

Investigation Report

The investigation was completed stating facts only, i.e. no analysis and conclusions.

Identification

Type of Occurrence: Serious Incident

Date: 21 June 2022

Location: Westerland/Sylt

Aircraft: Airplane

Manufacturer: Cessna Aircraft Company

Type: 525 A

Injuries to persons: None

Damage: Aircraft not damaged

Other Damage: None

State File Number: BFU22-0564-5X

Abstract

During climb, aileron fluttering occurred. The airplane returned to the aerodrome of departure and landed without further incident. After landing, it was determined that at the left aileron the trim tab was not hinged.

Factual Information

History of the Flight

At 1159 hrs¹, the airplane took off from runway 24 of Sylt Airport for a flight to Hanover Airport. Two pilots and two passengers were on board. During the climb, the flight crew noticed vibrations and aileron fluttering. They decided to return to the aerodrome of departure. The airplane turned immediately and landed opposite to the take-off direction at Sylt Airport. During the approach, while reducing speed the fluttering decreased. At 1202 hrs, it landed without any problems. Flight crew and passengers remained uninjured.

Personnel Information

Pilot in Command

The 61-year-old pilot in command held an Airline Transport Pilot Licence (ATPL(A)) issued in accordance with Part FCL by the Luftfahrt-Bundesamt (German civil aviation authority), with the type and instrument ratings for C525 valid until 31 July 2022. He had a class 1 medical certificate valid until 20 November 2022, with the restriction VML². According to the operator, up until the day of the occurrence he had a total flying experience of about 9,300 hours and about 8,500 landings. He had flown about 3,200 hours on type and conducted about 1,500 landings.

Co-pilot

The 27-year-old co-pilot held a Commercial Pilot License (CPL(A)) issued by the Luftfahrt-Bundesamt in accordance with Part-FCL. The licence listed the rating co-pilot on C525 and the instrument rating each valid until 31 July 2022.

He had a class 1 medical certificate valid until 25 January 2023 with the restriction VDL³.

According to the operator, the co-pilot had a total flying experience of about 1,150 hours and 1,020 landings, of which about 890 hours and 570 landings were conducted on C525.

¹All times local, unless otherwise stated.

² Correction for defective distant, intermediate and near vision.

³ Correction for defective distant vision.

Aircraft Information

The Cessna 525A is an all-metal low-wing airplane with a retractable landing gear in nose wheel configuration. The aircraft with the Manufacturer's Serial Number 525A-0403 was manufactured in 2008. It was powered by two Williams International type FJ 44-3A-24 turbine engines. It had a MTOM of 5,670 kg. It had a German certificate of registration and was operated by a German operator. At the time of the occurrence, the aircraft had a total operating time of 3,968 hours at 3,203 landings.

The last maintenance inspection was performed on 1 June 2022 at an operating time of 3,930:26 and 3,174 landings. During this maintenance action, aileron trim system work was performed, among other things.

Meteorological Information

The aviation routine weather report (METAR) of Sylt Airport issued at 1150 hrs read:

Wind:	270°, 13 kt
Visibility:	9999
Clouds:	Broken 017
Temperature:	4°C
Dewpoint:	10°C
QNH:	1,015 hPa

Aerodrome Information

Sylt Airport (EDXW) is located at the eastern edge of Westerland and had two asphalt runways. The runway with the orientation 060°/240° had a length of 1,696 m and a width of 45 m. Runway 14/32 was 2,120 m long and 45 m wide. On the day of the incident runway 24 was in service.

Accident Site and Findings on the Aircraft

The serious incident occurred on departure from Sylt Airport. The post-flight inspection showed that the link to the aileron trim tab was missing (Fig. 1).



Fig. 1: Missing link to the aileron trim tab

Source: Operator

The link between control and aileron trim tab consisted of two pushrods (Fig. 2, part number 160). Each of their clevises are bolted and secured to the trimming tab by a bolt (Fig. 2, part number 163) with washer (Fig. 2, part number 165) and a crown nut (Fig. 2, part number 167) with cotter pin (Fig. 2, part number 168). These components of the two screwings were missing and could not be found.

