Australian Government
Australian Transport Safety Bureau

Loss of control and collision with terrain involving YAK-9UM, VH-YIX

19 km west-north-west of Latrobe Regional Airport, Victoria, on 7 September 2018

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2018-061
Final – 17 June 2020

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, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Addendum

Page	Change	Date

Safety summary

What happened

On 7 September 2018, the pilot of a Yakovlev 9-UM (YAK 9) aeroplane, registered VH-YIX, departed Latrobe Regional Airport, Victoria for a local private flight. The aircraft was observed by witnesses to the north of Moe, Victoria performing aerobatic manoeuvers. A short time later the aircraft impacted the ground in a steep nose-down attitude, fatally injuring the pilot and destroying the aircraft.

What the ATSB found

The ATSB found that the aircraft entered a spin at low altitude from which it was not possible to recover. There was no evidence of pilot incapacitation, or a mechanical fault with the aircraft that contributed to the accident.

The pilot had limited experience and recency in the YAK 9 and had not previously conducted aerobatics in the aircraft. He was therefore likely unaware of its unique handling characteristics and not adequately prepared to conduct the solo aerobatic flight.

The ATSB also identified a number of other factors that, while not contributory, increased safety risk. These included inadequate aircraft maintenance and operation without important flight and maintenance documentation.

Safety message

This accident highlights the inherent risks associated with performing low-level aerobatics in high performance aircraft. Pilots engaged in such flights are encouraged to observe minimum approved operating heights above the ground, commensurate with their ability and qualifications, and to engage in regular flight reviews and/or flight instruction.

Pilots should also ensure that careful preparation and planning is undertaken prior to each flight and that all documentation, checklists and required manuals are appropriately stored and accessible within the aircraft.

Contents

The occurrence

What happened

On 7 September 2018, a Yakovlev 9-UM (YAK 9), VH-YIX was flown from Boonah Queensland, to Latrobe Regional Airport, Victoria. The relocation of the aircraft was undertaken by two separate pilots, with a handover conducted at Dubbo Airport, New South Wales. One of the pilots, an instructor, flew another aircraft from Latrobe Regional Airport to Dubbo. On arrival at Dubbo the pilots swapped aircraft for their respective return flights.

Prior to landing at Dubbo in the YAK 9, the pilot from Boonah opened the forward cockpit canopy in-flight to provide greater visibility for the landing. It was reported that the resultant turbulent airflow from the open canopy ejected a number of aircraft documents from inside the cockpit. After landing at Dubbo, the instructor was advised of the loss of the aircraft checklist, maintenance release, Certificate of Registration, and Special Certificate of Airworthiness from the aircraft.

The instructor conducted an uneventful flight back to Latrobe Regional Airport in the YAK 9, and landed at about 1155 Eastern Daylight-saving Time.[1] He refuelled the aircraft with 341 litres of aviation gasoline and parked the aircraft on the Latrobe Valley Aero Club hardstand at 1244.

One of the aircraft's owners (the pilot) met the instructor on arrival. The pilot told the instructor that his intention was to conduct some taxi practice prior to a pre-arranged instructional flight scheduled for 1630 that afternoon.

The instructor and the pilot discussed the absence of the checklist and other required documents. The instructor reported that they agreed that the aircraft should not be flown, but taxiing would be acceptable, provided the aircraft's operating temperatures were monitored. The instructor then proceeded inside the aero club to prepare another student for a training flight.

Sometime later, the instructor heard the pilot attempting to start the YAK 9. After numerous starting attempts, the instructor went outside to assist the pilot to apply the correct starting sequence.

At about 1420, the pilot began to taxi the aircraft, which was witnessed by two aircraft engineers standing outside a hangar at the northern end of runway 21. The aircraft was taxied along to the run-up bay. The witnesses observed that the rear canopy of the aircraft was open and that the pilot appeared to conduct routine engine checks. A short time later, the aircraft entered runway 21, the pilot applied power and commenced to take-off.

The instructor, who was walking across the tarmac from the aero club, recalled observing the take-off roll of the YAK 9 and noted that the aircraft used more than double the normal length of runway before it lifted off. The instructor then noticed that the rear canopy was not secure.

