AIR ACCIDENTS
INVESTIGATION INSTITUTE
Beranových 130
199 01 PRAGUE 99

CZ-20-0752

FINAL REPORT

Investigation of causes of a serious incident of CESSNA 525 A aircraft, registration mark G-TOWP, on 18 November 2020

Prague
March 2022

Contents

Abbreviations Used

ACC	Air Control Centre
ARP	Aerodrome Reference Point
CVR	Cockpit voice recorder
E	East, eastern longitude
EGJJ	International airport (Channel Islands, United Kingdom)
FL	Flight level
FMS	Flight management system
GBR	Great Britain
IFR	Instrument flight rules
FIR	Flight information region of the Czech Republic
LKTB	Brno Tuřany International Airport
N	North, northern latitude
PIC	Pilot-in-command
RWY	Runway
ATCS	Air traffic control service
TCC	Traffic Coordination Centre
CAA	Civil Aviation Authority
UTC	Coordinated Universal Time
AAII	Air Accidents Investigation Institute
VFR	Visual Flight Rules

A) Introduction

Aircraft manufacturer:	Cessna Aircraft Company (USA)
Type of aircraft:	Cessna 525 A, Model CJ 2+
Registration mark:	G-TWOP
Operator:	Bristol Flying Centre Ltd.
Location:	LKAA, 18 NM south of the VOZ beacon
Date and time:	18 November 2020, 10:02 (all times are UTC)

B) Synopsis

On 18 November 2020, the AAII was notified first by the ANS (ŘLP ČR, s.p.) and subsequently by the aircraft operator of a serious incident of the Cessna 525 A aircraft, registration mark G-TWOP. During a flight from the Channel Islands to the Brno Tuřany Airport (LKTB), shortly after commencing the descent from FL 380, the crew noticed physical change in cabin pressure and an increase in cabin altitude level. At 10:02, 18 NM south of the VOZ beacon, at FL 350, the crew issued an urgency PAN, PAN, PAN signal and requested emergency descent to FL 100 without stating any reason. The crew started an emergency descent to FL 130 and then to FL 90. During the descent, passenger oxygen masks were deployed automatically. Upon approaching LKTB, the aircraft was vectored for ILS RWY 27 where it landed safely at 10:28. Neither any serious injury nor any damage were sustained during the incident.

The cause of the serious incident was investigated by AAII Inspe

The Final Report was issued by:

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C) This Final Report consists of the following main parts:

1) Factual Information
2) Analysis
3) Conclusions
4) Safety Recommendations

1 Factual Information

When investigating the incident and related circumstances, crew's statements, and information collected from the aircraft operator and servicing organisation were used.

The Event History

The Cessna 525 A Citation CJ2+ aircraft operated by a foreign operator was flying from the Channel Islands as a flight number 9462 from Jersey Airport (EGJJ) to the Brno Tuřany Airport (LKTB) with two-member crew and one female passenger on board. Approx. 18 NM south of the VOZ (Vožice) beacon, a defect in the pressurisation system occurred at 10:02. At that moment, the aircraft was already descending from FL 380. The crew and the passenger noticed a sudden drop in the cabin pressure and shortly afterwards, passenger oxygen masks were deployed automatically. At FL 350, the Pilot-in-command declared an urgency PAN, PAN, PAN signal and emergency descent to ACC Prague without giving a reason. ACC issued a clearance to descent to FL 100. At 10:04, ACC Prague handed flight control over to INFO TCC (Brno sector). The Pilot-in-command reported an incorrect cabin pressure indication and as the cabin altitude stabilised at FL 130, requested no assistance. At 10:25, "Local emergency" was indicated to the rescue services at the airport. The aircraft was vectored for ILS RWY 27 where it landed safely at 10:28. At 10:32, when the aircraft landed and was parked, the "Local emergency" signal was cancelled.

According to the statement of the Pilot-in-command, a decrease in cabin pressure and an increase in cabin altitude were gradual at first. In his testimony, he said: *"A drop in the cabin pressure and an increase in cabin altitude were signalled. Later on, we noticed a change in pressure on our ear drums. We used oxygen masks and the passenger used one of the oxygen masks that dropped down from the drop-out boxes automatically.*"

Until the descent before approach, the flight up to FL 90 was performed without any complications, and approach and landing were normal. The aircraft Pilot-in-command did not require an assistance of airport rescue units.