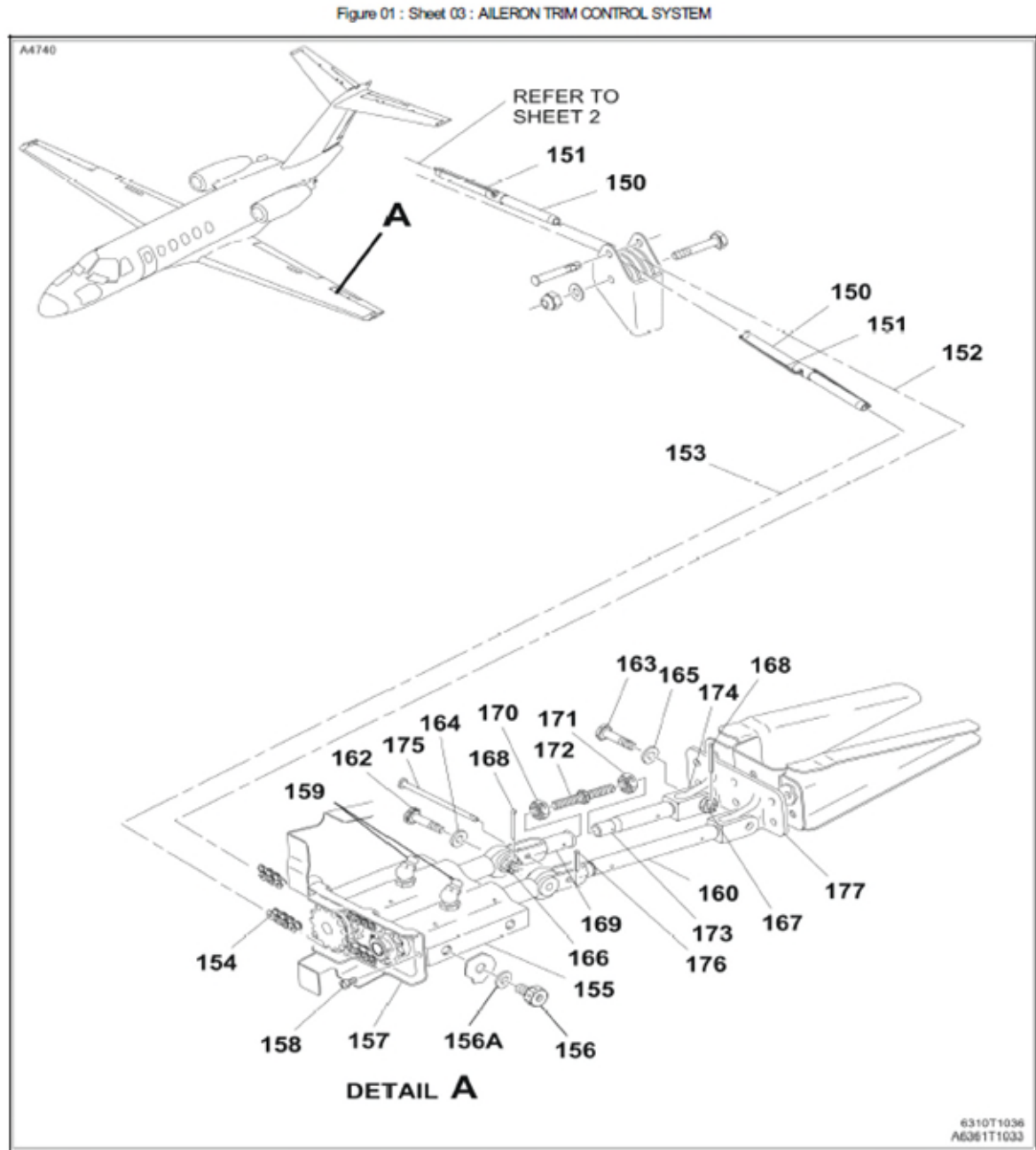


Fig. 2: Aileron trim control system

Source: Manufacturer

Organisational and Management Information

A maintenance organisation certified in accordance with Part 145 performed the maintenance action on the aircraft. The respective work order was stamped and signed. Subsequently, a Release to Service was issued.

Additional Information

In conjunction with the investigation BFU20-0362-7X, in 2021 the BFU issued the following information:

Due to occurrences and accidents involving aircraft which had just been subject to maintenance work, in the past a number of investigations were conducted and studies compiled, regarding possible causes, working conditions, and errors in organisations as well as potential countermeasures. The following are listed as examples:

In 2019, Joseph Homer Saleh, Archana Tikayat Ray, Katherine S. Zhang, Jared S. Churchwell, University of Louisville published: Maintenance and inspection as risk factors in helicopter accidents: Analysis and recommendations.

In 2016, the British aviation authority published: CAP 1367, Aircraft Maintenance Incident Analysis.

In 2015, Embry-Riddle Aeronautical University published: Causes and Trends in Maintenance-Related Accidents in FAA Certified Single Engine Piston Aircraft.

In 2010, Cranfield University published: Human Factors Effects in Helicopter Maintenance: Proactive Monitoring and Controlling Techniques.

In 2002, the American aviation authority FAA published: General Aviation Maintenance-Related Accidents: A Review of Ten Years of NTSB Data.

