Aviation Safety Investigation Report 199001449

Cessna 550 Citation II

19 September 1990

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Occurrence Number: 199001449 **Occurrence Type:** Incident
Location: Moorabbin VIC
Date: 19 September 1990 **Time:** 1825
Highest Injury Level: Nil
Injuries:

	Fatal	Serious	Minor	None
Crew	0	0	0	0
Ground	0	0	0	-
Passenger	0	0	0	0
Total	**0**	**0**	**0**	**0**

Aircraft Details: Cessna 550 Citation II
Registration: VH-ING
Serial Number: 5500141
Operation Type: Private
Damage Level: Substantial
Departure Point: Moorabbin VIC
Departure Time: 1824
Destination: Hobart TAS

Approved for Release: 24th September 1991

Circumstances:

The aircraft was climbing 600 ft after take-off when the pilot noticed a buzzing noise. While attempting to isolate the source of the buzzing two loud bangs were heard the right engine fan RPM reduced to zero and the generator dropped off line. Sparks and flames were seen in the right engine inlet area. The pilot shut down the right engine and executed a single engine landing. Initial investigation showed that the low compressor stator had ejected through the compressor casing with parts of the engine and cowlings falling into a residential area. This examination revealed that the low compressor stator also known as the fan stator had been rotated at high speed. The resultant high heat and milling action cut and severed the fan casing which dropped into the fan with destructive results. The stator had split and ejected through the severed case. The outer ring of the stator is positioned axially by mating snaps and is anchored against rotation by a series of 1/16 inch rivets. These rivets had sheared allowing the fan air flow to rotate the stator. The manufacturer advised that they had received reports of occasional loose or missing rivets and had also experienced two previous incidents of total rivet shear associated with stator spin but without the major break-up that occurred in this instance. Rivet failure has been attributed to a resonant condition in the fan area occurring at transient rotor speeds. It is also suspected that foreign object damage (FOD) and birdstrikes could by introducing a single event overload be a contributory factor. One of the two previous stator spin incidents occurred concurrent with a multiple bird strike. The failed engine suffered a bird-strike incident in June 1989. A visual and borescope inspection in accordance with the manufacturer's requirements found no evidence of damage. The engine was internally washed and then satisfactorily test run. It operated for a further 580 cycles and 620 hours before the rivet failure. The manufacturer has introduced two Service Bulletin (SB) modifications in an endeavour to rectify the rivet failures. SB7264 replaced the 1/16 inch rivets with 1/8 inch rivets and SB7268 fitted a silicon vibration dampening ring to the outer periphery of the fan case. Both recommended accomplishment when disassembly afforded access to the area; however neither was mandatory. The failed engine was fitted with the silicon vibration

dampening ring whilst undergoing the bird-strike inspection some 16 months prior to the incident. However the larger rivets had not been incorporated as the area had not been opened up since the SB was issued in January 1988. The rivets had not been closely inspected while the engine was in service because a rivet inspection was not specifically called for in the maintenance schedules nor was it listed as a requirement of the FOD/bird-strike inspection. The SBs themselves did not alert operators to the potential for rivet failures nor did they advise that rivet failures had occurred in service. The rivet replacement SB did not list the engines to which it was applicable. Accordingly the maintenance organisation responsible for this engine would not necessarily have been alerted that this engine was among those that needed to have the smaller rivets replaced. The reasons given for introducing the vibration dampening ring and for replacing the rivets were unlikely to alert maintenance organsations to the importance of the rivet replacement nor would they be sufficient to initiate specific inspection of these rivets during routine maintenance or bird-strike inspections. As a result of this incident the manufacturer recognised the possible effects of minor bird strikes on the stator securing rivets and called for a field inspection of the subject rivets. Out of 452 responses 43 (9.5) indicated some form of rivet discrepancy. There were no reports of discrepancies with the modified rivets. The manufacturer has revised Service Bulletin SB7264 to upgrade the compliance recommendation such that the rivet replacement be accomplished at either the first workshop visit or prior to the next flight following any foreign body ingestion. The manufacturer also issued specific instructions for inspection of the rivets which will be incorporated into the maintenance manuals and revised the format for Service Bulletins so as to provide operators with more details of the required maintenance action.

Significant Factors:

The following factors were considered relevant to the development of the incident

1. Engine design efficiency.

2. The rivets securing the low pressure compressor stator had a history of failure.

3. The engine had previously suffered a bird-strike incident.

4. The rivets were not inspected as there was no requirement to do so.

5. The rivets were not replaced as the engine had not been subjected to the compliance requirement.

6. The rivets securing the low-pressure compressor stator failed.

7. The engine was severely damaged when the low pressure compressor stator rotated at high speed and severed the compressor casing.