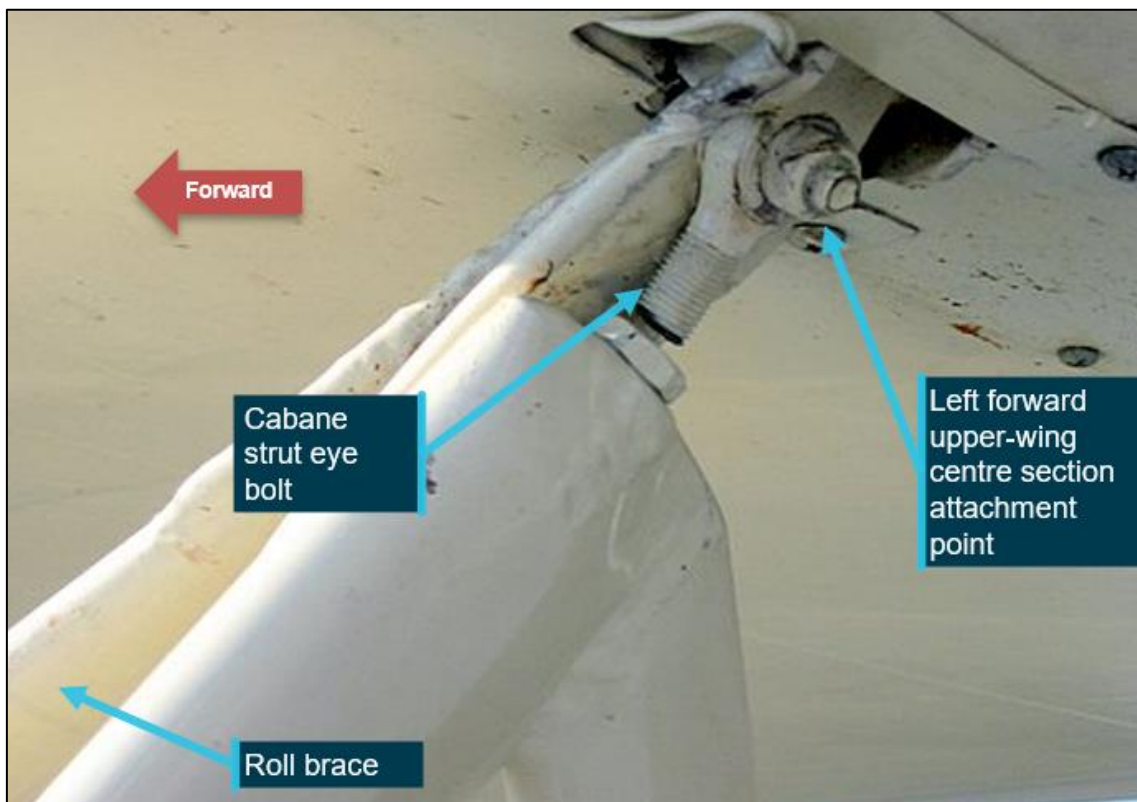
Source: ATSB

From the preliminary examination findings, it is indicative that fatigue cracking and then fracture of the eye bolts has led to structural instability of the centre-wing section and a consequential in-flight break-up of the upper-wing structure.

Eye bolt history and maintenance requirements

Information provided by industry experts familiar with the aircraft type indicates that there has been a history of cabane strut eye bolt cracking in the same area of the threaded section as occurred with VH-YEL. The ATSB was provided with a picture of an Acroduster SA-750 that had a left forward upper-wing cabane strut eye bolt fractured completely through its threaded section. The left roll brace was the only remaining structure providing support for that section of the wing (Figure 10).

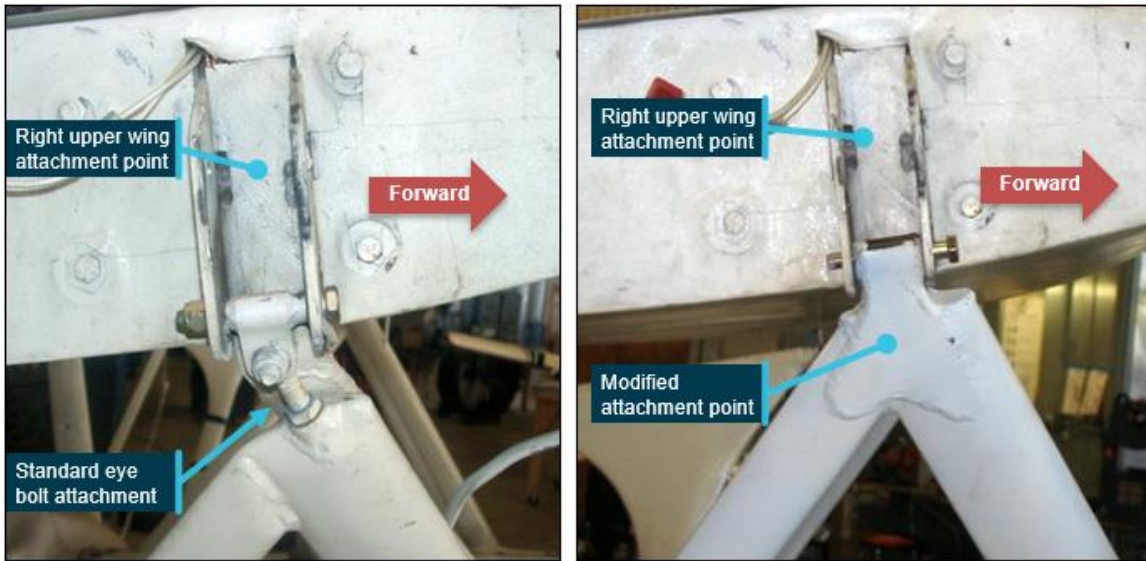
Figure 10: Previous example of another Acroduster SA-750 with a wing attachment eye bolt that had completely fractured through the threaded section



