Australian Government
Australian Transport Safety Bureau

In-flight break-up involving Cicaré S.A. CH-7BT, VH-JEW

near Roy Hill Station, Western Australia | 28 July 2015

Investigation

ATSB Transport Safety Report
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Addendum

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Safety summary

What happened

On 28 July 2015, the pilot and owner of an amateur-built Cicaré CH-7BT helicopter, registered VH-JEW, was conducting a ferry flight from Indee Station to Roy Hill Station, Western Australia. When about 8.5 NM north-east of Roy Hill Station, the stabiliser assembly fractured leading to an in-flight break up and collision with terrain. The pilot, and sole occupant, was fatally injured and the helicopter was destroyed.

What the ATSB found

The ATSB examined the helicopter wreckage and identified that the stabiliser had separated in-flight from the tail boom as a result of fatigue cracking of the stabiliser mount. This was the second fatal accident in Australia involving in-flight stabiliser separation on a Cicaré CH-7B helicopter (*In-flight break-up involving Cicaré CH-7B, VH-SWQ 43 km north-west of Barcaldine Airport Queensland on 12 May 2014* (AO-2014-086)). Following the event in 2014, the helicopter manufacturer, Cicaré S.A., released a mandatory service bulletin, BSC007, which required inspection of the stabiliser assembly. However, the bulletin did not include an initial or recurrent time interval for that inspection.

The ATSB found that there were notable differences between VH-JEW and SWQ, and the accidents were not directly comparable. However, it was established that both helicopters were fitted with an external storage pod, likely without the appropriate engineering assessment to ensure there would be no adverse effects on the performance, handling and structure of the helicopter. In addition, both helicopters had previously been used for mustering operations, although the helicopters were designed be used for recreational use only. The ATSB found other Cicaré CH-7B owners were also likely using their helicopters for aerial mustering and other agricultural activities. The addition of unapproved modifications and use for mustering operations can produce unintended stresses on the airframe leading to premature failure of components.

The ATSB determined that a combination of factors could have contributed to the development of the fatigue crack including, the stabiliser design, operating the helicopter in high load mustering activities, and the use of untested accessories. However, the investigation was unable to determine the contribution of these factors.

What's been done as a result

On 6 August 2015, the ATSB emailed an information letter to registered Cicaré CH-7B owners, informing them of the second accident, the mechanism of stabiliser failure, and a recommendation to ensure the integrity of the stabiliser prior to further operation and on an ongoing basis.

The ATSB has also released a Safety Advisory Notice (AO-2015-089-SAN-014) to raise awareness among amateur-built helicopter owners and the aerial mustering community regarding the risks associated with operating outside the recommended design intent.

A revision to the original bulletin, BSC007, was released in September 2015, which provided some additional information with regard to disassembly of the component to allow examination. The contents of this bulletin was incorporated into the ongoing maintenance documentation for the helicopter in March 2016, with the inspection required to be performed every 100 hours. The stabiliser was also redesigned, originally for the bigger CH-8 series helicopter. The latest design was incorporated into all new Cicaré helicopters and is available for retrofit on the CH-7T/B/BT. A number of operators in Australia have already installed the new stabiliser assembly.

Safety message

The addition of external loads may result in forces in excess of the manufacturer's limitations. This accident highlights the significance of ensuring that any modifications, such as external accessories, are appropriately assessed, and the effects on structural integrity and handling characteristics are considered prior to flight.

Further, it emphasises the importance of operating aircraft in accordance with the manufacturer's intent and limitations. Operating outside these has the potential to induce stresses on the aircraft, leading to premature wear and possible failure.

Lastly, as detailed in the information letter released in March 2016, the ATSB reinforces the importance of CH-7B owners ensuring the integrity of the stabiliser on an on-going basis. If any doubt arises concerning the inspection or maintenance of any part, piece or component, owners should immediately contact Cicaré.

Contents

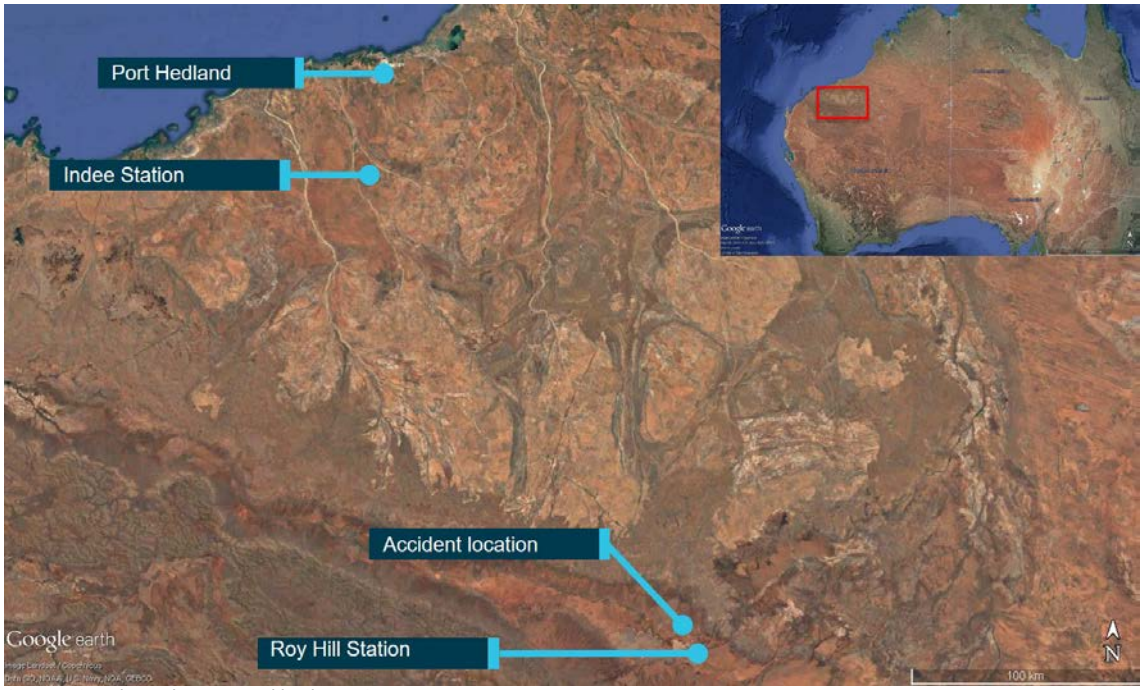
The occurrence

On 28 July 2015, at about 1535 Western Standard Time,[1] the pilot and owner of an amateur-built Cicaré CH-7BT helicopter, registered VH-JEW, departed Indee Station for a 2.5 hour flight to Roy Hill Station, Western Australia. The flight was a repositioning flight, for mustering work at Roy Hill Station, which was to commence the following day.

At about 1810, a company pilot who had arrived at Roy Hill Station about 2 hours prior, phoned another pilot who had remained at Indee Station to advise that VH-JEW had not yet arrived. They decided to give the pilot a little more time, however, when the helicopter still had not arrived by about 1930, it was reported missing to search and rescue, and the police. A search and rescue operation commenced the following morning.

On 29 July 2015, at about 1500, the wreckage was located about 8.5 NM north-west of Roy Hill Station, and 0.5 NM west of the intended track between Indee and Roy Hill Stations (Figure 1). The pilot was fatally injured and the helicopter destroyed.

Figure 1: VH-JEW accident site location, near Roy Hill Station



Source: Google earth, annotated by the ATSB

[1] Western Standard Time (WST): Co-ordinated Universal Time (UTC) + 8 hours.

Context

Pilot information

The pilot held a Commercial Pilot (Helicopter) Licence, issued on 13 June 1980. The pilot last completed a single-engine helicopter and low-level flight reviews in June 2015, valid until 30 June 2017 and 24 June 2017 respectively.

At the time of the accident, the pilot's Class 1 Aviation Medical Certificate required for conducting commercial operations[2] had expired on 13 April 2015 and the pilot was in the process of revalidation. The pilot held a Class 2 certificate, valid to 13 April 2016.

In May 2015, the pilot indicated on his aviation medical questionnaire that he had accumulated a total of 28,559 hours, with 78 hours of helicopter operations in the previous 6 months. The pilot was reported to have had extensive experience as a cattle mustering pilot. Anecdotal information supplied to the ATSB indicated that most of this flying had been completed in a Robinson Helicopter Company R22. The pilot had only recently starting flying the Cicaré CH-7BT, and it was reported that the pilot had been conducting commercial mustering operations[3] in the weeks leading up to the accident.

Witness reports from family and acquaintances indicated that the pilot was in good health and mental state prior to the flight. A post-mortem examination did not reveal any preconditions that would have affected the pilot's ability to fly the helicopter.

Helicopter information

VH-JEW was a single-seat, amateur-built[4] Cicaré CH-7BT helicopter, serial number 032, which was first registered with the Civil Aviation Safety Authority (CASA) on 25 June 2015 (about one month before the accident). It had a two-bladed, semi-rigid main rotor system, a two-bladed tail rotor system, and was powered by a Rotax 914 UL turbo-charged, four-cylinder piston engine. The helicopter kit manufacturer was located in Argentina with the kits and product support available through an Australian distributor. As at March 2019, there had been 39 CH-7B[5] kits sold worldwide, 13 of which were in Australia. At time of publication, there were six on the CASA VH-register.

Meteorological information

Personnel on the ground at Ginbata aerodrome (about 10 NM from the accident site) described the weather conditions on the day as fine and clear with light wind. This was consistent with the Bureau of Meteorology area forecasts for the afternoon.

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2 A Class 1 medical certificate is required whenever a pilot is exercising the privileges of a Commercial Pilot's Licence. Since March 2018, holders of a Commercial Pilot's Licence can undertake some operations with a Class 2 medical certificate. This is, a commercial flight with no passengers on-board and in an aircraft with a maximum take-off weight of less than 8,618 kg.

3 Civil Aviation Order 29.10 defines aerial mustering as 'the use of aircraft to locate, direct and concentrate livestock while the aircraft is flying below 500 feet above ground level'. Further, 'aerial mustering may be conducted as a private operation over land occupied by the owner of the aircraft or as an aerial work operation'. The pilot had been conducting aerial work in VH-JEW.