In general it was determined: *There is a clear and significant clustering of helicopter accidents immediately following maintenance and inspection. For example, about 21% of all accidents occur in the first ten hours of flight following maintenance and inspection, the majority of which occurs within the first couple of hours.*

Since 1993, the term “Dirty Dozen” is used by the entire aviation industry in regard to Human Factors. *The Dirty Dozen refers to twelve of the most common human error preconditions, or conditions that can act as precursors, to accidents or incidents. These twelve elements influence people to make mistakes. [...] The Dirty Dozen is not a comprehensive list of human error accident precursors, for example, ICAO Circular 240-AN/144 lists over 300 human error precursors. However, since 1993 all areas of the aviation industry, not just aircraft maintenance, have found the Dirty Dozen a useful introduction to open discussions into human error in their businesses, organisations and workplaces.*⁴

⁴ [www.skybrary.aero/index.php/The_Human_Factors_\"Dirty_Dozen\"](http://www.skybrary.aero/index.php/The_Human_Factors_\)

The list of “Dirty Dozen”:

1. Lack of communication	5. Complacency	9. Lack of knowledge
2. Distraction	6. Lack of teamwork	10. Fatigue
3. Lack of resources	7. Pressure	11. Lack of assertiveness
4. Stress	8. Lack of awareness	12. Norms

In 2012, the FAA Safety Team published a summary of possible errors during aircraft maintenance and prevention proposals based on the “Dirty Dozen” (Appendix).

Investigator in charge: Nehmsch

Braunschweig, 9 February 2023

Appendices

Summary published by the FAA-Safety-Team in regard to possible errors during aircraft maintenance and prevention proposals based on the “Dirty Dozen”.



Avoid the Dirty Dozen

12 Common Causes of Human Factors Errors

About **80** Percent of Maintenance Mistakes Involve **Human Factors** ... and if Not Detected... Would Lead to Accidents.

Put Safety First and Minimize the 12 Common Causes of Mistakes in the Aviation Workplace



1 Lack of Communication

Failure to transmit, receive, or provide enough information to complete a task. Never assume anything. Only 30% of verbal communication is received and understood by either side in a conversation. Others usually remember the first and last part of what you say.

Improve your communication—

- Say the most important things in the beginning and repeat them at the end.
- Use checklists.



2 Complacency

Overconfidence from repeated experience performing a task.

Avoid the tendency to see what you expect to see—

- Expect to find errors.
- Don't sign it if you didn't do it.
- Use checklists.
- Learn from the mistakes of others.



3 Lack of Knowledge

Shortage of the training, information, and/or ability to successfully perform.

Don't guess, know—

- Use current manuals.
- Ask when you don't know.
- Participate in training.



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4 Distractions

Anything that draws your attention away from the task at hand. Distractions are the #1 cause of forgetting things, including what has or has not been done in a maintenance task.

Get back in the groove after a distraction—

- Use checklists.
- Go back 3 steps when restarting the work.



5 Lack of Teamwork

Failure to work together to complete a shared goal.

Build solid teamwork—

- Discuss how a task should be done.
- Make sure everyone understands and agrees.
- Trust your teammates.



6 Fatigue

Physical or mental exhaustion threatening work performance.

Eliminate fatigue-related performance issues—

- Watch for symptoms of fatigue in yourself and others.
- Have others check your work.



7 Lack of Resources

Not having enough people, equipment, documentation, time, parts, etc., to complete a task.

Improve supply and support—

- Order parts before they are required.
- Have a plan for pooling or loaning parts.



8 Pressure

Real or perceived forces demanding high-level job performance.

Reduce the burden of physical or mental distress—

- Communicate concerns.
- Ask for extra help.
- Put safety first.



9 Lack of Assertiveness

Failure to speak up or document concerns about instructions, orders, or the actions of others.

Express your feelings, opinions, beliefs, and needs in a positive, productive manner—

- Express concerns but offer positive solutions.
- Resolve one issue before addressing another.



10 Stress

A physical, chemical, or emotional factor that causes physical or mental tension.

Manage stress before it affects your work—

- Take a rational approach to problem solving.
- Take a short break when needed.
- Discuss the problem with someone who can help.



11 Lack of Awareness

Failure to recognize a situation, understand what it is, and predict the possible results.

See the whole picture—

- Make sure there are no conflicts with an existing repair or modifications.
- Fully understand the procedures needed to complete a task.



12 Norms

Expected, yet unwritten, rules of behavior.

Help maintain a positive environment with your good attitude and work habits—

- Existing norms don't make procedures right.
- Follow good safety procedures.
- Identify and eliminate negative norms.

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This investigation was conducted in accordance with the regulation (EU) No. 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and the Federal German Law relating to the investigation of accidents and incidents associated with the operation of civil aircraft (*Flugunfall-Untersuchungs-Gesetz - FIUUG*) of 26 August 1998.

The sole objective of the investigation is to prevent future accidents and incidents. The investigation does not seek to ascertain blame or apportion legal liability for any claims that may arise.

This document is a translation of the German Investigation Report. Although every effort was made for the translation to be accurate, in the event of any discrepancies the original German document is the authentic version.

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