Australian Government
Australian Transport Safety Bureau

Loss of control involving a Cessna 152, VH-JIW

34 km east-south-east of Archerfield Airport, Queensland, on 28 May 2019

ATSB Transport Safety Report
Aviation Occurrence Investigation (Short)
AO-2019-028
Final – 15 October 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, ACT 2601
Telephone: 1800 020 616, from overseas +61 2 6257 2463
Accident and incident notification: 1800 011 034 (24 hours)
Email: atsbinfo@atsb.gov.au
Website: www.atsb.gov.au

Addendum

Page	Change	Date

Safety summary

What happened

On 28 May 2019, a Cessna 152, registered VH-JIW, was being operated by Basair Aviation College on a training flight from Archerfield Airport, Queensland. On board was a student pilot on their first flight, and a flight instructor.

During the training flight, the instructor was demonstrating the use of trim, with the student flying the aircraft. At about 2,000 ft above ground level, the aircraft abruptly pitched down and entered into a dive. The instructor took control of the aircraft and recovered from the descent at about 400 ft, about 25 seconds after the dive commenced. Subsequently the flight instructor elected to terminate the lesson and returned the aircraft to Archerfield Airport.

The instructor sustained minor injuries and the student was uninjured. An examination of the aircraft identified significant structural damage to the right horizontal stabiliser, which was indicative of in-flight overload during dive recovery. In addition, the instructor inadvertently bent the throttle control in the cockpit, which made movement of the control stiff but still operable.

What the ATSB found

The ATSB found that the student released the control wheel leading to the aircraft entering into a steep dive. The flight instructor had applied a large amount of nose-down trim during the course of instructing the lesson, resulting in a strong nose-down tendency of the aircraft when the controls were released. The flying school's instructor guide did not specify a limit of trim input for such exercises.

It was also determined that the instructor's hands were not in a ready position to take control in the event of any mishandling by the student pilot. The recovery by the instructor was likely further delayed after sustaining a head injury during the in-flight upset, and initially being unsure about what had happened and how to then recover the aircraft.

What has been done as a result

The operator has revised its training procedures for use of trim to include detailed instructor demonstrations prior to the student practicing manoeuvres. This ensures the student understands the required use of trim and the effect it has on the aircraft flight characteristics to maintain flight attitudes. The operator has also revised its training procedures to use a consistent moderate amount of trim.

Safety message

The first stages of flight training can be an exciting yet daunting period for a student. Any uncertainty should be raised with the instructor before taking action in case it leads to an unsafe situation. Conversely, instructors need to account for the potential for the student to carry out unexpected actions. This means that lessons should be conducted under the lowest risk conditions that still impart the lesson intent.

The investigation

The occurrence

On 28 May 2019, at about 1110 Eastern Standard Time,[1] a Cessna 152 aircraft, registered VH-JIW and operated by Basair Aviation College, departed Archerfield Airport, Queensland, for a training flight. On board was a student pilot on their first flight, and a flight instructor.