4 An amateur-built aircraft is an aircraft, the major portion (more than 50 per cent) of which has been fabricated and assembled by a person who undertook the construction project solely for their own education or recreation (CASA Advisory Circular AC-21.4(2) *Amateur-built Experimental Aircraft – Certification*). An amateur-built aircraft can be built from scratch, based on original or established designs, or from a kit.

5 Cicaré CH-7B included both the CH-7B and CH-7BT variants.

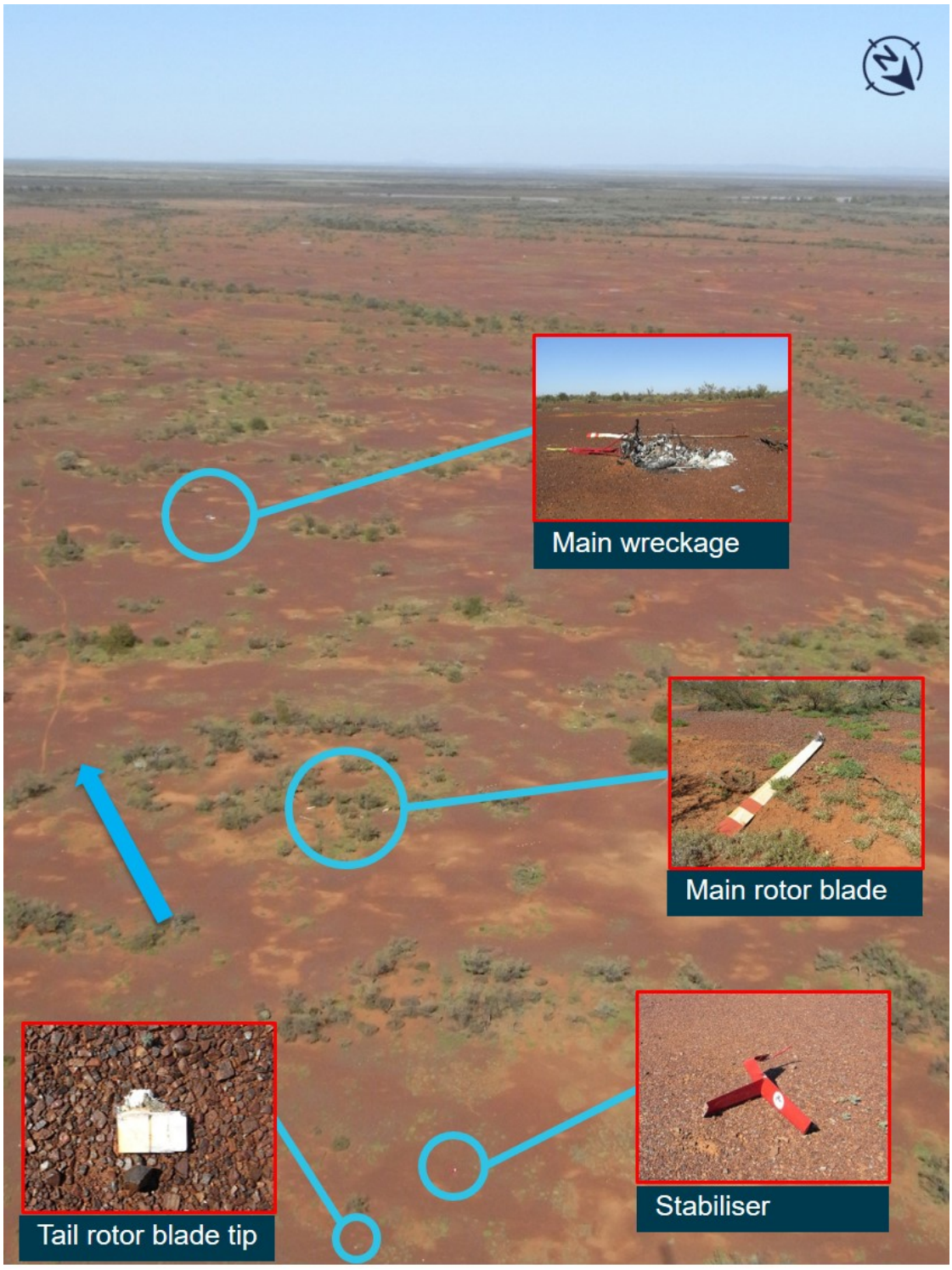
Sunset was recorded to be at 1737 and last light[6] at 1801. The helicopter departed Indee Station at about 1535, which would have put the arrival time at Roy Hill at about 1800. However, a worker at the nearby Roy Hill mining camp reported seeing black smoke for about 20 minutes at about 1720. Therefore, it was considered unlikely that the weather and available light conditions were a contributing factor to the accident.

Wreckage and impact information

The helicopter was found in an open area, having broken into multiple fragments. The fuselage was subject to a post-impact fire, and the tail rotor stabiliser assembly was identified some distance away from the main wreckage (Figure 2).

[6] Last light can also be referred to as the end of evening civil twilight.

Figure 2: Wreckage distribution showing main body and tail rotor stabiliser assembly, the blue arrow shows direction of travel



Source: ATSB

The stabiliser assembly and the tip from one tail rotor blade were the first items identified in the wreckage trail. The main rotor head components were located about 70 m beyond the stabiliser. The tail boom was still attached to the main wreckage, which was lying on its left side and facing opposite to the intended direction of travel, and was a further 180 m along. The tail rotor gearbox assembly was located near the fuselage. Overall, the wreckage distribution was about 250 m long in a southerly direction and consistent with an in-flight break-up.

The helicopter had been subjected to a post-impact fire, which destroyed much of the fuselage. Examination of the remaining wreckage identified:

- all major components of the helicopter were accounted for
- flight control damage was consistent with the in-flight break-up and did not indicate any pre-existing issues
- no indications of any issues with the engine and its related systems that may have contributed to the accident
- the stabiliser assembly had separated at the point where it mounted to the tail boom
- the tail rotor gearbox had fractured at its mount in overstress
- the main rotor head assembly had separated from the main mast in a manner consistent with severe mast bumping.[7]

The fracture surfaces of the stabiliser assembly attachment bracket that remained with the tail boom appeared to correspond to those of the separated stabiliser assembly in shape and irregular texture. The rear section of the tail boom, including tail rotor components and the stabiliser assembly were retained by the ATSB for further examination (see *Stabiliser assembly* below).

Similar occurrence

The ATSB investigated a similar fatal accident where the stabiliser assembly on a Cicaré CH-7B had separated from the tail in-flight leading to a collision with terrain (*In-flight break-up involving Cicaré CH-7B, VH-SWQ 43 km north-west of Barcaldine Airport Queensland on 12 May 2014* (AO-2014-086)). The investigation found that fatigue cracking of the stabiliser mount had led to the failure of the stabiliser assembly. The helicopter was reported to have had an issue with airframe vibration, and thee stabiliser had undergone two weld repairs following the identification of cracking of the stabiliser mount tube. The first weld repair was at about 130 hours' total time-in-service, after the fins were removed following reports of movement within the stabiliser structure. The second weld repair was performed at about 295 hours' total time-in-service. The investigation found these repairs were performed by a welder who did not hold a CASA-issued aviation welding authority, and that the first unauthorised welding carried out on the mount did not prevent further in-service metal fatigue cracking. The helicopter had also experienced a hard landing, sufficient to distort the rear cross-tube on the skid-landing gear. The investigation also found that the helicopter had undergone modifications, including the addition of heli-baskets and larger fuel tanks, which were not approved by CASA and/or the kit manufacturer, and could have affected the serviceability and flight characteristics.

Following this accident, the ATSB sent an advisory letter to all Australian registered owners of the CH-7B on 6 March 2015 which detailed the in-flight separation of the stabiliser.

The kit manufacturer advised that the accidents involving VH-SWQ and VH-JEW were the only known stabiliser fractures in the worldwide fleet of Cicaré 7 series helicopters[8].

Stabiliser assembly

The stabiliser assembly consisted of one horizontal and two vertical aerodynamic fins fitted to the helicopter tail boom. The fins generate aerodynamic forces during forward flight that keep the helicopter level and reduce the thrust required from the tail rotor.

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[7] Mast bumping: contact between the main rotor hub and the rotor mast, which, if excessive, could severely damage the mast, or result in the separation of the main rotor system from the helicopter. Damage from mast bumping is indicative of excessive blade flapping and/or excessive tilt of the main rotor disc relative to the mast.

[8] The Cicaré 7 series included the CH-7B, CH-7BT and CH-7T models. No CH-7T kits have been imported into Australia.

Flight characteristics without stabilisers

The kit manufacturer advised that they had performed testing of the flight characteristics of the helicopter when the stabiliser assembly was not fitted and found the following:

> …proving that for hovering flight condition and low speeds, the change in controllability was verily [sic] noticeable and for translational flight over 30 knots the helicopter showed a light instability in pitch and yaw that can be easily corrected by the pilot, a pilot with standard training is able to execute the emergency maneuver [sic]

However, the manufacturer also noted that:

> In case of loss of stabilizer [sic] in flight, even if the stabilizer doesn't hit the tail rotor, sudden change on aerodynamic loads and CG [centre of gravity] balance due to the sudden absence of the stabilizer would cause an unstable flight condition.