Neither any injury was sustained nor the aircraft nor any third-party's property was damaged during the incident.

Fig. 1 – Aircraft Cessna 525 A Citation CJ2+, registration mark G-TWOP.

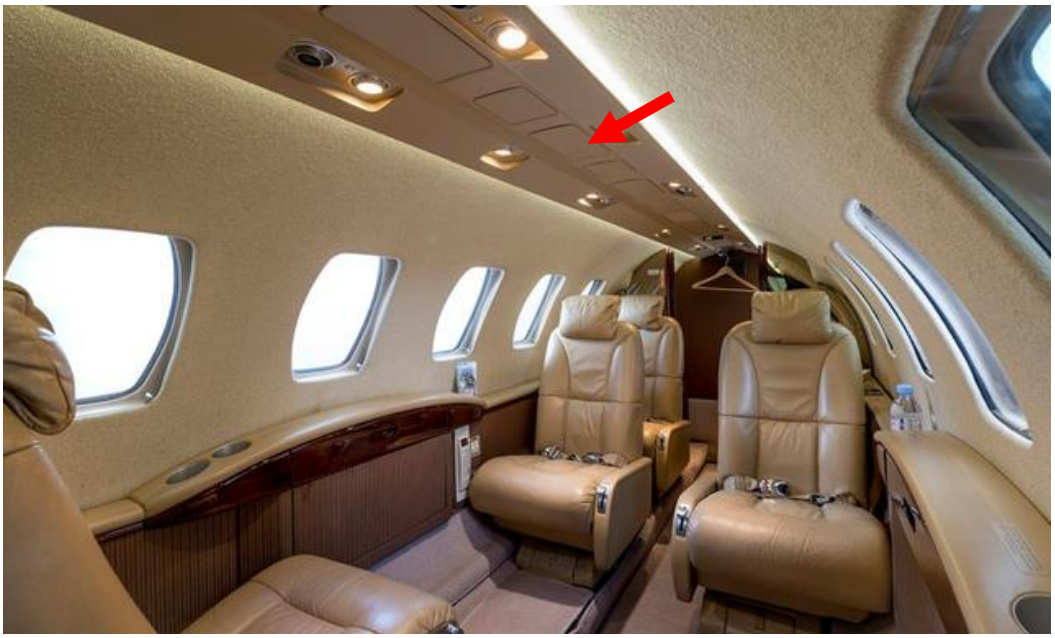

Fig. 2 – Cessna 525 A Citation CJ2+, drop-out boxes with passenger oxygen masks.

Injuries to Persons

No persons on board were injured during the serious incident.

Table 1 – Summary of injured persons

Injuries	Crew	Passengers	Other persons (inhabitants, etc.)
Fatal	0	0	0
Serious	0	0	0
Light/No injury	0/2	0/1	0/0

Personnel Information

Pilot-in-command

Male, aged 42 years, foreign national (United Kingdom). He held a valid British Private Pilot Licence (GBR). FCL. AT. 406652J.A, which was valid; he had a valid class 1 medical certificate with no limitations, and type qualification for the C 525 aircraft. Other Qualifications: MP – multi-pilot aircraft, IR – instrument rating, FI(A) – flight instructor.

He had flown 3,038 hours in total, out of which 1,789 hours as PIC. He had flown 1,689 hours on the type and 889 hours as PIC on the type. He had flown 27 hours over the last 30 days.

First Officer

Male, aged 48 years, foreign national (United Kingdom). He held a valid British Private Pilot Licence (GBR). FCL. CP. 487185E. A, which was valid; he had a valid class 1 medical certificate with no limitations, and type qualification for the C 525 aircraft. Other

Qualifications: MP – multi-pilot aircraft, IR – instrument rating, FI(A) – flight instructor.

The First Officer had flown 2,464 hours in total, out of which 1,750 hours as PIC. He had flown 1,082 hours on the type and 510 hours as PIC on the type. He had flown 30 hours over the last 30 days.

Another person on board was a passenger without flying experience who did not require any medical treatment and shortly after landing, after passport clearance, left by another aircraft.