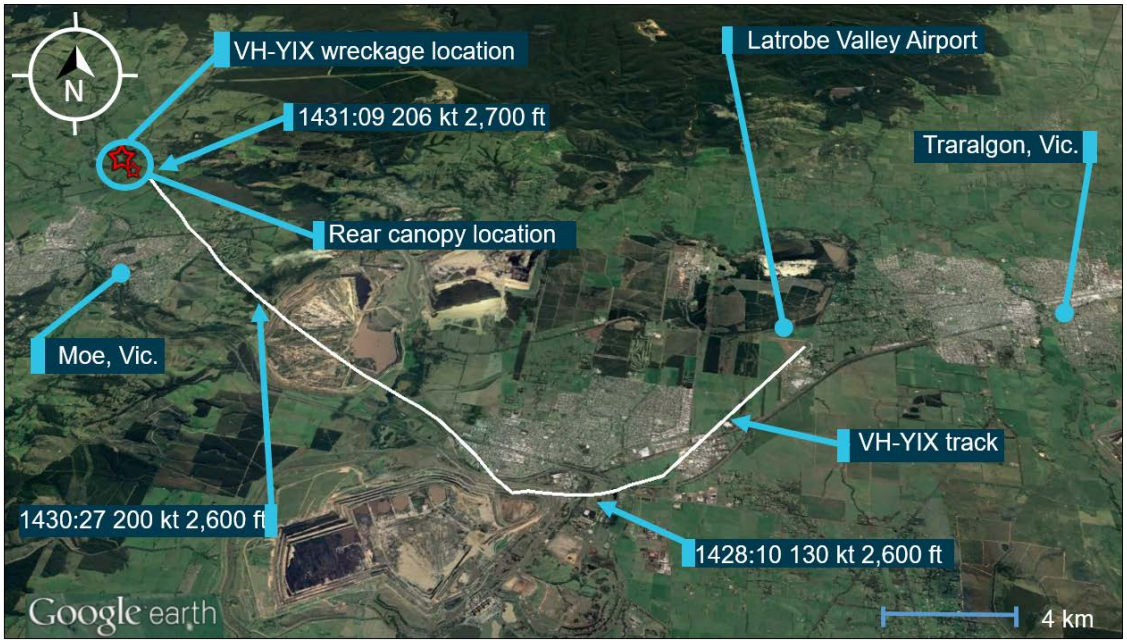
He attempted to contact the pilot from within the aero club by radio to advise him that the rear canopy was not secure. The instructor made several broadcasts but did not receive a response from the pilot. However, another pilot in the area responded to the instructor's radio call, which confirmed that the radio call had been broadcast.

The YAK 9 initially maintained runway heading as it continued to climb. At 1428, it was identified by military radar turning off runway heading to the west at about 130 kt (Figure 1). The aircraft climbed to about 2,600 ft above mean sea level (AMSL). About 4.6 km to the south-west of Latrobe Regional Airport, it was observed on radar to level out.

---

[1] Eastern Daylight-saving Time (EDT): Coordinated Universal Time (UTC) + 11 hours

Figure 1: Flight track of VH-YIX



Source: Google Earth with annotations by ATSB

At 1431:09, the aircraft was about 18 km to the north-west Latrobe Regional Airport at about 2,800 ft, and travelling at 206 kt groundspeed when the pilot began to conduct what ground witnesses assessed as aerobatic manoeuvers. Radar contact with the aircraft was lost during those manoeuvres. The aircraft briefly reappeared on radar at 1431:34, at about 3,100 ft, (2,900 ft above ground level) with a groundspeed of 157 kt. This was the last contact received by radar, and showed a 49 kt reduction in groundspeed during the 25-second period when the aircraft was not visible on radar.

Figure 2: Video captured by a witness with overlayed ATSB analysis

Source: Witness footage with ATSB analysis and annotations

Witnesses in the Moe region, who were actively watching the aircraft from the ground, observed the YAK 9 conduct a series of what appeared to be aerobatic manoeuvers. One witness described what appeared to be a roll followed by a loop. They stated that as the aircraft came out of the bottom of the loop, the aircraft appeared to conduct an abrupt left turn before it began spiralling towards the ground. Video taken by another witness showed the aircraft in a spinning, steep nose-down attitude prior to disappearing from view (Figure 2). These four frames were captured over 0.48 seconds.

At about 1432, the aircraft impacted terrain in a paddock about 3 km north of Moe, in a flat, slightly right-wing and nose-low attitude, with little to no forward movement (Figure 4). The aircraft was destroyed, and the pilot was fatally injured.

Context

Pilot information

Qualifications

The pilot held a Commercial Pilot Licence (Aeroplane), issued in March 1983. At the time of the accident, the pilot held the appropriate aircraft ratings and endorsements to operate the YAK 9. The pilot had undertaken an aeroplane flight review with an instructor in a twin-engine Cessna 310, about two weeks prior to the accident.

In August 1997, the pilot conducted spin training in a basic aerobatic training aircraft. At that time, the pilot also received an aerobatic endorsement. This qualification permitted the pilot to perform basic aerobatic manoeuvres such as loops, aileron rolls, slow rolls, barrel rolls and stall turns. The endorsement contained an altitude restriction which required the pilot to have completed any aerobatic manoeuvre by 3,000 ft above ground level.

Experience

The pilot was a relatively experienced private aircraft operator, and had operated a number of ex-military, high-performance warbird aircraft. The pilot had logged over 2,000 flight hours in multiple aircraft types, and had flown about 100 hours in warbird aircraft. The pilot had recorded a total of 1.9 hours in VH-YIX as at 29 March 2018, however it was reported that a number of additional flights were undertaken in the aircraft but not recorded in the pilot's logbook. The instructor who had overseen all of the pilot's operation of the aircraft estimated that the pilot's experience in the YAK 9 was about 5-6 hours.

As part of transitioning to operate high-performance warbird aircraft, the pilot had voluntarily undertaken a significant number of instructional flights in warbird aircraft since 2011. Flight training records and instructor interviews indicated that the pilot normally required debriefing in a number of areas after these flights. Basic warbird aircraft handling issues were identified as the most prevalent debriefing points. However, the use of checklists and correct procedures were also identified a number of times. Several different instructors noted in the pilot's training records that he needed to fly often to retain currency and consistency in operating warbird aircraft.