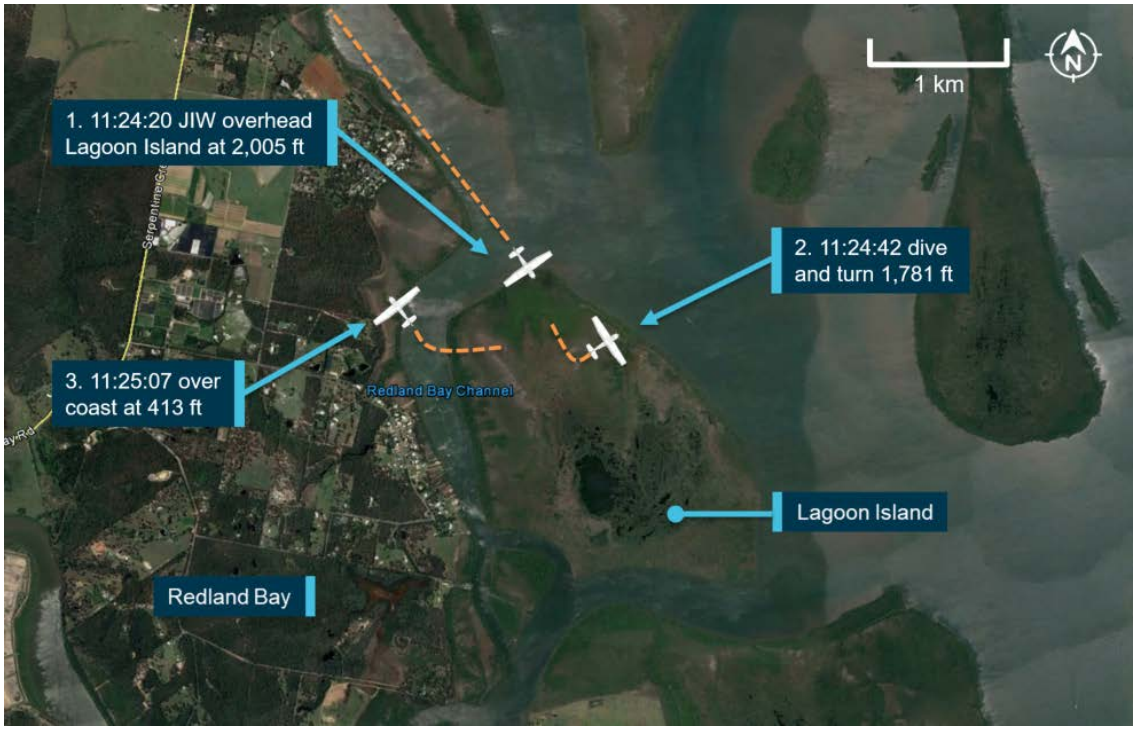
During the flight, the instructor demonstrated a number of manoeuvres from the 'effects of control' flight-training syllabus. As part of this, the instructor placed the aircraft out of trim with the pitch trim wheel,[2] while the student was maintaining straight and level flight.

With the aircraft in a nose-up trim, the student then practiced re-trimming the aircraft for level flight while maintaining attitude using nose-down pressure on the control wheel. As the aircraft was approaching overhead Lagoon Island at about 2,000 ft above ground level, with the student flying, the instructor moved the pitch trim to about two-thirds travel nose down. The student maintained attitude with nose-up pressure on the control wheel. The instructor's feet were lightly on the rudder pedals, left hand on their leg, and right hand resting on the glareshield (next to the control wheel).

The student maintained straight and level flight for a short period. When the procedure was to return the elevator trim to neutral, the student became confused about the correct procedure and let go of the control wheel. The aircraft rapidly pitched nose-down, rolled left, and entered into a dive. During these events, the flight instructor's headset dislodged from their head.

The flight instructor took control of the aircraft and subsequently arrested the descent at about 400 ft, about 25 seconds after the descent commenced. The available radar data (Figure 1) showed that from when the dive commenced, to when the instructor regained control, the aircraft had an average rate of descent of over 3,000 ft/minute, with the rate being higher in the initial part of the descent.

Figure 1: VH-JIW's flight path, dive and recovery as derived from radar data



Source: Google Earth, modified by the ATSB

[1] Eastern Standard Time: Coordinated Universal Time (UTC) +10 hours

[2] The aircraft's pitch trim system is utilised to relieve flight loads on the control wheel at a given attitude.

During the occurrence sequence, the instructor pulled the throttle back quite rapidly and, at some stage during the initial stages of the sequence, the throttle was bent. The throttle then became stiff, however was still able to be moved. The instructor recalled applying right rudder during the recovery but did not fully recollect if that was to recover from a left spiral dive or spin. The instructor stated they did not re-trim the elevator system to a neutral position until after recovery from the dive.

When they had recovered from the dive, the aircraft was on a reciprocal heading. The instructor carried out a flight control function check and confirmed the aircraft was controllable. The instructor then terminated the lesson and advised air traffic control that their aircraft had descended 1,500 ft 'quite suddenly' and they were returning to Archerfield Airport. The aircraft landed without further incident at about 1139.