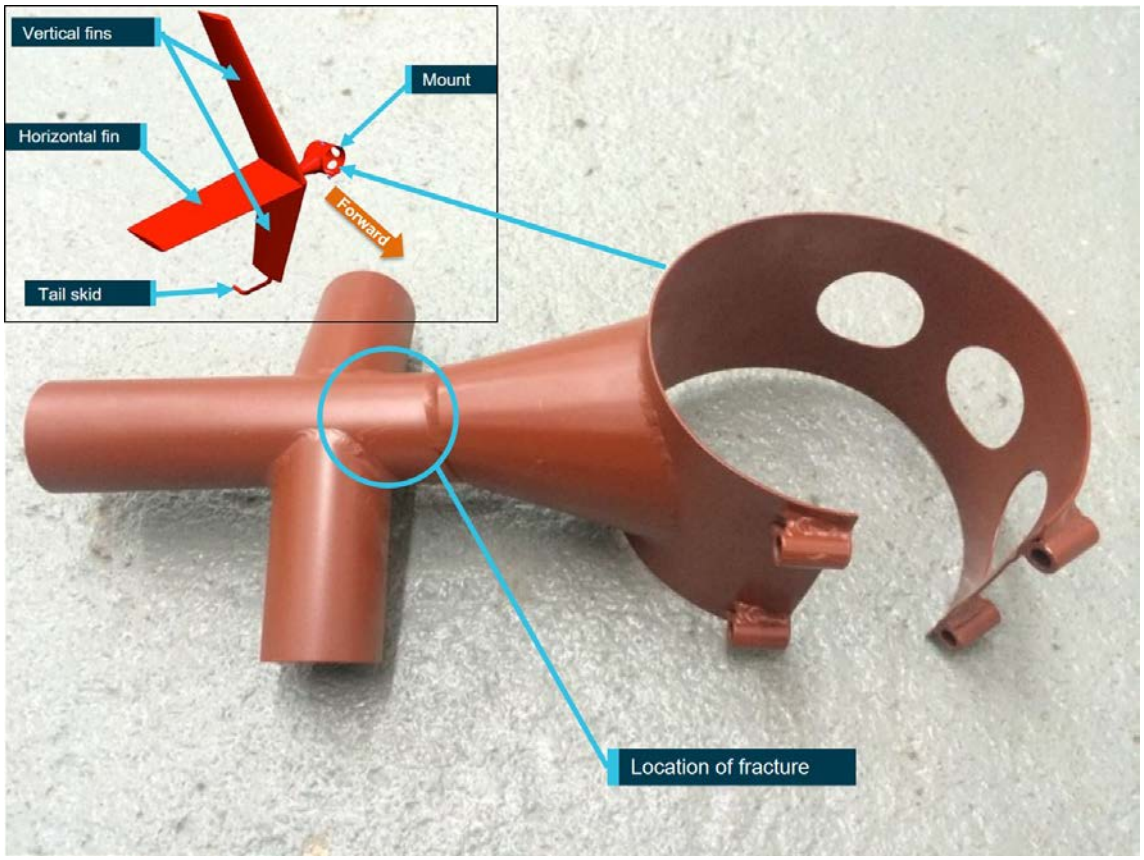
With regard to the failure of the tail rotor/gearbox, the manufacturer advised:

> For the case of an eventual tail rotor loss, during flight-testing there was no presence of "loss tail rotor effectiveness" under normal flight operations. In case of tail rotor or tail rotor gearbox failure, due to the variety of conditions that may occur it's not possible to determine the exact behaviour of the aircraft.

Assembly build and fitting

While the build manual provided instructions for manufacturing this component, the kit manufacturer and Australian distributor advised that the CH-7B kits for Australia were supplied with the stabiliser assembly as a pre-assembled component (inset, Figure 3).

Figure 3: Stabiliser assembly showing location of fracture on VH-JEW



Source: Cicaré, modified by the ATSB

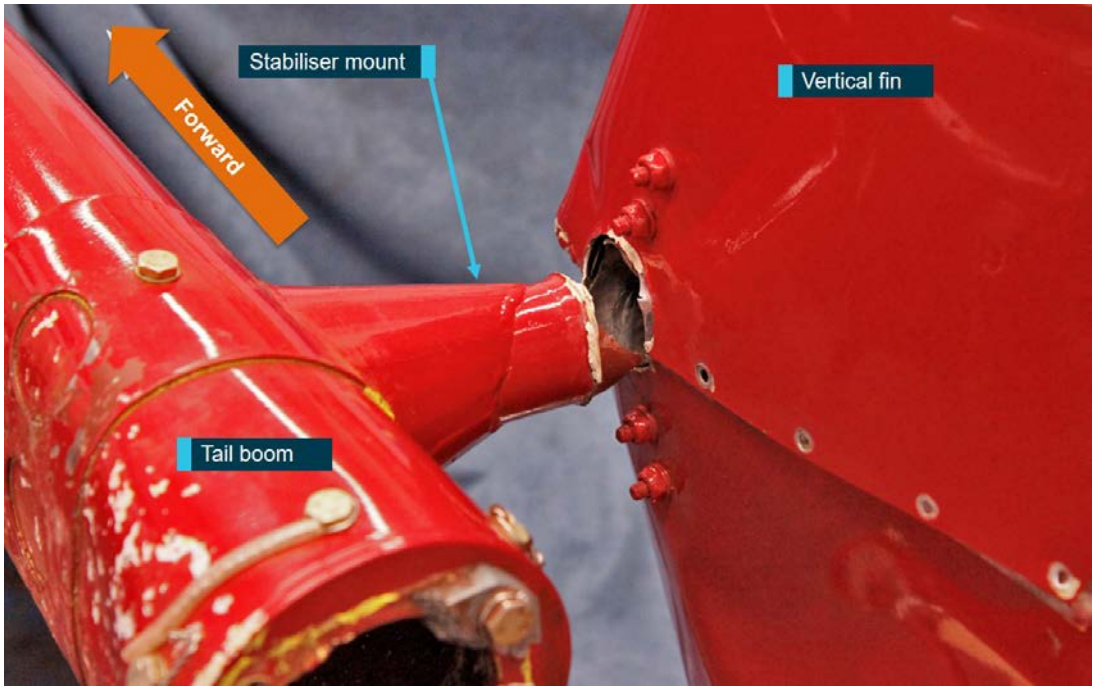
The CH-7BT kit build manual provided instructions for fixing the stabiliser on the tail boom. A factory pre-drilled hole in the stabiliser mount was to be positioned 115 mm forward of the tail rotor

gear box mount and aligned with the top centre-line of the tail boom. A hole was then drilled into the boom skin, using the locator hole as a guide, and a bolt inserted through the mount and boom.

Technical examination of the stabiliser assembly

While it was outside the scope of the investigation to conduct an engineering assessment of the helicopter design, a detailed examination of the retained tail components was conducted at the ATSB's technical facilities in Canberra, with a focus on the fracture of the stabiliser support. That examination found that the failure had occurred adjacent to the welded region of the support. The location of the cracking was also coincident with the point at which the upper and lower vertical stabiliser fairings met the mount (Figure 4).

Figure 4: Location of the stabiliser failure adjacent to the welded region

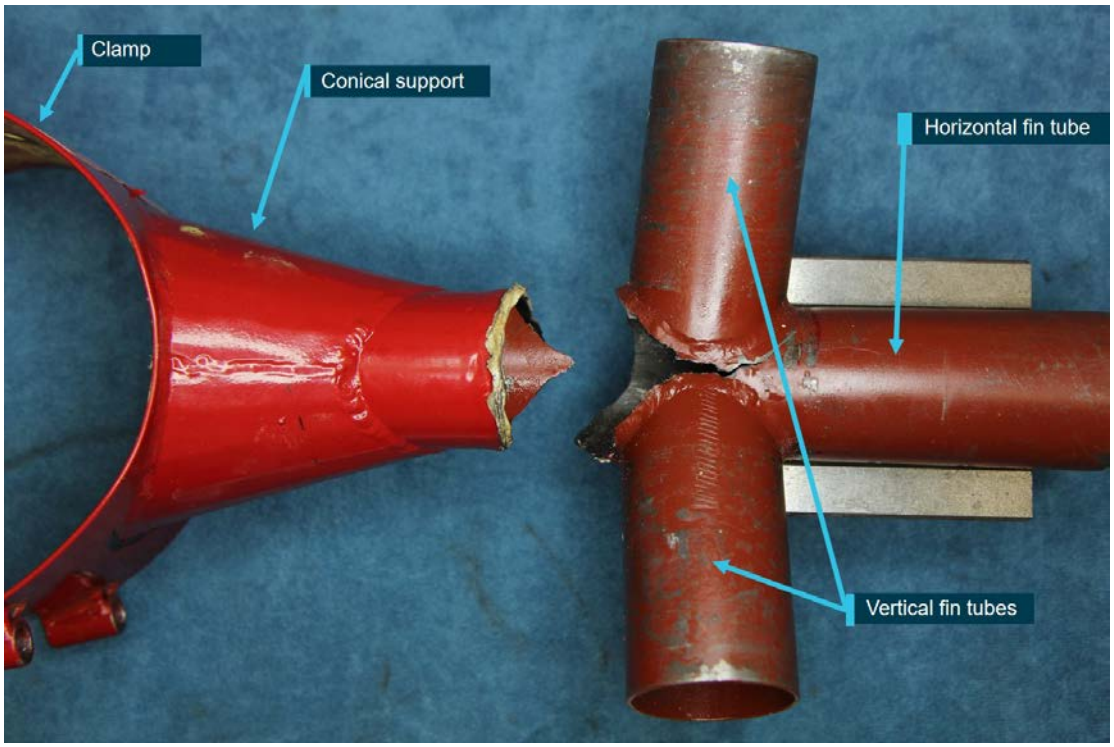


Source: ATSB

Stabiliser mount

The stabiliser fins were removed from the stabiliser assembly in order to completely expose both portions of the fractured stabiliser mount (Figure 5). The stabiliser mount was comprised of three main sections; a clamp for attaching to the tail boom, conical support, and three oval-shaped, thin-walled seamless metal tubes that were used to locate and secure the fins into position (Figure 5). During manufacture at the factory, the three tubes had been cut to fit and then welded together at the conical support.