The pilot had conducted aerobatics in a number of high-performance warbird aircraft in the two years prior to the accident, however he had not flown the YAK 9 in over 3 months, and had not previously conducted aerobatics in the aircraft.

Medical

The pilot conducted an aviation medical examination on 10 July 2018 and was issued a Class 2 aviation medical certificate on 31 July 2018. Limitations placed on the pilot's medical certificate required distance vision correction to be worn whilst flying and reading correction to be available whilst exercising the privileges of the licence. A review of the previous five years of medical files did not identify any medical concerns. The post-mortem examination found no evidence of any medical conditions that may have affected the pilot's performance.

The pilot was reported to be excited about the return of the YAK 9 to Latrobe Regional Airport, and took a flight bag when departing for the airport that morning. However, family members reported that the pilot was uncertain if he would fly the aircraft that day.

Aircraft information

General

The YAK 9 is a two-seat, low-wing, aerobatic[2] aircraft with retractable landing gear. At the time of design, it was intended to perform the role of an advanced wartime aerial combat platform. Manufactured with front and rear flight controls, the primary flight controls are located in the front cockpit section with independent, secondary flight controls located in the rear passenger cockpit.

VH-YIX was manufactured in Russia in 1996 and exported to the United States shortly after construction without an engine. A Special Airworthiness Certificate issued for the purpose of experimental exhibition was granted on 20 February 2004 to allow the aircraft to operate in the United States. Logbook entries indicate that an Allison V-12 liquid-cooled engine was installed and on 12 April 2004, the aircraft had flown 1.5 hours. The aircraft was imported to Australia and was placed on the Australian civil aircraft register on 19 July 2004, as VH-YIX.

Handling characteristics

As part of dive recovery, most aircraft require the application of rearward pitch control input to raise the nose and ease out of a dive. Experienced YAK 9 pilots reported that the aircraft exhibited a divergent pitch control that was more pronounced when it had a rearward centre of gravity. This characteristic, which is different to most other warbird aircraft, meant that the effort required to pull back on the control stick reduced as the airspeed increased during a high-speed dive. That behaviour increases the possibility of the pilot over-controlling the aircraft with excessive pitch-up input. This, in turn, increases the risk of unintentionally entering a high-speed stall by exceeding the wing's maximum angle of attack[3] and entering a spin.[4]

The YAK 9 flight manual emphasises the need for smooth and deliberate control inputs for aerobatics. A high-speed stall occurs when the airflow over one or both wings of an aircraft detaches and becomes turbulent due to a high angle to the relative airflow.[5] At this point the addition of a yawing force, most typically due to an out of balance condition, begins to rotate the aircraft into a spin. These forces will continue until control input from the pilot stops them. High-performance aircraft like the YAK 9 transition into a fully developed spin quicker and more forcefully than a typical light training aircraft. It is essential during recovery from a spin to have sufficient altitude to effect the recovery. Experienced YAK 9 pilots stated that, depending on pilot experience, 5-7,000 ft is required to safely recover the aircraft from a developed spin.

The YAK 9 flight manual states that recovery from a spin (Figure 3) also requires considerable forward control stick movement to hold the aircraft in a dive until the speed builds up. It also warns pilots not to energetically over-control the elevator during dive recovery as the aircraft may 'wing rock', which is a symptom of impending stall. Should too much rearward control stick application continue, then the aircraft may re-enter a stalled state that may lead to a further spin.