During the occurrence, the instructor sustained several minor injuries, including an injury to their left shin after it contacted the underside of the instrument panel, a head injury from impact with the cabin roof, and bruising to the right hip. The student pilot was uninjured. The aircraft sustained damage to the right horizontal stabiliser.

Context

Personnel information

The instructor pilot held a grade 3 instructor rating and had about 320 total flight hours, including 100 hours in Cessna 152 aircraft. They had instructed this lesson about seven times before this occurrence.

The student pilot was conducting their first flight.

Pitch trim system

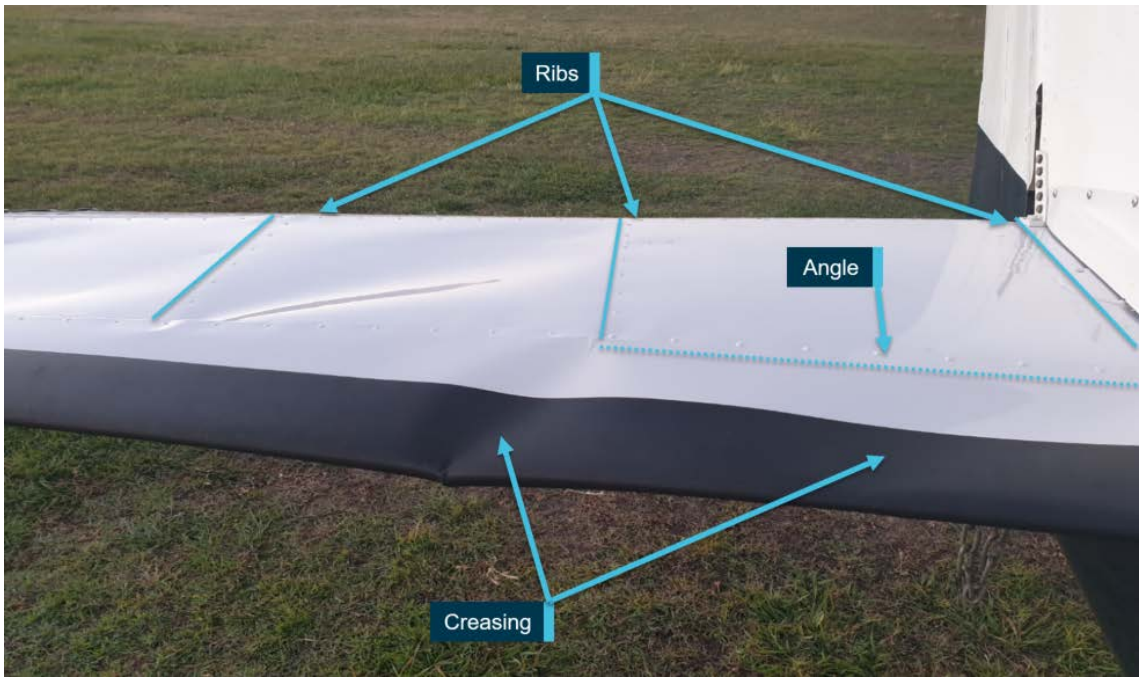
The pitch trim system on VH-JIW consisted of a manual trim wheel located on the lower instrument panel, which controlled a full-span trim tab on the right elevator only.

Placing the aircraft in an out-of-trim condition places a load on the flight control surfaces that results in the aircraft changing attitude accordingly, if the pilot does not oppose the condition. The flight controls will have a 'heavy' feel to them when held against the trimmed attitude. This force is neutralised when the aircraft is either re-trimmed, or allowed to adopt the trimmed attitude.

Aircraft damage

A post-flight inspection of the aircraft found that the right horizontal stabiliser was bent and twisted during the occurrence, resulting in creasing on the upper and lower skin sections (Figure 2). The left horizontal stabiliser had no significant damage.

