



EASA Safety Information Bulletin

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Subject: **Disassembly of Engines following In-Flight Shutdown with Indication of Critical Part Failure**

Ref. Publication: None

Applicability: Maintenance organisations and continued airworthiness management organisations, performing work on engines featuring critical parts, installed on aircraft operated for commercial air transport.

Description: Subsequent to an engine stall and exhaust gas temperature (EGT) limit exceedance during normal take-off operation of an aeroplane, the engine suffered an in-flight shutdown (IFSD). The engine failure sequence was reported by the flight crew as high vibration followed by N1 spooling down to zero. Troubleshooting was performed after the aircraft landed and the post-flight boroscope inspection showed low pressure turbine (LPT) damage outside the Maintenance Manual limits. The engine was removed from the aircraft and sent to a Maintenance Station. When the LPT was separated from the core, it was found that both the high pressure turbine (HPT) and LPT had suffered significant thermal and mechanical damage and one rotor had failed, although fully contained. In absence of any specific advice, the maintenance station proceeded with the teardown preparing for normal overhaul.

Since a forensic teardown was not performed, many details were not recorded and some relevant parts were lost.

Failures of engine critical parts have the potential to result in a hazardous condition of the aircraft on which they are installed. Therefore, such parts have to comply with specific criteria in design and production with the goal to meet a failure probability of "extremely remote". The service history of engine critical parts is observed in order to confirm that the criteria applied in the design phase are valid throughout their service life. Furthermore, the root cause of an engine critical part failure must be thoroughly investigated anytime it occurs. It should be noted that such failure may be the result of a failure and/or design deficiency of certain parts associated to the critical ones. Therefore it is necessary to perform a failure

investigation which includes disassembly of the engine and the affected modules/components, applying a forensic approach, i.e. retaining all parts and performing a complete recording of the disassembly process.

The failure investigation itself is clearly within the responsibility of the type certificate (TC) holder. This SIB is published to promote awareness of the importance of a specific kind of disassembly and the need for specific support from the engine TC holder, in order to define adequate disassembly procedures if there is any indication of a critical part failure.

Note: For the purpose of this SIB, engine critical parts are parts identified as critical by the engine TC holder, which typically include parts for which a replacement time, inspection interval, or related procedure is specified in the airworthiness limitations section or certification maintenance requirements of the engine manufacturer's maintenance manual or instructions for continued airworthiness.

Recommendation: If, following an engine IFSD and subsequent on-wing inspection, there is any evidence which may indicate engine critical parts failure, e.g.:

- EGT/turbine gas temperature (TGT) exceedance with metal parts found in the exhaust,
- rapid N1 spool down to zero,
- rotor seizure,
- penetrated compressor/turbine casings,
- significant compressor/turbine damage outside of the Maintenance Manual limits, etc.,

EASA recommend that the Maintenance Station immediately inform the engine TC holder and ask for specific instructions to perform the disassembly process.

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