Aircraft Information

Cessna 525 A Citation CJ2+ is a twin-engine low-wing monoplane business jet. The aircraft construction is all-metal construction with some composite parts used. The landing gear is retractable, nose type with hydraulic brakes on the main wheels. The 525 A Citation CJ2+ has an air-conditioned pressurised cabin for 5 to 7 passengers. The aircraft is powered by two Williams FJ44-3A-24 twin-jet engines, each with thrust of 11.08 kN, controlled by FADEC. The aircraft is equipped with advanced avionics and is IFR day/night certified. It is manufactured by Cessna Aircraft Company of Wichita (USA). The type is another member of the Citation Jet family, the upgraded Citation CJ2+ variant has been in serial production since 2005.

Basic characteristics:

Wingspan:	15.19 m
Length:	14.53 m
Height:	4.27 m
Weight empty (basic):	3,642 kg
Maximum takeoff weight:	5,670 kg
Maximum speed:	774 km/h
Overflight range:	3,298 km
Range with maximum payload:	2,130 km
Max. operational flight level:	13,700 m (FL 450)
Type and model:	C 525 CJ2+
Serial number:	525A-0397
Registration mark:	G-TOWP
Year of manufacture:	2008
Certificate of airworthiness inspection:	valid until 19 April 2021
Liability insurance:	valid until 17 May 2021
Total hours flown:	6,983 hours

The aircraft was overhauled on 25 September 2020 and flew 47 hours without faults until the incident.

The left engine type Williams FJ44-3A-24, serial number 216201, had 6,640 flight hours. The right engine type Williams FJ44-3A-24, serial number 216202, had 6,204 flight hours. Both the engines were last overhauled on 18 November 2020.

The operator used the aircraft for commercial air transport. It was regularly serviced and maintained in good technical and operational condition.

Basic information on cabin pressurisation system

The aircraft is equipped with a fully automatic cabin pressurisation system. The operation of the system is controlled by a digital control unit. The air for the system is taken from the compressors of both engines. The flight level, departure and landing aerodromes' altitudes are determined from the data entered in the flight plan in the FMS. The required rate of change and pressure differential for the flight is then calculated automatically. The landing altitude can be entered manually. The system is not equipped with any manual pressure rate of change or pressure differential controller. Cabin pressure control depends on the altitude limiter in the cabin (max. 14,800 feet) and the maximum pressure differential relief valve (max. 9 pounds per square inch).
The system has a "High Altitude" mode that provides automatic adjustment to lower cabin pressure (higher cabin altitude) when landing at airports with an altitude of 8,000 feet (2,430 m). To avoid abrupt pressure changes during take-off, the system ensures that once the power levers are set to take-off power, the pressurisation system begins to pressurise the cabin very slightly during take-off (lowering the actual cabin altitude by approximately 200 feet (61 m)).