---

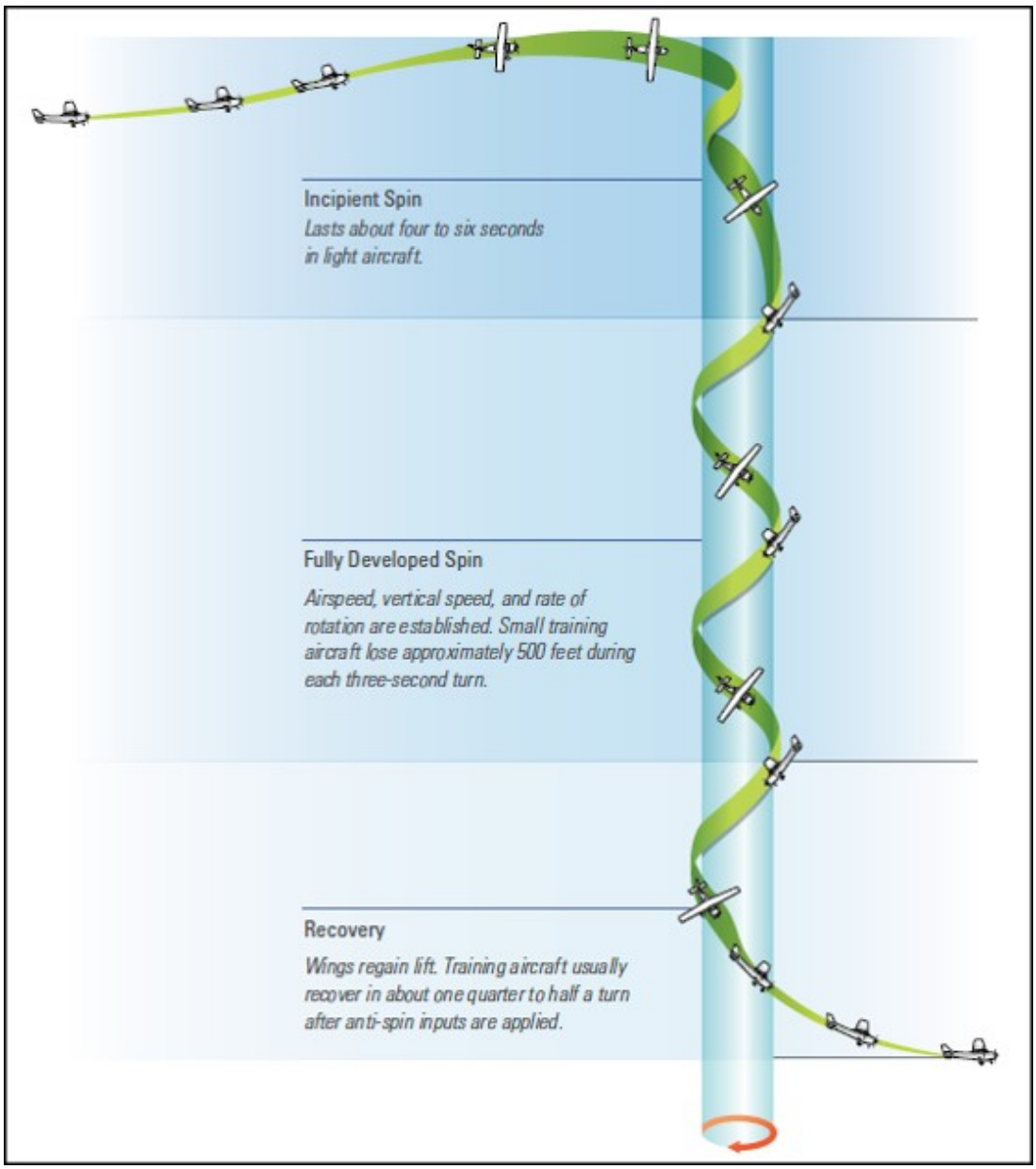
2 Civil Aviation Advisory Publication 155-1(0) defines aerobatics as manoeuvres intentionally performed by an aircraft involving an abrupt change in its attitude, an abnormal attitude, or an abnormal variation in speed.

3 The angle of attack is the angle measured between the wing chord line and relative airflow.

4 A spin is a sustained spiral descent of a fixed-wing aircraft, with the wing's angle of attack beyond the stall angle.

5 Angle of the airflow relative to the chord of the wing.

Figure 3: Spin recovery stages



Source: Civil Aviation Authority New Zealand- *Spin Avoidance and Recovery* –page 11.

Maintenance

It is an Australian regulatory requirement that the aircraft maintenance history is documented in the aircraft and engine logbooks. A review of the aircraft's logbooks indicated that the YAK 9 was operated in Australia for about 106 hours before the aircraft was damaged in a landing incident at Tyabb, Victoria, in September 2015. The aircraft underwent a significant repair process, which was completed on 21 October 2016. The aircraft logbook indicated that, as part of the repair the:

- rudder and port aileron had been removed, repaired, recovered and refitted
- fin and port wingtip had been repaired
- engine was removed, bulk stripped and refitted
- propeller was overhauled and propeller blades replaced
- centre and rear cockpit canopy transparencies were removed and replaced.

An independent inspection of the flight control system was undertaken relating to the rudder and port aileron refit.

Following the purchase of the aircraft from the original owner, a maintenance provider conducted a periodic inspection, and a maintenance release was issued on 20 December 2017. The aircraft's total time in service was 107.9 hours when it became registered to the pilot on 22 January 2018.

Entries in the maintenance release[6] indicated that it flew a further 15.9 hours before the day of the accident. The last recorded entry on the aircraft maintenance release was dated 29 May 2018 and listed a total time in service of 122.8 hours with no recorded outstanding maintenance or defects. It was reported by the ferry pilot that prior to departing Boonah, there were no outstanding recorded maintenance or defects.

It was originally reported that the Yak 9 was relocated to Queensland for maintenance, however the only maintenance performed on the aircraft during its time at Boonah related to checking the security of coolant hoses. It was subsequently reported that the aircraft was primarily flown to Queensland to attend, and conduct a display at, an air show.

Requirements for the carriage of a documents in flight

The Civil Aviation Regulations 1988 (CAR) require that the pilot-in-command of an aircraft carries, as a minimum on the aircraft during flight, the maintenance release and the flight manual (if any).

Paragraph 139 (1) (c) of the (CAR) also directs that an aircraft shall not commence a flight unless there is a valid maintenance release or other approved document in force, covering the period of the proposed flight. This is to ensure that the pilot-in-command:

- is informed of any defects in the aircraft
- is able to determine that all required maintenance on the aircraft has been completed and certified
- can determine that no maintenance requirement will become due during the time of the proposed flight.