Figure 5: Location of the stabiliser failure following removal of the fins

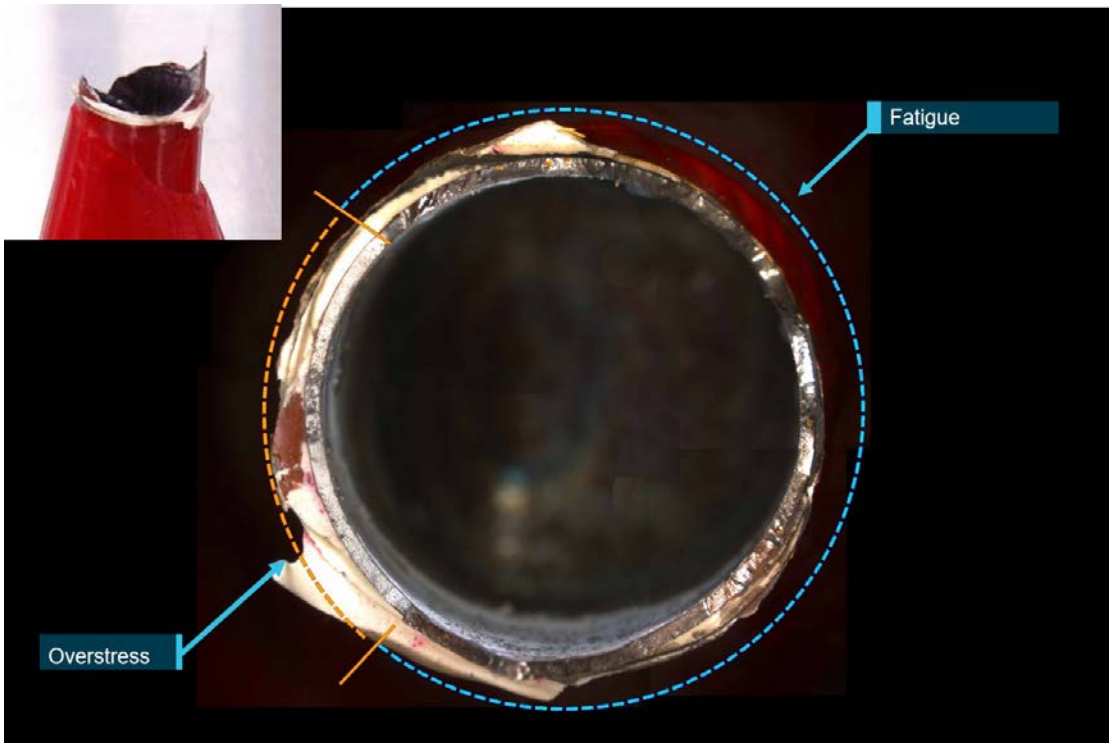


Source: ATSB

Detailed microscopic examination of the stabiliser mount fracture surfaces was accomplished using a binocular microscope. The examination revealed that the fracture path primarily followed the welded portions of the tube junction. A large portion of the fracture surface was discoloured, and exhibited fretting and corrosion product along with the presence of a series of finely spaced continuous progression marks. Such features were consistent with a fatigue crack growth mechanism as a result of in-service cyclic stresses and suggested that the crack had been present for some period of time prior to final fracture.

The fatigue crack had propagated in a circumferential manner through about 75 per cent of the structure prior to the failure (Figure 6). Once a significant portion of the cross section had fractured, the remaining section could no longer sustain in-flight loads and the stabiliser failed due to overstress. The origin of the fatigue cracking could not be clearly identified due to post-accident damage. No obvious defects or anomalies were observed in the welded regions that might have otherwise contributed to the growth of the fatigue cracking.

Figure 6: Stabiliser fracture surface showing fatigue and overstress areas



Source: ATSB

Sectioning of the fracture surface for detailed microstructural examination and hardness testing did not reveal the presence of any anomalies that might have contributed to the failure. Chemical analysis of the stabiliser mount tubes was consistent with an SAE grade 4130 steel, as specified by the manufacturer.

Comparison between the stabiliser mount of VH-JEW and VH-SWQ

The two stabilisers had failed in a similar location, however, three differences were observed between the construction of the stabiliser mount of VH-JEW and VH-SWQ[9] including:

- The vertical and horizontal tubes had been manufactured from welded tube for VH-SWQ, and seamless tube for VH-JEW.[10]
- The mount on VH-SWQ was hollow through the joins in the horizontal tube where the vertical tubes were attached (Figure 7 left). For VH-JEW, the horizontal tube was not hollow (intact tube) where the vertical tubes were attached (Figure 7 right).

The horizontal tube for VH-JEW was welded at the conical support, while for VH-SWQ the tube was welded in two locations – at the conical support and just outboard of the intersection with the vertical tubes. (Figure 7 left).

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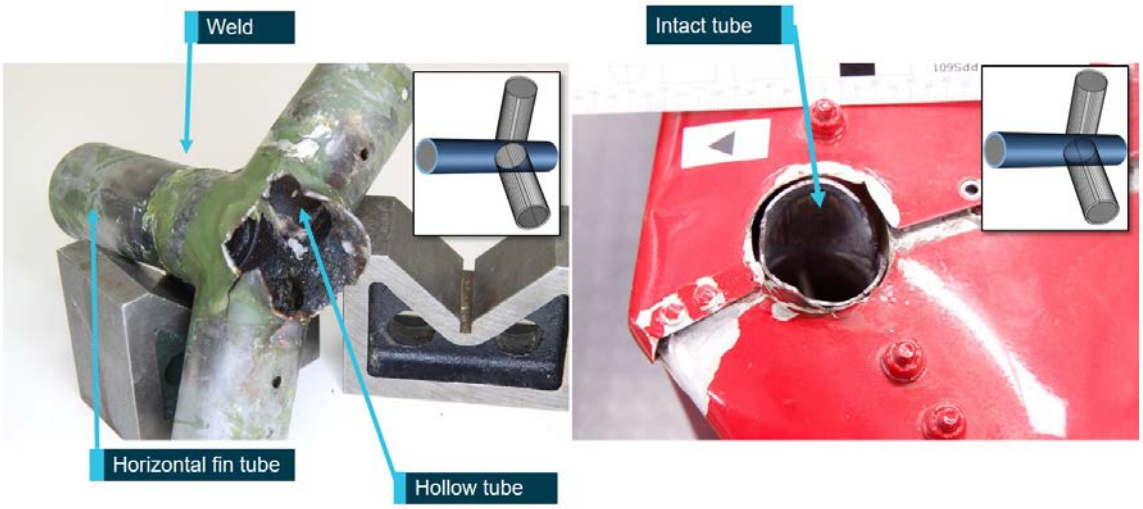
[9] The manufacturer advised that the change from welded to seamless tube, and difference in weld locations, occurred between helicopter serial number 11 (VH-SWQ) and serial number 32 (VH-JEW).

[10] Welded tube is formed from a metal strip that is roll formed and welded to produce a tube. A seamless tube does not have any welded seam.

Figure 7: Comparison between stabiliser fracture on VH-SWQ (left) and VH-JEW (right)



Source: ATSB

VH-JEW information and history

Construction and certification

VH-JEW was constructed as an amateur-built and experimental (ABE) aircraft under the Civil Aviation Safety Regulations 1998 (CASRs) Part 21 Subpart H, and Civil Aviation Regulations 1988 (CAR 1988) 262AP. Regulation 21.191 outlined the reasons an experimental certificate may be issued. Referring to the operation of amateur-built aircraft, sub-part (g) stated: 'the major portion of which has been fabricated and assembled by a person who undertook the construction project solely for the person's own education or recreation'. CASA Advisory Circular AC-21.4(2) *Amateur-built Experimental Aircraft – Certification*, provided guidance and information to those applying for an experimental certificate.

An aircraft that does not have a standard certificate of airworthiness[11] cannot operate unless it has been issued with a special certificate of airworthiness (including an experimental certificate) or a special flight permit. According to CASA Advisory Circular AC-21.10 v4.2 (issued March 2019), *Experimental certificates*:

> Special certificates of airworthiness (CofA), which include experimental certificates, are issued to permit certain kinds of operations of aircraft that do not meet the requirements for a standard CoA or that, because of certain modifications, do not conform to their type certificates, but are capable of safe operations under defined operating conditions and purposes.
>
> In recognition of the lack of compliance with some of the airworthiness standards, the aircraft is normally permitted to be operated under more restrictive operating conditions than in the case of a comparable aircraft operating on a standard CofA.

An authorised person (AP)[12] could issue experimental certificates under CASR 21.195A to allow operation of amateur-built and kit-built aircraft. This special certificate of airworthiness detailed the conditions under which the aircraft was permitted to be operated. For example, the helicopter involved in the previous ATSB investigation (refer to *Similar occurrence*), VH-SWQ, had a special certificate of airworthiness with a condition that it was not to be flown for commercial operations.

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11 A standard certificate of airworthiness is issued to individual Australian aircraft that meet the International Civil Aviation Organization Annex 8 *Airworthiness of Aircraft* requirements, and have been issued with a type certificate.

12 CASA authorises persons to act on behalf of CASA in the inspection of amateur built aircraft and the issue of airworthiness certificates. The authorised person inspects the aircraft to assess it conforms to applicable CASA administrative requirements.

Under the experimental certificate, ABE aircraft were inspected at least once prior to the initial test flight by CASA or by an AP, who may operate under the Sport Aircraft Association of Australia (SAAA) maintenance procedures. Advisory Circular AC-21.4(2) described that the purpose of the inspection was to:

> allow the inspector to make a subjective assessment of the workshop methods, techniques and practices used in the construction of the aircraft solely for the purpose of prescribing appropriate conditions and operating limitations necessary to protect other airspace users and persons on the ground or water, i.e. to protect persons and property not involved in the activity

As part of the certification process, an ABE aircraft was initially limited to operations within an assigned flight test area for at least 25 hours, to demonstrate it was capable of safe flight.

VH-JEW was built by the pilot and owner in south-east Queensland in early 2015 from a kit supplied by the manufacturer. It was reported to the ATSB that the helicopter build took longer than the pilot expected. Below is a timeline of the events related to the helicopter build:

- 26 March 2015: The pilot initially contacted the SAAA requesting an onsite inspection of VH-JEW on 4 May 2015.[13] According to documentation provided by the SAAA, that visit was cancelled and rescheduled as the helicopter was not ready for inspection.
- The onsite inspection was rescheduled to 27 May 2015, however, it was again delayed as the helicopter was not ready for inspection.[14]
- 3 June 2015: The pilot submitted an application for a special certificate of airworthiness in the experimental (kit-built) category.
- 4 June 2015: A visit was carried out by the SAAA AP, however, it was reported that the helicopter was still not completed, and some of the required documentation was not completed or available. Following that visit, the pilot continued discussions with the SAAA about completion of the relevant requirements. The outstanding items were not related to the stabiliser or tail boom assemblies.
- 16 June 2015: The SAAA AP received an email containing a copy of the helicopter logbook and test flight record pages, dated 28 June 2015, indicating that 26.2 flight hours had been completed.[15]
- 25 June 2015: The helicopter was registered with CASA.
- 15 July 2015: As the SAAA AP had not issued the authorisation for test flights to commence, a letter was sent to the pilot,[16] advising that:

  > You are currently flying your aircraft without a Certificate of Airworthiness
  >
  > The process of submitting the requested information listed on previous email has not been received
  >
  > Copies of certifications for duplicate inspections from airframe log book not received
  >
  > Submission of the nominated pilots and nominated flight test area not received.

