

ACCIDENT

Aircraft Type and Registration:	Cessna Citation 560XL, SE-RHJ
No & Type of Engines:	2 Pratt & Whitney PW545A turbofan engines
Year of Manufacture:	2000
Date & Time (UTC):	29 November 2015 at 1350 hrs
Location:	On descent into Farnborough Airport, Hampshire
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 9
Injuries:	Crew - None Passengers - None
Nature of Damage:	Right engine upper cowling detached in flight, impact damage to horizontal and vertical stabilisers
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	41 years
Commander's Flying Experience:	3,700 hours (of which 2,200 were on type) Last 90 days - 4 hours Last 28 days - 4 hours
Information Source:	AAIB Field Investigation

Synopsis

During the descent into Farnborough Airport the majority of the right engine upper cowling detached, damaging the leading edges of the vertical and horizontal stabilisers. The investigation concluded that the cowling probably detached because a number of the fasteners had not been secured during maintenance.

History of the flight

The aircraft had departed Göteborg City Airport, Sweden, bound for Farnborough, Hampshire. During the descent, at approximately FL200, there was a sudden bang and the aircraft started to vibrate. The crew reduced speed and disengaged the autopilot; the engine parameters were normal and the aircraft remained in trim. They were concerned that something at the rear of the aircraft was damaged but nothing untoward could be seen through the cabin windows. They configured the aircraft for landing and decided not to use thrust reverse. The landing was uneventful.

Investigation

The aircraft was recovered to a local maintenance organisation where the majority of the right engine upper cowling was observed to be missing, Figure 1. Damage on the leading edges of the vertical and horizontal stabilisers was consistent with them being struck by debris.



Figure 1

Right engine cowlings following recovery of the aircraft to the hangar

The upper cowling is attached to the engine by 19 quick release fasteners; 10 on the leading edge and 9 on the trailing edge. The fasteners are locked by turning them clockwise approximately $\frac{1}{4}$ turn, moving a cross pin up a cam until a mechanical stop where the cross pin drops into a locking detent. A spring within the fastener assembly governs the preload and prevents the fastener coming loose due to vibration.

The remnants of the upper cowling that remained with the aircraft had been pulled from the fasteners, which, with the exception of four, remained securely locked, Figure 2. Three fasteners were missing from the inboard leading edge and one was missing from the inboard trailing edge. The empty locking receptacles were confirmed to be serviceable using a representative fastener and the surrounding structure showed no evidence of damage.