Pilots familiar with operation of the YAK 9 reported that there was little provision to store flight documents in the cockpit. When preparing to land the aircraft, it was common for a pilot to open/slide the forward canopy rearward to allow for a better view of the landing area during the final turn for landing. On a previous occasion, opening the forward canopy in flight resulted in the loss of the aircraft maintenance release and the aircraft checklist. At that time, the maintenance release was re-issued by an approved maintenance organisation.

A similar situation occurred when the aircraft arrived at Dubbo, on its return flight to Latrobe Regional Airport on the day of the accident. As a consequence, the aircraft departed Dubbo without the maintenance release or checklist. The instructor reported that on arrival at Latrobe Regional Airport, he asked the maintenance provider to arrange a replacement maintenance release for VH-YIX. However, before a maintenance release could be reissued, the aircraft departed the airport without an aircraft checklist or current maintenance release.

In the case of VH-YIX, the aircraft checklist was incorporated into, and formed part of the flight manual. Neither the flight manual nor the maintenance release were located at the accident site.

Rear canopy

The rear canopy of the YAK 9 can be secured from the rear seat inside the cockpit, or prior to flight from the front seat. Securing the rear canopy from the front seat requires the front seat pilot to face backwards in order to lock the rear canopy in place, prior to resuming the control seat.

The YAK 9 pre-flight checklist specifically requires that in single seat operations, prior to starting the engine, the rear seat must be properly prepared by securing the seatbelt assembly to prevent

---

[6] A record of the current legal airworthiness status of the aircraft.

interference with the aircraft's controls, and the rear canopy is also to be locked in place prior to taxi. It is not possible to secure the rear canopy once seated from the front seat.

Wreckage and impact information

On-site examination

The accident site was in a flat grazing paddock, 19 km west-north-west of Latrobe Regional Airport. The aircraft collided with terrain close to the fence line of two properties.

Figure 4: Major features of the wreckage at the accident site

Source: ATSB

The site inspection confirmed the presence of all the major flight control surfaces including trim tabs, the tailplane, fuselage and wings.

Fuel burns to grass were identified forward of the aircraft's orientation. This was the result of the highly compressed wing structure rupturing the main leading edge fuel tanks, allowing fuel to escape on impact, chemically burning vegetation adjacent to the accident site.

The lack of wreckage trail, high compression of the aircraft structure and close proximity of the majority of the aircraft pieces indicated an impact at a high vertical speed with little forward movement.

Figure 5: Right wing structure impact damage

Source: ATSB

Ground impact marks and aircraft damage indicated that the YAK 9 collided with terrain in about a 30° right wing low, and 30° nose-low attitude (Figure 5). This attitude and wreckage distribution was consistent with the wreckage pattern of an aircraft established in, or partially recovering from, a spin.

One propeller blade separated from the aircraft at impact and the other two sustained damage consistent with the engine operating under low power at the time of the accident. Witness reports of engine popping and backfiring prior to impact were consistent with the engine operating in a dive with a reduced power setting. The inspection of the engine and its controls did not reveal any defect that may have prevented its operation. The availability of fuel, serviceability of the ignition and engine control systems and a lack of structural defects, indicated that all systems appeared serviceable during the flight.

In combination with the propeller blade damage, it is likely that at the time of impact with terrain, the engine was operating, however at a low power setting.

The flight controls were present and accounted for at the site. Examination of the systems did not reveal any pre-existing defects that may have inhibited normal operation.

Some anomalies were noted within the wreckage during the ATSB's on-site phase of the investigation, these included:

- the rear canopy was not accounted for within the wreckage at the accident site - it was subsequently located by a land owner in a nearby paddock
- one of the rear seat rudder control balance cables and pulley had detached from the airframe
- internal corrosion was identified within the compromised structure of the welded steel fuselage
- unsecured fasteners in the forward and rear seats
- rear-seat seatbelt assembly unbuckled and unsecured.

Rear canopy

The rear passenger canopy was located approximately 500 m to the south-east of the impact site. The proximity of the canopy in relation to the accident site, in combination with the recorded radar track of the aircraft during the final moments of the flight, indicated that the canopy most likely separated from the aircraft during the vertical descent.

Assessment of canopy photographs identified that the canopy was relatively intact, sustaining only minor damage upon separation from the aircraft and some further damage on impact with the ground. The canopy's transparency contained two large cracks on the left and right side; originating at the forward corners of the canopy frame and extending rearward. The transparency was contained within its alloy frame. The forward part of that frame, identified as the canopy bow, had buckled in a rearward manner, likely due to impact with the ground (Figure 6). There was no evidence that the rear canopy contacted the aircraft structure, including the flight controls, following detachment.