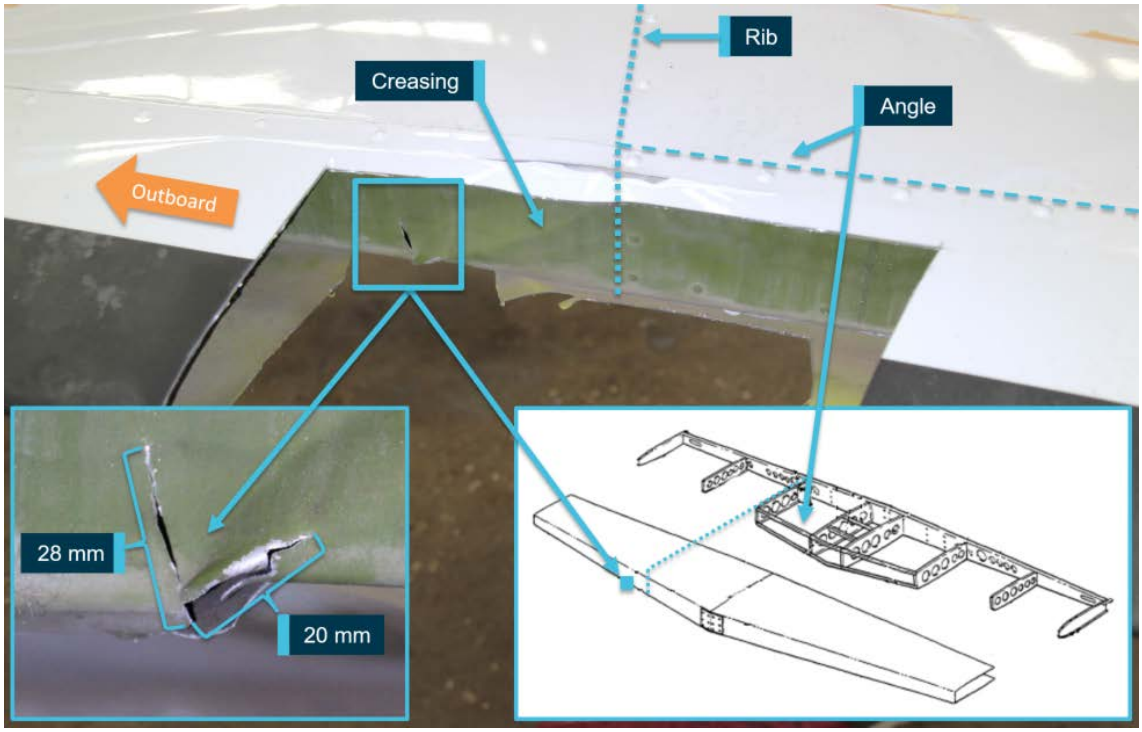
Figure 2: Right stabiliser damage



Source: Operator, annotated by the ATSB

The deformation of the right stabiliser resulted in a number of rivets on the aft lower surface pulling through the skin. The internal structure was cracked and creased (Figure). There was no evidence of damage to attachment points of the stabiliser assembly.

Figure 3: Leading edge removed showing cracking to internal structure



Source: ATSB and Cessna, annotated by the ATSB

An ATSB examination of the right horizontal stabiliser did not identify evidence of pre-existing damage to the structure.

In addition to the bent throttle control, the aircraft compass had detached from its mount on the windscreen.

Meteorological information

The aerodrome forecast (TAF) for Archerfield Airport issued at 0907 on 28 April stated that conditions would be CAVOK (cloud and visibility ok and no significant weather phenomena). The forecast wind was 260° at 10 kt. Recorded weather conditions at 1130 were consistent with the forecast. The area forecast also did not show any adverse weather conditions, such as turbulence, that may have contributed to the aircraft experiencing a rapid change of direction or altitude.

Flight instructor guidance

The flight training school's instructor guide outlined the procedure for teaching the use of the trim component of the effects of controls lesson. This procedure was in accordance with the guidance provided by the Civil Aviation Safety Authority in Appendix D of Civil Aviation Advisory Publication (CAAP) 5.14-2 (*Flight instructor training (Aeroplane)*).

The guidance stated that, with the student flying straight and level, the instructor would place the aircraft out of trim. The student then re-trimmed the aircraft to relieve the load on the controls. This was then repeated in the opposite direction of trim travel.