As a result, the SAAA advised that they were unable to proceed any further with the application at that time. Due to the limited timeframe between when the letter was dated, and the date of the accident, the investigation could not be assured that the pilot had received the letter.

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[13] It was likely that this inspection was scheduled prior to the build start as the pilot reportedly flew from Western Australia to Perth on 8 April 2015.

[14] The pilot's family stated that some of the delays were due to having to wait for components to arrive from Argentina.

[15] A discrepancy between the dates the SAAA reported receiving the email from the pilot, and the date on the helicopter logbook was noted. This discrepancy could not be reconciled from the information available, but was considered that the reported date of the email was incorrect, and was likely closer to 15 July 2015.

[16] At the same time, the SAAA also advised CASA who initiated a process to follow up with the pilot.

Helicopter flight history

Following the build, the pilot departed Queensland in VH-JEW on the morning of 27 June 2015 and arrived in Western Australia on the evening of 29 June 2015. At the time of the accident, the most recent entry on the maintenance release (5 days prior on 23 July 2015) showed the helicopter had accumulated 168.7 hours' total time-in-service. Of the eight entries recorded, six of them showed the helicopter had accumulated between 8.3 and 11 hours on these days. This, together with information supplied by associates of the pilot, indicated that it was likely that the helicopter had been involved in some (commercial) aerial work, including aerial stock mustering and/or spotting, since arriving in Western Australia. It was also reported that the pilot was generally happy with the operation of the helicopter, and had not mentioned any major issues or the presence of vibrations.

Following the accident, a colleague of the pilot stated that there was a report of the temperature gauge reading above the normal operating range, however, it was mentioned that it was a one-time occurrence and the reason for this was not determined. An acquaintance of the pilot reported to the ATSB that the pilot had advised him that the helicopter had experienced a hard landing in early July 2015, but it didn't appear to have caused any damage to the helicopter.

Airworthiness and maintenance

Under sub-regulation 42ZC(6) of CAR 1988, the owner/builder of an amateur-built aircraft may be authorised to carry out maintenance on the aircraft, if they were the primary builder. CASA Instrument 33/13 *Authorisation of person to carry out maintenance on certain amateur-built, kit-built and light sport aircraft with a special certificate of airworthiness,* detailed the conditions of the owner/builder's maintenance authorisation. One of the conditions was that the owner/builder was required to have satisfactorily completed a course in maintenance procedures.[17] Further, maintenance conducted could only be on the elements of the aircraft that they had assembled.

The most recent maintenance release, issued by the pilot on 16 July 2015, at 105.9 hours' total time-in-service, indicated the helicopter was to be maintained in accordance with the manufacturer's maintenance schedule manual. The maintenance manual recommended a complete inspection of the helicopter every 12 months or 100 hours' time-in-service. This included:

> During inspection, check the general condition of the components and observe if there is evidence of damage, color change due to high temperatures, dents, scratches, notches, corrosion and specially cracks. Also check for any sign of friction in the parts that are near one another.

Specific to the stabilisers, the manual stated the following:

> Check the whole surface of the stabilizers. Verify there are no scratches or cracks.
>
> Check each stabilizer bearing. Verify there are no cracks around the attachment holes. Also check that the attachment screws are in proper condition.
>
> Check the tailskid. Verify if there is evidence of strikes against the ground.

As the helicopter logbooks were not located, the ATSB was unable to determine what, if any, maintenance and/or inspections had been carried out on VH-JEW since leaving Queensland.

In addition, the ATSB also noted that there were several omissions and inaccuracies with how the maintenance release had been completed, making it invalid. However, as the aircraft had not been authorised for flight operations, it was determined there would be little benefit in further investigation. While these irregularities did not likely contribute to the accident, continued

[17] It could not be established if the pilot had completed a maintenance procedures course. The SAAA did not have a copy of the course certificate on file for the pilot, however, the ATSB was advised that the pilot could have attended a course and not applied to receive a certificate. The helicopter importer was of the belief that the pilot had completed a course.

operation and maintenance outside of the regulations increases the risk that the safety protections they offer will be eroded.

Manufacturer's stabiliser mount inspection

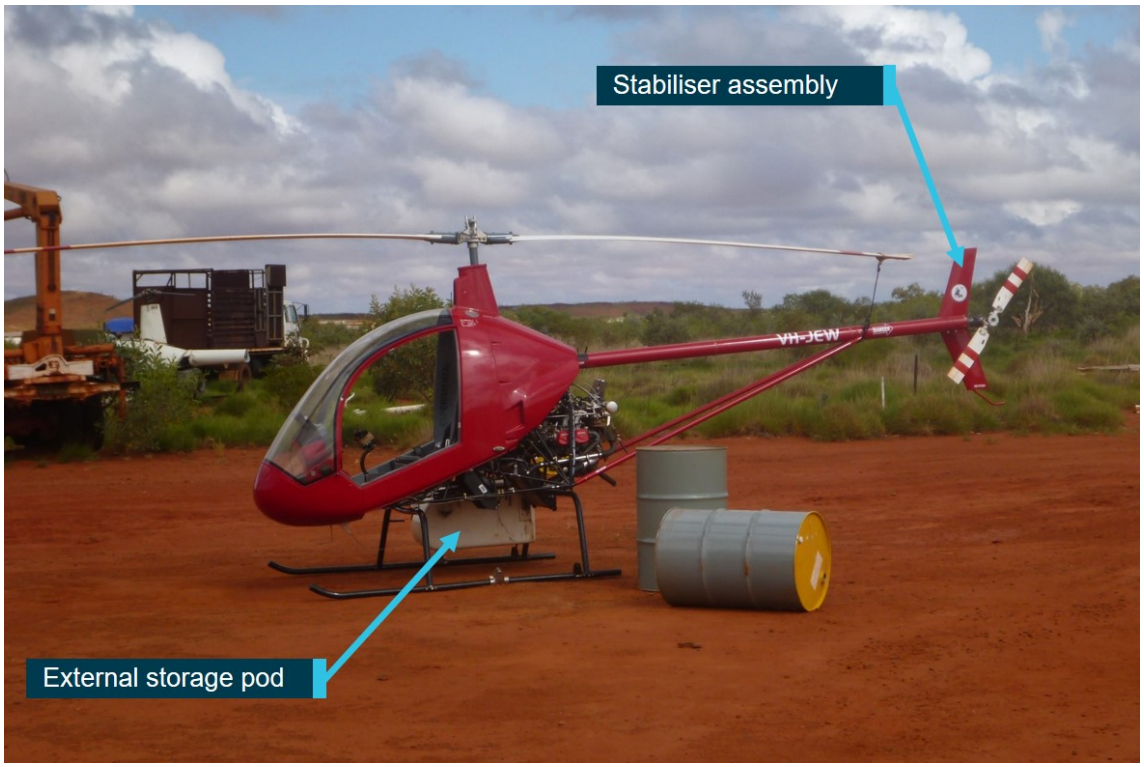
Following the accident involving VH-SWQ (refer to *Similar occurrence*), the manufacturer released a service bulletin on 24 September 2014 (BSC007) requiring dye penetrant inspection of the stabiliser. This document included instructions on how to perform the testing on the stabiliser mount. However, there was no mention of how to remove the support assembly from the horizontal and vertical fins to perform the inspection, which would have been necessary to inspect the relevant area. For VH-JEW, as this component had been pre-assembled by the manufacturer for import into Australia, this maintenance would need to have been performed by an appropriately qualified person, such as a licensed aircraft maintenance engineer. Additionally, the document did not include any inspection interval requirements (initial or recurrent). The manufacturer reported that owners were advised to evaluate the stabiliser mount every 100 hours, or if there were any signs of wear on the stabiliser. No evidence was supplied to the ATSB as to how this information had been disseminated to owners.

External storage pod

The helicopter had been modified with an external storage pod, attached to the rear strut of the right skid-landing gear (Figure 8). The storage pod was not included on the weight and balance documents provided as part of the special certificate of airworthiness approval process. It was reported that this pod was fitted for the flight from Queensland to Western Australia. However, as the helicopter logbooks were not located, the ATSB was unable to establish if the storage pod remained fitted for the life of the helicopter, or if any authorisations[18] had been received.

[18] Under regulation 42U of *Civil Aviation Regulations 1988*, a person may only modify an aircraft if the modification is approved. For an amateur-built experimental aircraft, there are no design standards against which a modification can be approved, so CASA Instrument number EX51/15 exempted limited category and experimental aircraft from those requirements. However, the exemption was not applicable where the modification or repair was considered a major design change. A major design change was defined as 'a design change that has a significant effect on (a) the weight and balance of the aircraft; or (b) the structural strength of the aircraft; or (c) the performance of the aircraft; or (d) the operational characteristics of the aircraft; or (e) other characteristics that may affect the validity of the special certificate of airworthiness or the experimental certificate for the aircraft'.

Figure 8: External storage pod as fitted to VH-JEW at Indee Station on 23 July 2015



Source: Andrew Miles, annotated by the ATSB

Helicopter landing gear is designed to provide energy absorbing capabilities during landing. Fixing external loads to the landing gear can result in forces applied to the landing gear in excess of the design limit and can also increase the in-flight dynamic loads due to increased vibration. Advice published by Robinson Helicopter Company for the R22 in the pilot operating handbook included a safety notice, SN-13, which stated that;

> …even a small weight attached to the landing gear may change the natural frequency[19] enough to cause high loads to inflight vibration.