Figure 6: Forward looking view of the rear canopy

Source: Insurance assessor image with ATSB annotations

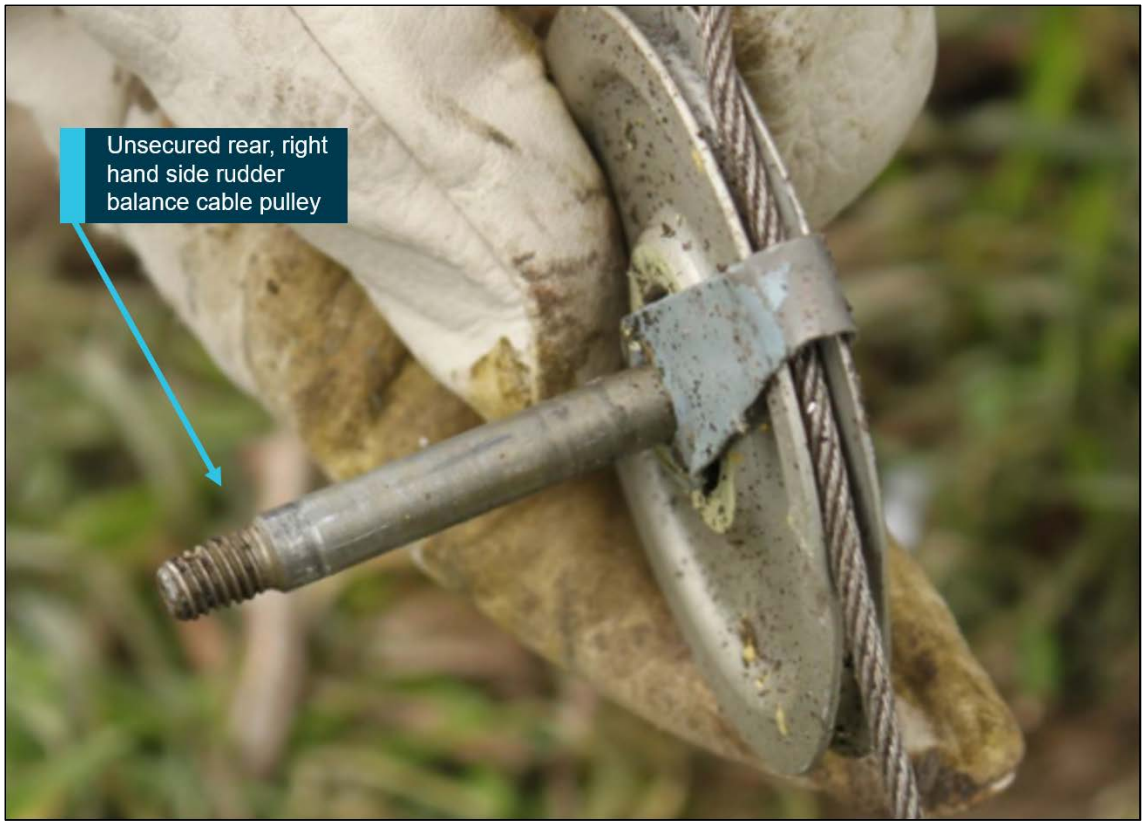
Rear rudder control assembly

The YAK 9-UM is a tandem two-seat aircraft. Each seating position has independent rudder cables running from the rudder, through a series of pulleys, to the rudder pedals. To balance the movement of each rudder pedal position in each seat, a balance cable ran between the left and right rudder pedals. This ran through a series of pulleys to ensure that if one rudder pedal was depressed then the other would raise. Each rudder control, for both the forward and rear seating positions, was independent of each other. This means that in the event of a failure in one, the other would function appropriately.

On-site wreckage examination identified that the passenger right-side rudder balance cable pulley had separated from its mount within the airframe structure. The castellated nut, washer and accompanying split pin that would normally secure the pulley bolt to the airframe tube were not

able to be located and there was no evidence that the fastener had failed due to force associated with the impact sequence (Figure 7).

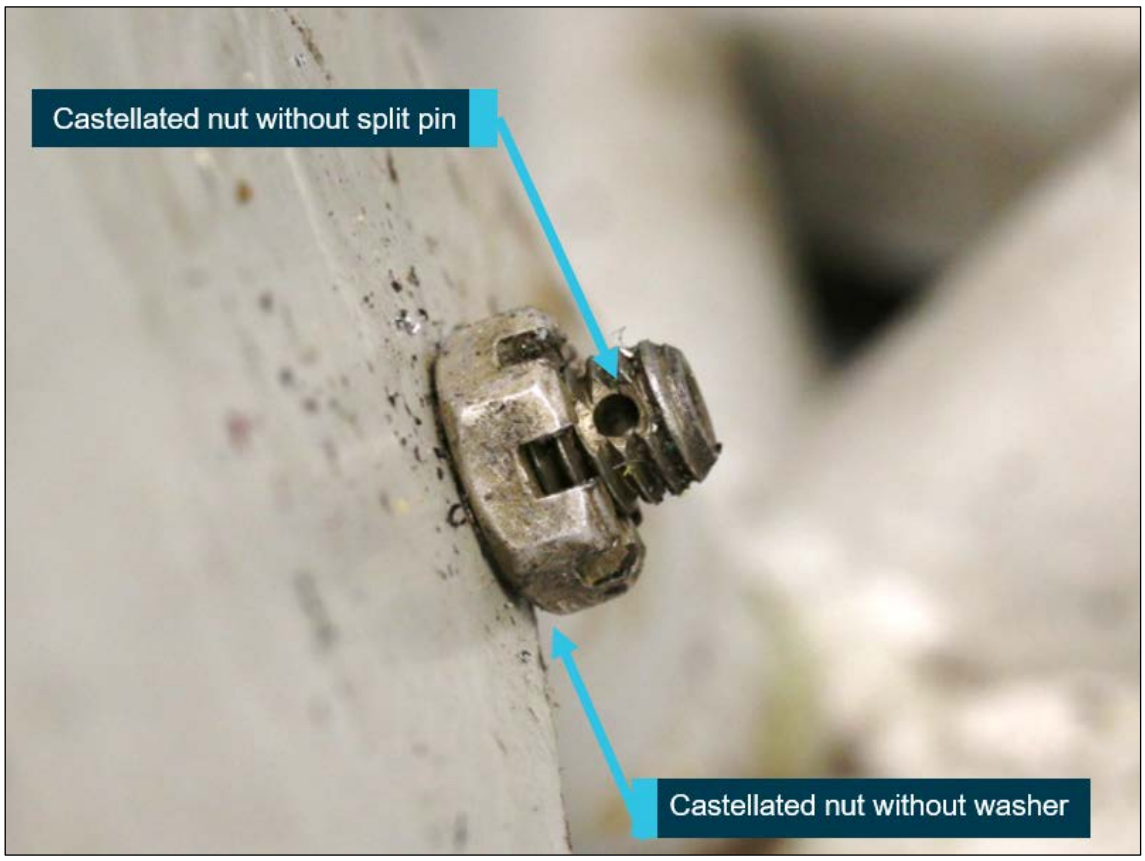
Figure 7: Rear right rudder pulley, found away from the airframe.