Source: Supplied, annotated by the ATSB

The ATSB was advised that some aircraft owners of Acroduster aircraft have made modifications to the upper-wing attachment points. The modification removed the eye bolts and replaced them with a welded structure, which attached directly to the upper-wing attachment point (Figure 11). The ATSB notes that the modification shown is not approved by the aircraft design owner and advice should be sought from a suitably qualified aeronautical engineer on any design changes undertaken.

Figure 11: Right-side upper-wing centre-section attachment point with a standard eye-bolt attachment on the left and a modified attachment on the right



Source: Supplied, annotated by the ATSB

The location of fatigue cracking in the forward upper-wing attachment eye bolts makes identifying fatigue crack during visual inspections difficult and in some cases impossible without removing the eye bolts from the cabane strut.

Apart from a general inspection of the wing structure, the aircraft type does not have a specific detailed inspection schedule for the eye bolts to ensure their ongoing airworthiness. In addition, the aircraft type does not have a time life replacement of the eye bolts at set flight hours and/or cycles.

Safety action

ATSB notifications

On 20 August 2021, the ATSB notified the Civil Aviation Safety Authority and the US National Transportation Safety Board (NTSB) of the initial finding that fatigue cracking had been identified within the upper-wing centre-section attachment eye bolts. The ATSB requested the NTSB provide details of this accident to the US Federal Aviation Administration and the kit plane design/material provider for its information. The ATSB also contacted the owner of the only other Stolp Acroduster II SA-750 on the Australian civil aircraft register and informed them of the issue.

With the release of this preliminary report, the ATSB has issued a safety advisory notice SAN in an effort to inform aircraft type owners of the circumstances of the accident and the fatigue crack issue.

Safety advisory notice

Action number: AO-2021-033-SAN-001

The Australian Transport Safety Bureau advises all owners, operators and maintainers of Stolp Acroduster SA-700/750 aircraft to consider the safety implications of the initial findings of this investigation regarding the fatigue cracking on forward cabane strut upper-wing centre-section attachment eye bolts, and take action where considered appropriate to ensure that their aircraft remain airworthy.

Further investigation

To date, the ATSB has:

- recovered and examined the aircraft wreckage
- conducted a preliminary examination of the two cabane strut attachment eye bolts
- examined the maintenance history of the aircraft.

The investigation is continuing and will include:

- further metallurgical examination of the entire upper-wing attachment hardware and structure
- review of the operational history of the aircraft
- review of aircraft maintenance procedures and inspection requirements
- analysis of the available radar data.

Should any further critical safety issues be identified during the course of the investigation, the ATSB will immediately notify relevant parties so appropriate and timely safety action can be taken.

A final report will be released at the conclusion of the investigation.

Acknowledgements

The ATSB would like to acknowledge the assistance provided by the Queensland Police Service, McLaren's Aviation, and Clayton's Towing Service for their assistance in the prompt recovery of the aircraft prior to it being submerged by the incoming tide.

General details

Occurrence details

Date and time:	18 August 2021 – 0915 EST	
Occurrence class:	Accident	
Occurrence categories:	In-flight break-up	
Location:	16 km north-east of Caboolture Airfield, Queensland	
	Latitude: 26° 57.121' S	Longitude: 153° 3.15' E

Aircraft details

Manufacturer and model:	Amateur-built aircraft Stolp Acroduster II SA-750	
Registration:	VH-YEL	
Serial number:	T-02	
Type of operation:	Private	
Activity:	General aviation / Recreational-Sport and pleasure flying-Pleasure and personal transport	
Departure:	Caboolture Airfield	
Destination:	Caboolture Airfield	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1 (fatal)	Passengers – 0
Aircraft damage:	Destroyed	