The ATSB could not determine whether the potential effects on the in-flight loads, flight characteristics and operating weight were considered by the pilot prior to the fitment of the external storage pod.

The Cicaré CH-7B was promoted in the Australian website *Beef Central*[20] in a 19 April 2011 article *Heli-mustering game-changer*, which included the promotion of the use of an external storage box:

> While the Cicaré has a payload limit of around 100kg (not including pilot), it can be set up with a storage box to carry a chainsaw, fencing tools and enough wire for many on-the-job fencing repairs, for example.

However, correspondence from the kit manufacturer advised that the helicopter was not designed to carry external loads, and had not been tested under asymmetrical load conditions. The kit manufacturer was of the opinion that the difference between the two helicopters with cracked stabilisers and the rest of the Cicaré fleet with unaffected stabilisers was the addition of accessories (the storage pod in the case of VH-JEW and a heli-basket and larger fuel tanks for VH-SWQ), 'making it very hard to ignore that this [sic] accessories could be related to the premature wear of the stabilizer'.

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19 Natural frequency is the frequency at which a system tends to oscillate in the absence of any driving or damping force.

20 BeefCentral.com is a free online premium news and market intelligence service dedicated to the Australian beef industry.

Ground handling

The flight manual contained the procedures for moving the helicopter on the ground, using the wheels provided, which attached to the landing gear. These procedures stipulated that the helicopter was to be pushed or pulled by holding the tail rotor gearbox. Additionally, the flight manual included the following caution:

> Do not move [the] Cicaré CH-7BT by holding either the horizontal or vertical stabiliser, or from the tail rotor, or the tail rotor controls, or tailskid.

Manoeuvring the helicopter via the tail skid, particularly over rough terrain, could induce unintended forces on the stabiliser mount. However, as the pilot's ground handling practices could not be established, the ATSB was unable to determine if this contributed to the development of the stabiliser mount fatigue crack.

Commercial flying

In order to conduct commercial aerial work operations, including aerial mustering and spotting, at the time of the accident, the pilot was required to hold a Commercial Pilot Licence. Additionally, Civil Aviation Regulations 1988 (CAR) 206 stated that an Air Operator's Certificate was also required to conduct commercial operations.

The pilot held a Commercial Pilot Licence (Helicopter), and had regularly conducted commercial flying operations in helicopters. The pilot also held an AOC, on which two Robinson Helicopter Company R22's were listed. VH-JEW was not listed on the Air Operator's Certificate.

Operational aspects

The Cicaré S.A. website stated that the Cicaré CH-7B was a helicopter 'for sport use'. However, the Australian experience indicated that these helicopters were increasingly being used for agricultural operations and other aerial work, such as mustering and spotting.

Both VH-SWQ and VH-JEW had been used for mustering operations during their lifetime, and the ATSB was aware of one other reported accident involving another Cicaré CH-7B helicopter while engaged in agricultural operations in October 2018.

While the use of an amateur-built helicopter for *private* agricultural operations, including mustering and spotting, was not specifically excluded under the CASA regulations, such operations can involve extremely frequent manoeuvring and rapid power changes that can apply very high loads on the helicopter. The fatigue life of various components can be adversely affected by the type of operation and loading history of the components. CASA Airworthiness Bulletin (AWB) 02-015 *Helicopter – Effects on fatigue on life limited components* described some operational situations where the fatigue life might be affected, and included:

> …Operations of helicopters in low level flying, agricultural, mustering or other operations where high loads may be encountered more frequently than envisaged by the designer/manufacturer.

Cicaré CH-7B flying activity

Activity data for the CH-7B between 2011 and 2018 was supplied by the Bureau of Infrastructure, Transport and Regional Economic (BITRE) is shown in Table 1.[21] This data was reported to BITRE by registered aircraft owners in the annual BITRE *General aviation activity survey*.

Table 1: Reported flights and hours for Cicaré CH-7B aircraft between 2011 and 2018[21]

	2011	2012	2013	2014	2015	2016	2017	2018
Number of aircraft	3	4	8	4	7	5	6	5
Number of landings	24	35	62	10	89	51	293	562
Total hours	17	28	52	19	83	43	457	408
Private	17	28	52	-	-	-	-	-
Agriculture mustering	-	-	-	0	6	0	0	0
Agriculture-other	-	-	-	19	0	19	397	0
Other aerial work	-	-	-	0	0	0	0	181
Pleasure and personal transport				0	48	8	57	7
Other sport and pleasure flying	-	-	-	0	29	16	3	7
Other flying	-	-	-	0	0	0	0	213

Source: Bureau of Infrastructure, Transport and Regional Economics

The data showed that only 6 hours total had been attributed to agricultural mustering over this period. However, in 2017-2018, there was a significant increase in the reported landings/hours for the Cicaré CH-7B fleet, together with an increase in the number of hours attributed to 'agricultural-other' (which includes all non-mustering and non-spraying agricultural activities including stock spotting), other aerial work and other flying categories.

The manufacturer advised that a number of helicopters within the fleet had accumulated up to 400 hours in Argentina and at least one helicopter in Australia had reached 1,500 hours total time-in-service. However, they were unable to provide any information on what types of operations these helicopters may have been performing when these house were accumulated.

Previous research

Stress loads from aerial stock mustering and spotting

In 2004, the ATSB commissioned AeroStructures, an Australian engineering company, to undertake a study of the forces acting on a Robinson Helicopter Company (RHC) R22 (also extensively used in mustering operations in Australia) while engaged in aerial mustering operations. The study (*Robinson R22 helicopter aerial mustering usage investigation*) provided a comparison of the flight profiles in aerial mustering operations and compared these with the flight profiles used during certification.

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[21] The operation categories recorded by BITRE changed between 2013 and 2014.
For the 2011-2013 data, the available categories included; private, business, test and ferry, training, survey and photography, pipe and powerline patrol, mustering, S&R, ambulance, towing, other aerial work, agriculture, charter, regional RPT.
From 2014, the categories were expanded, and included; advertising, aerobatics, agricultural mustering, agricultural spreading/spraying, agriculture-other, air ambulance, construction, domestic, ferry flights, firefighting, glider towing, instructional flying, international, joyflights/sightseeing, observation and patrol, other commercial air transport, other aerial work, other flying, other sport and pleasure flying, own use business travel, parachute dropping, passenger transport charters, photography, pleasure and personal transport, S&R, pipeline or powerline surveying, test flights, freight only-scheduled, freight only - non-scheduled, construction-sling loads, other surveying, policing, instructional flying -non-commercial, community service flights

The report found that aerial mustering exhibited frequent low speed manoeuvres and rapid power changes, and five measurements showed higher peak stresses than for the certification flights, one of which was the tail rotor drive shaft torque. The report stated that:

> Owners and operators need to fully appreciate the stresses placed on aircraft during mustering operations, and the characteristics of aerial mustering operations, which may be quite different [to] the type of flying for which the type originally received certification

Advice was contained in a safety notice produced by the Robinson Helicopter Company, who manufactured the R22 helicopter. Safety Notice, SN-37 - *Exceeding approved limitations can be fatal* discussed how fatigue damage can accumulate within components without a visible indicator.

The kit manufacturer, Cicaré S.A, advised that

> experimental category covers recreational and sport use. However this won't prohibit anyone to use it for other activities.

Amateur-built aircraft research

ATSB research has identified that amateur-built aircraft are over-represented in aviation accidents and incidents in Australia (AR-2007-043 (2) *Amateur-built aircraft Part 2: Analysis of accidents involving VH-registered non-factory-built aeroplanes 1988-2010*). The research found that, although pilots of amateur-built aircraft involved in accidents were significantly more experienced overall than pilots of accidents in equivalent factory-built aircraft, they were less experienced on the type that they were flying at the time of the accident.

While this report did not include amateur-built helicopters due to the small numbers in operation at that time, much of the data and outcomes of the report were relevant to aeroplanes and helicopters. The prevalence of amateur-built helicopters in Australia is also increasing.

Safety analysis

While on a ferry flight from Indee Station to Roy Hill Station, Western Australia, the stabiliser assembly on VH-JEW fractured leading to an in-flight break-up and collision with terrain. The pilot was fatally injured and the aircraft was destroyed.

Available information indicated that it was unlikely that the pilot became incapacitated during the flight, and pilot fatigue, weather and poor manufacturing of the welded stabiliser structure were not considered factors.

This analysis will examine the potential factors that may have led to the failure of the stabiliser and resulting in-flight break-up.

In-flight break-up

The fracture of the stabiliser mount and subsequent in-flight separation of the stabiliser from the tail boom led to severe mast bumping sufficient to sever the mast and main rotors. Consistent with the wreckage distribution, the helicopter broke up in-flight, resulting in a collision with terrain.

In the event of a stabiliser failure, the manufacturer indicated that, although the helicopter was theoretically controllable under certain circumstances, the sudden change to the aerodynamic loads and centre of gravity balance, would lead to an unstable flight condition. Additionally, this was the second accident where a loss of control had resulted following the loss of the stabiliser assembly.

Stabiliser mount cracking

Analysis of the tail components identified that the stabiliser assembly mount was significantly weakened by cracking associated with metal fatigue. While the ultimate fracture of the mount was due to overstress, a fatigue crack was found to have propagated about 75 per cent of the way around the mount's circumference, adjacent to the welded region. The investigation considered the potential factors that contributed to the cyclical loading that resulted in fatigue cracking of the stabiliser mount. These included, in no particular order:

- fitment of the external storage pod
- possible operations exceeding the manufacturer's limitations
- stabiliser assembly design.

The helicopter had been fitted with an external storage pod attached to the rear strut of the right skid-landing gear, although it was unknown if it was in place on the accident flight. The storage pod was not on the weight and balance documents associated with the special certificate of airworthiness process, and a special certificate of airworthiness had not been issued. While the helicopter logbooks were not located, it was unlikely that an engineering assessment had been conducted prior to the helicopter departing Queensland.