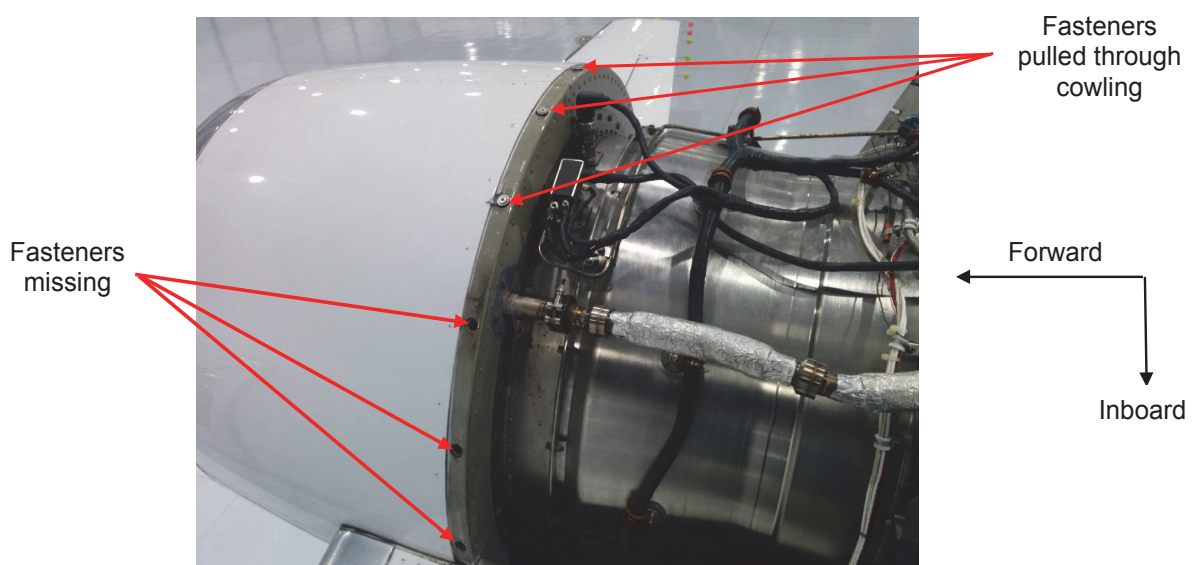


Figure 2

Upper cowling inboard leading edge attachment fasteners

Aircraft history

The aircraft had been leased to the operator six days prior to the occurrence and was on its fourth flight following maintenance. The total flight time since maintenance was approximately five hours.

An investigation carried out by the maintenance organisation established that the engine cowlings had been removed and refitted several times to allow engine troubleshooting. Records showed that the fasteners had been removed from the cowlings as part of a periodic inspection for retention hole wear. No anomalies were identified and the original fasteners were refitted when the check was complete.

Two mechanics installed the cowlings approximately two weeks prior to the occurrence. The cowlings were installed without difficulty and one of the mechanics signed the post maintenance inspection records to confirm '*Engine cowlings closed and attachments tightened*'. The cowlings were not disturbed after the aircraft left the maintenance organisation.

Previous occurrences

In April 2008, Cessna Citation 560XL SE-RCL was flying from Bromma to Geneva when the left engine cowlings detached as the aircraft was on final approach. Investigation identified that the cowlings had not been fastened securely and the maintenance organisation introduced a number of changes to prevent recurrence.

In June 2008, Cessna Citation 560XL G-OROO¹ was on a post-maintenance flight when the crew heard a rumble and felt a 'thud' in the rear of the aircraft. Inspection after landing revealed approximately 75% of the left engine upper cowling had detached in flight, damaging the leading edge of the vertical stabiliser and left elevator. The AAIB concluded that a number of fasteners on the inboard leading edge of the cowling had not been secured and investigation at the maintenance organisation established that the mechanic installing the cowlings had been interrupted and had not completed the task. The maintenance organisation introduced a number of changes to prevent recurrence including enhanced inspections.

The aircraft manufacturer reviewed their service records and advised that the only known occurrences of cowling loss on Cessna Citation 560XL series aircraft were the occurrences highlighted within this report. Furthermore, they analysed data for aircraft in service and confirmed that there was no evidence of any emergent trends relating to the upper cowlings.

Conclusion

It is unlikely that the fasteners were the wrong size or had failed in flight and investigation concluded that the cowling probably detached because a number of fasteners had not been securely fastened during maintenance.

Footnote

¹ https://assets.digital.cabinet-office.gov.uk/media/5422f9fce5274a13170007c7/Cessna_560XL_Citation_XLS__G-OROO_03-09.pdf

Safety action

The maintenance organisation has changed their inspection procedures to ensure that, following installation, the security of engine cowlings is checked by an independent mechanic.

The manufacturer highlighted the three events to their Continued Operational Safety group to assess possible options to minimise occurrences in the future. This includes a proposed video for maintenance agencies to emphasise the importance of ensuring that the quick release fasteners are secure.