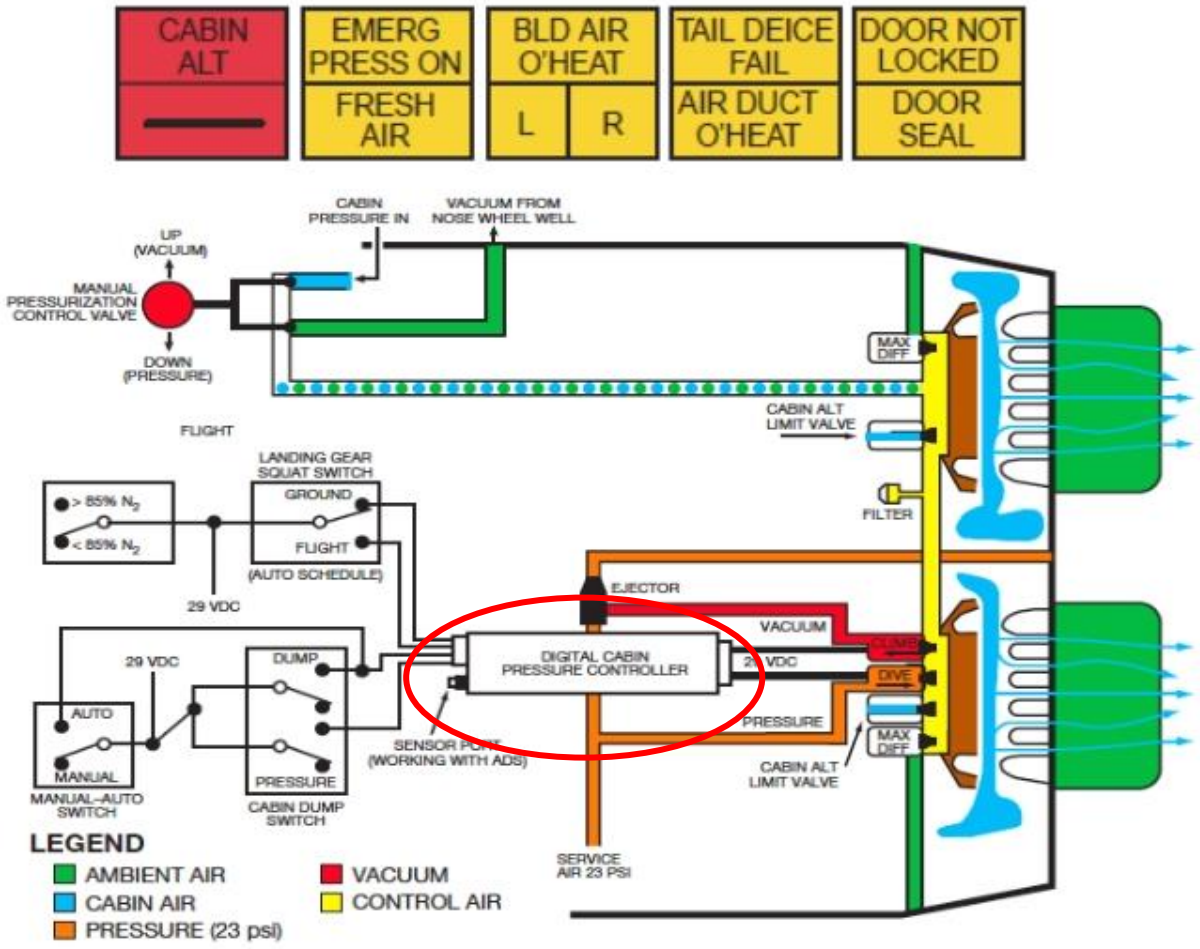

Fig. 3 – Diagram of the C 525's pressurisation system. The digital control unit of the pressurisation system that has malfunctioned is marked in red.

After the aircraft landed, the pressurisation system was inspected by a service organisation and a technical fault was found in the digital control unit of the system.

Meteorological Information

Visibility was observed above 10 km, with no precipitation or other weather phenomena. It was almost clear, with occasional low or medium cloud cover. The temperature at ground level was around 10 °C.
No turbulence or frost was forecast for the whole eastern part of the Czech Republic. Winds were mainly northerly at 30 m/s in the upper FL 340 – FL 450.

METAR LKTB Reports[1]

METAR LKTB 180930Z 11003KT 080V150 9999 SCT049 10/06 Q1030 NOSIG=
METAR LKTB 181000Z VRB03KT 9999 SCT049 10/06 Q1030 NOSIG=
METAR LKTB 181030Z 16004KT CAVOK 11/06 Q1030 NOSIG=
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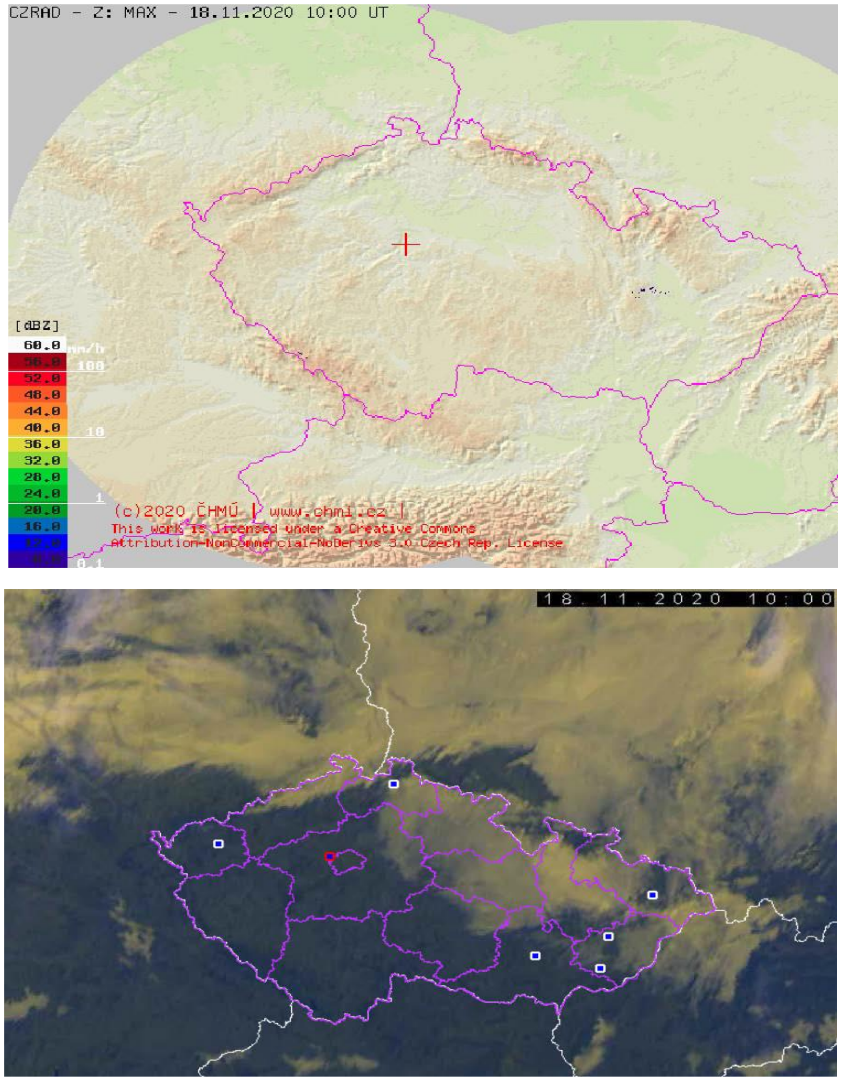