Source: ATSB

An additional anomaly was noted with the left-side rudder pulley. Although the castellated nut was present on the bolt threads to that pulley, no split pin had been fitted. Furthermore, even if one had been fitted, the fastener arrangement would not have prevented loosening of the castellated nut (Figure 8).

Figure 8: **Left side rear rudder balance cable bolt and castellated nut**



Source: ATSB

Internal corrosion within tubular structure

During the on-site examination of the wreckage, corrosion was noted inside a number of airframe tubes. The rear cockpit's rudder balance cable pulley structure also had evidence of internal corrosion. The pilot's seat rear mount cross-member had separated from the tubular side frames of the forward cockpit, revealing further evidence of internal corrosion. Internal corrosion was also found in the tubular steel structure of the fuselage. It was noted that there was little provision for applying and draining corrosion-inhibiting products to the internal surfaces of the tubes.

Further examination

ATSB identified other anomalies during the on-site examination of the wreckage. There was evidence of incomplete maintenance activity, with further examples of missing split-pins, in the rear-seat mounting bolts and nuts. A split-pin was also missing from the pilot's seat lower mounting bolt securing nut, which was engaged by several threads, with the locking portion of the nut disengaged.

The rear seat was found outside the aircraft near the tailplane with the individual straps of the seatbelt assembly loose. The position of the seat indicated that significant force/s had been applied to it, raising the possibility that the rear seatbelt assembly became unclipped during the impact sequence.

However, the instructor who flew the aircraft to Latrobe Valley earlier that day reported that, on arrival, he removed a bag that had been secured via the harness to the rear seat and left the seatbelt undone in preparation for a planned 1630 flight with the pilot. If that harness was not secured by the pilot prior to the accident flight, the straps may have fouled the control stick and inhibited full and free movement in flight. From the available evidence, it was not possible to determine if that occurred.

Safety analysis

Introduction

VH-YIX departed Latrobe Regional Airport, Victoria at about 1428 and climbed to 2,600 ft before turning to the north and accelerating to over 200 kt north of Moe. The pilot then began to conduct manoeuvres identified by witnesses as being consistent with aerobatics. A short time later the aircraft impacted the ground in a steep nose-down attitude, fatally injuring the pilot.

This analysis will discuss the development of the accident, including the pilot's qualifications and readiness for the flight. Aspects of the aircraft maintenance and associated documentation will also be detailed.

Development of the accident

Aerobatic manoeuvres

Witness reports indicated that the pilot was performing manoeuvres consistent with aerobatics, including loops and rolls, immediately prior to an abrupt loss of control.

Analysis of video footage provided by a witness indicated that VH-YIX was established in a spin when the aircraft disappeared from view below 1,000 ft above ground level (AGL). The aircraft damage and localised nature of the accident site confirmed that the aircraft collided with terrain in a right wing-low and nose-down attitude at high vertical speed and with little forward movement. That impact signature was consistent with the aircraft established in a spin.

Analysis of radar coverage in that area identified that an aircraft operating below about 1,800 ft above mean sea level would be below radar coverage, and therefore not identifiable on radar. The absence of radar identification of the aircraft during the latter part of the flight therefore indicated that the pilot was operating significantly below his approved 3,000 ft AGL aerobatic limit. More importantly, the aircraft was also well below the altitude that experienced YAK 9 pilots advised was required to safely recover from a spin. As such, and consistent with the observed impact signature, the spin was probably unrecoverable in the height available.

The pilot was qualified to perform basic aerobatics above 3,000 ft AGL, and the aircraft type was appropriate for the aerobatics conducted. However, while the pilot had experience conducting aerobatics, he had limited experience and recency in the YAK 9 and had not previously conducted aerobatics in the aircraft. He was therefore likely unaware of its handling characteristics during such manoeuvres. Specifically, the possible pitch control sensitivities required during aerobatic manoeuvres or spin recovery in the YAK 9.