GLOSSARY OF ABBREVIATIONS

aal	above airfield level	lb	pound(s)
ACAS	Airborne Collision Avoidance System	LP	low pressure
ACARS	Automatic Communications And Reporting System	LAA	Light Aircraft Association
ADF	Automatic Direction Finding equipment	LDA	Landing Distance Available
AFIS(O)	Aerodrome Flight Information Service (Officer)	LPC	Licence Proficiency Check
AFRS	Aerodrome Fire & Rescue Service	m	metre(s)
agl	above ground level	mb	millibar(s)
AIC	Aeronautical Information Circular	MDA	Minimum Descent Altitude
amsl	above mean sea level	METAR	a timed aerodrome meteorological report
AOM	Aerodrome Operating Minima	min	minutes
APU	Auxiliary Power Unit	mm	millimetre(s)
ASI	airspeed indicator	mph	miles per hour
ATC(C)(O)	Air Traffic Control (Centre)(Officer)	MTWA	Maximum Total Weight Authorised
ATIS	Automatic Terminal Information System	N	Newtons
ATPL	Airline Transport Pilot's Licence	N_R	Main rotor rotation speed (rotorcraft)
BMAA	British Microlight Aircraft Association	N_g	Gas generator rotation speed (rotorcraft)
BGA	British Gliding Association	N_1	engine fan or LP compressor speed
BBAC	British Balloon and Airship Club	NDB	Non-Directional radio Beacon
BHPA	British Hang Gliding & Paragliding Association	nm	nautical mile(s)
CAA	Civil Aviation Authority	NOTAM	Notice to Airmen
CAVOK	Ceiling And Visibility OK (for VFR flight)	OAT	Outside Air Temperature
CAS	calibrated airspeed	OPC	Operator Proficiency Check
CG	Centre of Gravity	PAPI	Precision Approach Path Indicator
cm	centimetre(s)	PF	Pilot Flying
cc	cubic centimetres	PIC	Pilot in Command
°C,F,M,T	Celsius, Fahrenheit, magnetic, true	PNF	Pilot Not Flying
DGAC	Direction Général à l'Aviation Civile	POH	Pilot's Operating Handbook
DME	Distance Measuring Equipment	PPL	Private Pilot's Licence
EAS	equivalent airspeed	psi	pounds per square inch
EASA	European Aviation Safety Agency	QFE	altimeter pressure setting to indicate height above aerodrome
ECAM	Electronic Centralised Aircraft Monitoring	QNH	altimeter pressure setting to indicate elevation amsl
EGPWS	Enhanced GPWS	RA	Resolution Advisory
EGT	Exhaust Gas Temperature	rpm	revolutions per minute
EICAS	Engine Indication and Crew Alerting System	RTF	radiotelephony
EPR	Engine Pressure Ratio	RVR	Runway Visual Range
ETA	Estimated Time of Arrival	SAR	Search and Rescue
ETD	Estimated Time of Departure	SB	Service Bulletin
FAA	Federal Aviation Administration (USA)	SSR	Secondary Surveillance Radar
FIR	Flight Information Region	TA	Traffic Advisory
FL	Flight Level	TAF	Terminal Aerodrome Forecast
ft	feet	TAS	true airspeed
ft/min	feet per minute	TAWS	Terrain Awareness and Warning System
g	acceleration due to Earth's gravity	TCAS	Traffic Collision Avoidance System
GPS	Global Positioning System	TGT	Turbine Gas Temperature
GPWS	Ground Proximity Warning System	TODA	Takeoff Distance Available
hrs	hours (clock time as in 1200 hrs)	UHF	Ultra High Frequency
HP	high pressure	USG	US gallons
hPa	hectopascal (equivalent unit to mb)	UTC	Co-ordinated Universal Time (GMT)
IAS	indicated airspeed	V	Volt(s)
IFR	Instrument Flight Rules	V_1	Takeoff decision speed
ILS	Instrument Landing System	V_2	Takeoff safety speed
IMC	Instrument Meteorological Conditions	V_R	Rotation speed
IP	Intermediate Pressure	V_{REF}	Reference airspeed (approach)
IR	Instrument Rating	V_{NE}	Never Exceed airspeed
ISA	International Standard Atmosphere	VASI	Visual Approach Slope Indicator
kg	kilogram(s)	VFR	Visual Flight Rules
KCAS	knots calibrated airspeed	VHF	Very High Frequency
KIAS	knots indicated airspeed	VMC	Visual Meteorological Conditions
KTAS	knots true airspeed	VOR	VHF Omnidirectional radio Range
km	kilometre(s)		
kt	knot(s)		
KTAS	knots true airspeed		