Fig. 4 – Radar image and satellite image (IR) from 18/11/2020, 10:00 UTC.

[1] For abbreviations in METAR reports, see National Aviation Code L8400.

Airport Information

Brno Tuřany Airport is an international airport with operational applicability H 24,VFR/IFR.

The airport has two runways, RWY 09/27 with dimensions of 2,650 x 60 m, concrete and RWY 08/26 with dimensions of 800 x 30 m, grass. This runway is only usable for VFR day flights.

ARP position: 49° 09' 05" N, 16° 41' 38" E, altitude of 778 ft / 237 m.

Supplementary Information

Emergency procedures for Cessna 525 [2]

MEMORY ITEMS:

CABIN ALT (CABIN ALTITUDE)

1. Oxygen mask – DON and 100% OXYGEN.
2. Oxygen microphone switches – MIC OXY MASK.
3. Emergency Descent – As Required.
4. Passenger Oxygen – Ensure Passengers are receiving oxygen.

EMERGENCY DESCENT

1. AP TRIM DISC button – PRESS AND RELEASE.
2. Throttles – IDLE.
3. Speedbrakes – EXTEND.
4. Aircraft pitch attitude – APPROXIMATELY 20° NOSE DOWN.
5. To Safety Flight level – DESCENT (FL 100).

Useful or Effective Investigation Techniques

Serious incident investigation was carried out in compliance with ICAO ANNEX 13.

[2] Document CE 525 CJ Note Taking Guide Ver. 1.0; 1.1 Original New cover & edits 1/15/2016 6/10/2017

2 Analyses

The investigation of the incident used information from the testimonies of both pilots, information from the operator and the findings of the service organisation that repaired the pressurisation system of the aircraft, and information from the CVR inspection carried out by the operator.

General Information

The aircraft was airworthy, regularly serviced and in good condition until the incident. The weight and the centre of gravity were within the permitted limits and had no impact on the occurrence of the event.

The weather had no influence on the incident occurrence either.

The crew were airworthy and qualified to perform the flight. The crew's actions and troubleshooting procedures were in accordance with Flight Manual C 525 CJ2+; Part "Abnormal procedures". The crew and passengers used oxygen masks from the time of the malfunction until descent to a safe FL 90.

The Pilot-in-command did not require technical assistance in landing because the pressure relief value had stopped dropping and the cabin altitude had stabilised at a value corresponding to FL 130.

The increase in cabin altitude and the decrease in the pressure relief values were caused by a technical failure of the digital control unit of the pressurisation system.

3 Conclusions

Causes

The cause of the serious incident was a technical fault in the digital control unit of the pressurisation system which caused a pressure drop in the pressurised cabin with an increase in cabin altitude.

Investigator-in-charge

4. Safety Recommendations

AAII issues no safety recommendations.

In Prague, 21 March 2022

Director

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