The CASA CAAP referred to the Federal Aviation Administration (FAA) *Aviation Instructor's Handbook*, which stated:

> Flight instructors should always guard the controls and be prepared to take control of the aircraft.

Safety analysis

Use of trim

When the student released the controls without re-trimming the aircraft, the aircraft entered a sudden dive. Since the flying school operator's instructor guide did not include a limit to the amount of trim used during the 'effects of control' lesson, flight instructors could set the trim to differing amounts. On the occurrence flight, it had been set at about two-thirds nose-down travel. This amount meant that the aircraft's nose-down response was more abrupt and stronger than needed to convey the intent of the lesson.

Instructor hand position

During the exercise, the instructor's right hand was resting on the glareshield; this was not an optimal position to guard the controls and to be ready to react to any adverse student inputs. This, coupled with the suddenness of the movement and the instructor's injuries, and being unsure as to the cause of the dive and best recovery technique, likely led to a delay in taking control of the aircraft and its subsequent recovery.

Dive recovery

The instructor attempted to regain control of the aircraft before placing the elevator trim into a neutral position, leading to the aerodynamic force being concentrated on the right horizontal stabiliser (where the trim tab was located) rather than spread across both stabilisers during the dive recovery.

These asymmetric flight loads, induced by the elevator trim imparting additional load on the right side, twisted the stabiliser at the forward outboard tip, about 30 mm downwards relative to its original position. This likely resulted in the right stabiliser being close to total failure. The large amount of nose-down trim at the time of the upset also increased the effort and effect required to recover from the dive.

Findings

From the evidence available, the following findings are made with respect to the loss of control of Cessna 152, registered VH-JIW, which occurred near Archerfield Airport, Queensland on 28 May 2019.

Contributing factors

- In the course of the student pilot's first training flight, during a lesson in the effects of control, the student released control wheel backpressure suddenly.
- The instructor's use of a large amount of nose-down elevator trim for the lesson increased the effect when the student released backpressure on the elevator, leading to a sudden nose-down pitch change and subsequent entry into a dive.
- The instructor was not prepared for the sudden nose-down pitch change, leading to a delay in the recovery from the dive.

Other factors that increased risk

- During the recovery from the dive, the horizontal stabiliser experienced excessive asymmetric flight loads, resulting in bending and buckling of the right horizontal stabiliser structure.

Safety action

The operator proactively revised its instructor guide for the use of trim. The new procedure introduced placing the aircraft into a cruise climb and explaining how the use of trim can reduce the control load. This ensured the student understood the required use of trim and the effect it had on the aircraft flight characteristics to maintain flight attitudes.

The revised instructor guide also included detailed instructor demonstrations prior to the student practicing the manoeuvre. The new procedure was taught with the aircraft in a nose-up condition only and ensured that all instructors were using the same trim input to maintain the best rate of climb.

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Basair Aviation College
- instructor and student pilot
- Airservices Australia
- Bureau of Meteorology.

References

Civil Aviation Safety Authority March 2012, Civil Aviation Advisory Publication CAAP 5.14-2(0) *Flight Instructor Training (Aeroplane).*

United States Department of Transportation, Federal Aviation Administration 2008, FAA-H-8083-9, *Aviation Instructor's Handbook*.

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section 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 following directly involved parties:

- the flight instructor
- the student pilot
- Basair Aviation College
- Civil Aviation Safety Authority.

Submissions were received from:

- the flight instructor
- Basair Aviation College.

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

General details

Occurrence details

Date and time:	28 May 2019 – 1125 EST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	34 km east-south-east of Archerfield Airport, Queensland	
	Latitude: 27º 68.325' S	Longitude: 153º 3.269' E

Aircraft details

Manufacturer and model:	Cessna 152	
Registration:	VH-JIW	
Operator:	Basair Aviation College	
Serial number:	152-81439	
Type of operation:	Flying training - dual	
Activity:	General Aviation > Instructional flying – commercial	
Departure:	Archerfield Airport	
Destination:	Archerfield Airport	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – 1 minor	Passengers – Nil
Aircraft damage:	Substantial	