Additionally, as there was no flight manual/checklist available to the pilot, he was unable to refer to important operational information such as operating airspeeds/limitations during the flight.

In summary, the ATSB concluded that the pilot was probably not adequately prepared to conduct a solo aerobatic flight in the YAK 9.

Canopy

Numerous witnesses recalled that the rear canopy of the YAK 9 was not secure prior to take-off. Consequently, this allowed in flight air loads to slide it fully rearward along its guide rails and ultimately detach it from the aircraft. There was no evidence that the canopy struck any other part of the aircraft as it departed the airframe.

While it remains unknown if an open rear canopy may have a detrimental effect on airflow over the rear control surfaces of the YAK 9, it is unlikely to have been sufficient to cause a loss of control as it was open from the commencement of the take-off. However, the canopy's departure from the airframe was probably sudden and could well have distracted the pilot. Given the proximity

between the canopy and the wreckage location and the flightpath of the aircraft however, it was considered likely that the canopy detached during the spinning vertical descent.

Aircraft maintenance

Defects

Examination of the rear rudder balance cable pulleys identified that the associated fasteners were not correctly secured. Specifically, the required split pins were not fitted and this led to detachment of one of the castellated nuts. Despite that, the design of the pulleys is such that the bolt shank is unlikely to migrate from its installation during operation as cable tension from the rudder control is likely to keep the rudder pulley bolt in place during service.

In addition, wreckage examination also identified unsecured rear seat mounting bolts and an unsecured pilot's seat mounting nut.

Finally, significant corrosion was identified within the steel fuselage frame. The nature and progression of the corrosion was not at a magnitude to be visually identifiable on the external airframe, however it may have presented a significant future risk to aircraft operation. Russian accredited representatives advised that internal tube anti-corrosion measures are not applied to the YAK 9, and that no internal surfaces are coated during manufacture.

These observations, while not considered to have contributed to the accident, indicated that maintenance had not been performed on the aircraft to an acceptable standard. That had the potential to affect the future airworthiness of the aircraft.

Documentation

The loss of the maintenance release approaching Dubbo Airport meant that the written means to convey relevant maintenance information or defects was unavailable to both the instructor and the accident pilot. While this did not influence the development of the accident, operation without this document increases the risk that maintenance may be overdue, or that a defect may compromise the safety of the aircraft.

Findings

From the evidence available, the following findings are made with respect to the collision with terrain involving the Yakovlev 9-UM (YAK 9), registered VH-YIX, which occurred 19 km west-north-west of Latrobe Regional Airport, Victoria on 7 September 2018. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- While conducting aerobatic manoeuvers, the aircraft entered a spin and impacted terrain.
- The pilot initiated aerobatics lower than his flight activity endorsement permitted and well below the height required to safely recover the YAK 9 from a spin.
- The pilot had limited experience and recency in the YAK 9 and had not previously conducted aerobatics in the aircraft. He was therefore likely unaware of its unique handling characteristics and not adequately prepared to conduct the solo aerobatic flight.

Other factors that increased risk

- The rear canopy was unsecured before take-off and consequently separated from the aircraft during flight. This increased the risk of damage to aircraft structure, distraction of the pilot and possibly adverse handling qualities.
- Post-accident examination of the aircraft identified incomplete maintenance practices, including inadequate airframe anti-corrosion measures and insecure primary flight controls and seat fasteners.
- The aircraft was operated without the maintenance release or the flight manual, which deprived the pilot of important operational and maintenance-related information.

General details

Occurrence details

Date and time:	7 September 2018 – 1432 EDT	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	19 km west-north-west of Latrobe Regional Airport, Victoria	
	Latitude: 38° 8.838’ S	Longitude: 146° 16.255’ E

Pilot details

Licence details:	Commercial Pilot Licence (Aeroplane) issued April 2010
Endorsements:	Manual Propeller Pitch Control; Retractable Undercarriage
Ratings:	SEA, MEA, PIFR, AERO, SPIN, FF A
Medical certificate:	Class 2, valid to 20 July 2020
Aeronautical experience:	Approximately 2,030 hours
Last flight review:	31 August 2018

Aircraft details

Manufacturer and model:	YAKOVLEV AIRCRAFT FACTORIES YAK-9UM	
Year of manufacture:	1996	
Registration:	VH-YIX	
Serial number:	0470409	
Total Time In Service	122.8 hours	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1	Passengers – 0
Damage:	Destroyed	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- witness interviews
- the pilot's previous flight instructors
- interviews with YAK 9 pilots
- the aircraft logbooks and maintenance documentation
- the aircraft flight manual and documentation
- Airservices Australia and Department of Defence radar data
- the Civil Aviation Safety Authority pilot licence and aircraft documentation
- the pilot logbook
- video and audio information related to the flight.

Submissions

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

A draft of this report was provided to the Civil Aviation Safety Authority, Airservices Australia, Department of Defence, National Transport Safety Bureau, Interstate Aviation Committee, the maintenance provider and the pilot's recent flying instructor and a subject matter expert in the YAK 9.

A submission was received from the pilot's recent flying instructor. The submission was reviewed and, where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The 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 ATSB's 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.