In addition, the manufacturer indicated that the helicopter was not designed to carry external loads and expressed reservations about the addition of an accessory on both VH-JEW and VH-SWQ. Specifically, they were of the opinion that the fitment of the external accessories to both these aircraft could have been the reason for the premature failure of the stabiliser. The fitment of the pod had the potential to adversely affect the structural integrity and handling characteristics of the helicopter. However, as it was likely the pod had not been assessed, the ATSB was unable to determine the extent to which this contributed to the initiation and propagation of the fatigue crack.

While the Australian activity data indicated minimal mustering activity in the CH-7B, the ATSB was aware of three accidents where the helicopter had, at some point, been conducting this type of operation. For VH-JEW, the investigation was able to establish that the helicopter had operated for 168.7 hours up until 23 July 2015, and likely only a few hours on the day of the accident. The

available records indicated that in the month prior to the accident, it had been used for at least 60 hours of low-level mustering operations. The Cicaré CH-7B helicopter is advertised as being for recreational use, and operation outside the manufacturer's limitations has the potential to induce stresses on the airframe and components, leading to premature wear and possible failure. Further, operations such as mustering and similar activities can also increase the risk of premature ageing of aircraft structure due to an increased load spectra.

In addition, while two aircraft in Australia exhibited premature failure of the same component, in a similar location, at relatively low time in-service, these were the only two helicopters in the worldwide fleet to exhibit cracking. While there were some similarities between the accidents involving VH-SWQ and VH-JEW, in that both helicopters had been fitted with untested external accessories and were being used for mustering operations, there were some notable differences. VH-SWQ had experienced a number of other issues, including a hard landing and ongoing airframe vibrations possibly, as a result of a tail rotor imbalance, which may also have contributed to the development of a fatigue crack within the stabiliser mount. In addition, the design of the stabiliser had been modified for helicopter kits manufactured after VH-SWQ, including VH-JEW. Therefore, it was not possible to make a direct comparison between the two accidents.

While it was outside the scope of the investigation to conduct an engineering assessment of the helicopter design, the stabiliser mount has been shown to be susceptible to fatigue cracking of under certain conditions. However, if there was an inherent design issue with the helicopter, it was not unreasonable to expect more incidence of cracking in the worldwide fleet. This was particularly so given a number of helicopters in the fleet had accumulated up to 400 hours in Argentina and at least one helicopter in Australia had reached 1,500 hours total time-in-service. However, VH-JEW and VH-SWQ were the only helicopters that have exhibited cracking. As a result, the investigation was unable to determine the contribution of all factors such as design, operating conditions, untested accessories, and the magnitude of the effect these elements may have had on the development of the fatigue crack.

Manufacturer's service bulletin

Following the accident involving VH-SWQ in 2014, the manufacturer released a mandatory service bulletin, BSC007, to all operators of the Cicaré 7 series helicopters. While the service bulletin provided a general instruction to perform a non-destructive dye penetrant inspection of the stabiliser mount, it did not include essential information such as how to disassemble the stabiliser to perform the inspection, a compliance time, or a recurring inspection interval.

Given the extent of the fatigue crack found on the stabiliser mount, it was likely that the crack had been present for some time since the helicopter entered service. However, the absence of a compliance timeframe or requirement for a recurring inspection reduced the likelihood of the crack being detected prior to reaching a critical size. Additionally, as the bulletin was released prior to the pilot purchasing and building the helicopter, it was possible that he did not have knowledge of the requirement to conduct the inspection.

Airworthiness documentation and regulatory aspects

Amateur-built experimental aircraft are not required to comply with the full range of safety regulations that are applicable to commercially-manufactured aircraft. However, the regulations that do apply are fundamentally important and have been introduced to control and reduce (as much as possible) the risks associated with the operation of this category of aircraft.

At the time of the accident, the aircraft had not been issued with a Civil Aviation Safety Authority (CASA) special certificate of airworthiness. As a result, the aircraft was not on the operator's Air Operator's Certificate, and therefore, not authorised to be flown for commercial aerial work such as aerial spotting or mustering. Not having the certificate meant that compliance with the applicable airworthiness standards could not be assured.

In addition, as an amateur-built experimental helicopter, it was very likely that the special certificate of airworthiness would have been issued with prescriptive operational uses, which would not have included commercial mustering. It was reported that the pilot had been conducting commercial aerial mustering operations in the helicopter in the weeks leading up the accident and was intending to continue after arriving at Roy Hill Station.

While the pilot had significant aeronautical experience and held a valid Class 2 Aviation Medical Certificate, the pilot's Class 1 certificate had expired several months prior. Although he was in the process of revalidation, the pilot was unable to exercise the privileges of a Commercial Pilot's Licence until such time. Of note, the pilot had no apparent medical issues.

The ATSB had considered if the pilot was experiencing time or commercial pressures to complete the build of VH-JEW. However, due to the limited information available, this could not be established. Therefore, the ATSB was unable to determine if this had influenced his actions with regard to the aircraft certification process.

The pilot's decision not to follow certain regulations may not have directly influenced the in-flight break-up of the stabiliser assembly. However, it did result in the helicopter being used for commercial mustering operations that it was not authorised for and would very likely not have been approved for by the Civil Aviation Safety Authority. This exposed the helicopter to higher operational stress and had the potential to increase the risk to the pilot and those working around the helicopter during the flying operations.

Findings

From the evidence available, the following findings are made with respect to the collision with terrain of a Cicaré CH-7BT helicopter, registered VH-JEW, that occurred near Roy Hill Station, Western Australia on 28 July 2015. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance. A safety issue is an event or condition that increases safety risk and (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 operating environment at a specific point in time.

Contributing factors

- While conducting a ferry flight, the stabiliser mount fractured, resulting in an in-flight break-up and collision with terrain.
- The helicopter's stabiliser mount fractured due to overstress, following propagation of a fatigue crack in the area adjacent to the weld. While the ATSB was unable to fully determine the reasons for the intiation and propagation of the fatigue crack, it was likely the result of some combination of the design, operating conditions, and untested accessories.

Other factors that increased risk

- The helicopter was modified with an external storage pod, likely without the appropriate engineering assessment to ensure there would be no adverse effects on the performance, handling and structure of the helicopter.
- Although the amateur-built Cicaré CH-7B helicopter was intended for recreational and sport use only, this and other CH-7B helicopters had been used for agricultural mustering. Operating outside the manufacturer's design intent had the potential to induce stresses on the aircraft, leading to premature wear of components and possible failure.
- **The Cicaré 7T/B/BT mandatory service bulletin (BSC007) for the general stabiliser support assembly provided limited guidance for disassembly of the manufactured component and did not stipulate a compliance period within which to perform the inspection nor provide consideration for repeat inspections. This potentially reduced the opportunity to detect the presence of crack initiation and growth in the stabiliser support assembly. [Safety issue]**

Other findings

- The helicopter was being operated without a Civil Aviation Safety Authority special certificate of airworthiness. Further, it was being used for commercial mustering operations, however, as an amateur-built experimental helicopter it would very likely not have been approved to conduct such operations. In addition, while the pilot had significant aeronautical experience, his Class 1 Aviation Medical Certificate had expired and although in the process of renewing it, the pilot was unable to exercise the privileges of his Commercial Pilot's Licence.

Safety issues and actions

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

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the [aviation, marine, rail - as applicable] industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions are repeated separately on the ATSB website to facilitate monitoring by interested parties. Where relevant the safety issues and actions will be updated on the ATSB website as information comes to hand.

Cicaré S.A. CH-7T/B/BT service bulletin

Safety issue number:	AO-2015-089-SI-01
Safety issue owner:	Cicaré S.A.
Operation affected:	Aviation: General aviation
Who it affects:	All owners and operators of Cicaré CH7T/B/BT helicopters

Safety issue description:

The Cicaré 7T/B/BT mandatory service bulletin (BSC007) for the general stabiliser support assembly provided limited guidance for disassembly of the manufactured component and did not stipulate a compliance period within which to perform the inspection nor provide consideration for repeat inspections. This potentially reduced the opportunity to detect the presence of crack initiation and growth in the stabiliser support assembly.

Proactive safety action

Action taken by:	Response to safety issue by Cicaré S.A.
Action number:	AO-2015-089-NSA-015
Action type:	Proactive safety action
Action status:	Closed

Safety action taken: BSC007 Revision 2 was released on 30 September 2015, which included a description of how to remove the vertical and horizontal fins to perform the inspection. It referred to the same inspection procedure as Revision 1. However, both versions did not include an initial or recurrent time period within which to conduct the inspection.

The inspection was incorporated into their maintenance manual and scheduled inspection table, and is required every 100 hours' time-in-service. Cicaré advised that they continue to monitor the ongoing non-destructive inspections of the assembly, and that as of November 2019, no other cracks have been found.

Cicaré have also advised that the stabiliser assembly was redesigned at the end of 2015. The new stabiliser was originally designed for the Cicaré CH-8 series helicopter, as the original Cicaré

7 series stabiliser was too small for a two (side-by-side) seat helicopter, such as the CH-8. Cicaré also advised that they wanted to improve the structural and aerodynamic characteristics, and improve the production process. Following design, static testing and flight testing on the CH-8, the new design was tested on the Cicaré 7 series and Cicaré 12 with positive results. All new helicopters, except the SVH4 trainer, utilise the new design and it is also available for retrofit on earlier Cicaré 7 series models.

BSC013, *T-type stabilizer installation*, released on 18 March 2019, provided information on why and how to perform the installation. If the new stabiliser was installed, the 100 hourly inspection, in accordance with BSC007, was no longer required. Cicaré have advised that they are continuing to monitor in-service behaviour of the new stabiliser in the Cicaré CH-8 every 100 hours, as part of the certification process and internal tracking of the in-service life of the components The ATSB has been advised that at least two operators in Australia have installed the new design.

Status of the safety issue

Issue status: Adequately addressed

Justification: The ATSB is satisfied that, with the inclusion of BSC007 in the maintenance manual and a clear direction to inspect the stabiliser assembly every 100 hours, cracking in this location will likely be identified prior to failure. Additionally, Cicaré have redesigned the component, and all new Cicaré 7 series helicopters will be fitted with the new design, which is also available for retrofit on earlier helicopters.

Additional safety actions

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence

Additional safety action taken by Cicaré S.A.

Action number: AO-2015-089-NSA-016

Cicaré have advised that they are intending to release a revision to the Pilot's Operating Handbook at the end of January 2020, which will indicate that the helicopters are not intended or recommended for aerial work, particularly mustering operations, which can cause a significant increase of loads and affect the fatigue life.

ATSB safety advisory notice to owners of Cicaré CH-7B and the agricultural aerial mustering community

Action number: AO-2015-089-SAN-014

Operating a helicopter within the stated design intent and limitations is essential for safe conduct of flight. The ATSB advises owners/operators of amateur-built experimental aircraft to be fully aware of the risks associated with this category of aircraft and that operation outside the limitations prescribed by the manufacturer, such as the addition of unapproved modifications and use for mustering operations, can produce unintended stresses on the airframe leading to premature failure of components.

ATSB information letter

On 6 August 2015, an information letter was emailed to registered Cicaré CH-7B owners, informing them of the second accident, the mechanism of stabiliser failure and a recommendation to ensure the integrity of the stabiliser prior to further operation and on an ongoing basis. The content of the letter is included as an Appendix and is also available on the ATSB website.

General details

Occurrence details

Date and time:	28 July 2015 – 1720 WST	
Occurrence category:	Accident	
Primary occurrence type:	In-flight break-up	
Location:	8.5 NM Roy Hill Station, Western Australia	
	Latitude: 22°31'34.52" S	Longitude: 119° 53' 15.43" E

Aircraft details

Manufacturer and model:	Cicaré CH-7BT	
Year of manufacture:	2015	
Registration:	VH-JEW	
Serial number:	032	
Total Time In Service	Approximately 170 hours	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1 (fatal)	Passengers – 0
Damage:	Destroyed	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- The Civil Aviation Safety Authority
- Western Australia Police and Coroner
- Cicaré S.A.
- The Australian importer of Cicaré S.A. kits
- Bureau of Meteorology
- Sport Aircraft Association of Australia
- Bureau of Infrastructure, Transport and Regional Economics.

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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 Cicaré S.A., the Civil Aviation Safety Authority, the Sport Aircraft Association of Australia, the distributor of Cicaré helicopters in Australia, and the pilot's next of kin.

Submissions were received from Cicaré S.A., the Civil Aviation Safety Authority, and the pilot's next of kin. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Appendices

Appendix A – ATSB information letter

Cicaré CH-7B helicopters

- The ATSB recommends owners of CH-7B series helicopters ensure the integrity of the stabiliser before flying.

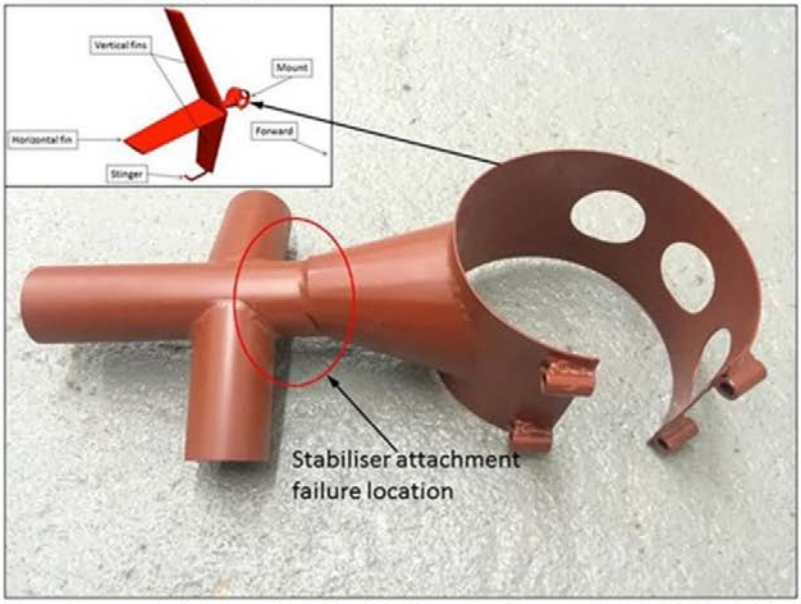
The ATSB is investigating a second fatal accident involving in-flight separation of the stabiliser, and subsequent loss of control, involving Cicaré CH-7B helicopters.

Preliminary technical examination at the ATSB's facilities in Canberra, indicates that in both instances the stabiliser failed due to cracking associated with metal fatigue. In the most recent accident, the crack propagated in a circumferential manner through approximately 75 per cent of the welded structure prior to failure.

While the ATSB is working to establish the factors leading to the two failures, owners are advised to exercise extreme caution in the operation of their helicopters.

The examination showed cracking in the stabiliser attachment outboard of the tail boom, coincident with the welded intersection of the conical and tubular sections of the attachment. The location of the cracking in the attachment cannot be easily inspected as they are obscured by the upper and lower vertical stabiliser fairings.

Stabiliser attachment failure location

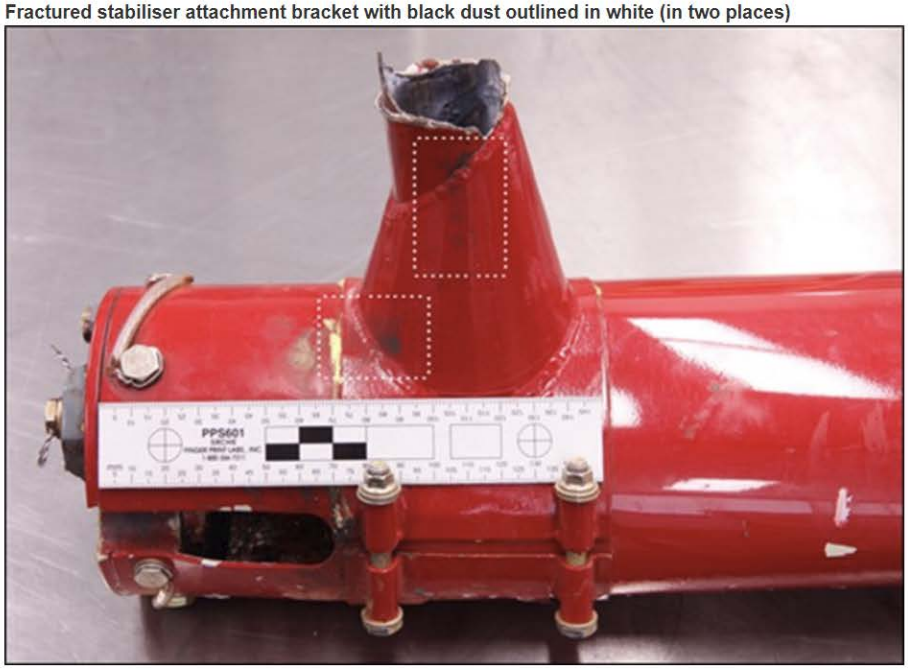


The cracking is unlikely to be easily visible during inspection. However, black dust in the vicinity of the attachment bracket, and working rivets are indicative of increasing stabiliser movement as the crack develops.

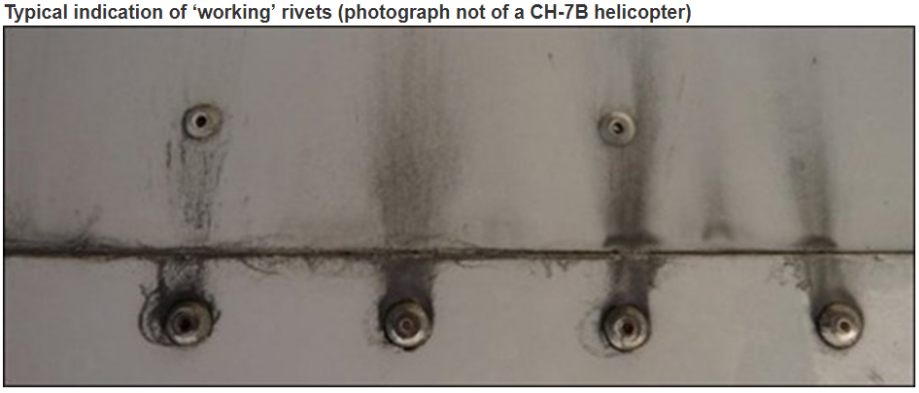
The ATSB is working to establish the origin of the failure. However, initial indications are that the fatigue cracking occurred after as little as 100 hours of operation and may be associated with aerial stock mustering. Additionally, in the first accident, operation of the helicopter with a high level of vibration may have been a factor.

CH-7Bt tail section showing the location of fatigue fracture on the stabiliser attachment

Fractured stabiliser attachment bracket with black dust outlined in white (in two places)



Typical indication of 'working' rivets (photograph not of a CH-7B helicopter)



The ATSB recommends that owners of CH-7B series helicopters ensure the integrity of the stabiliser prior to further operation and on an ongoing basis. While the ATSB is working to establish the factors leading to the two failures, owners are advised to exercise extreme caution in the operation of their helicopters.

Cicaré has advised that if any doubt arises concerning the inspection or maintenance of any part, piece or component, their technical department should be immediately consulted.

In addition, owners may wish to discuss any concerns with an appropriately-licenced aircraft maintenance engineer, the Sport Aircraft Association of Australia or with the Civil Aviation Safety Authority before further flight.

If you find any cracks in the stabiliser attachment, please call us on 1800 020 616 or email ATSBinfo@atsb.gov.au.

Related investigations:

- **AO-2014-086 -** Collision with terrain involving Cicare CH-7B, VH-SWQ, 43 km NW of Barcaldine Airport, Qld, on 12 May 2014
- **AO-2015-089 -** Collision with terrain involving Cicare CH7b helicopter, VH-JEW, near Roy Hill Station, WA, on 28 July 2015

www.atsb.gov.au/media/news-items/2015/cicar-C3-A9-ch-7b-helicopters

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB 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 operations involving the travelling public.

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 factors related to the transport safety matter being investigated.

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 it appropriate. 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 factor: a 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 factor would probably not have occurred or existed.

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

Other findings: 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.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

In-flight break-up involving Cicaré S.A. CH-7BT, VH-JEW
near Roy Hill Station, Western Australia, on 28 July 2015

AO-2017-005
Final – 20 December 2019