MINISTRY OF DEFENCE

Military Aircraft Accident Summary

MILITARY AIRCRAFT ACCIDENT SUMMARY

AIRCRAFT ACCIDENT TO ROYAL AIR FORCE

HARRIER GR MK5 ZD355

Date:	17 October 1990
Parent Airfield:	RAF Wittering
Place of Accident:	32 nm North West of Karup, Denmark
Crew:	One
Casualties:	One Minor

CIRCUMSTANCES

1. The pilot of Harrier ZD355 was the leader of a formation of aircraft, and had planned a sortie to return to base after taking part in a Danish air defence exercise. The weather at his departure airfield was good and shortly after take-off, he set an appropriate power setting for the climb en route for the UK.

2. Whilst the aircraft was passing 23,500 feet, the pilot heard a very loud bang behind him and felt an immediate loss of thrust. He saw the engine Revs Per Minute (RPM) reducing and noted that the engine Jet Pipe Temperature (JPT) was very high; at the same time he felt severe engine vibration and heard mechanical grinding noises. He lowered the nose, selected the throttle to idle and transmitted a distress call while turning back towards his departure airfield. A formation member who saw a large puff of black smoke emerge from ZD355, followed the leader to render assistance if required. The pilot of ZD355 realised that there was something seriously wrong with the engine, although other aircraft services continued to work normally. In the descent, he noted that the RPM was at a normal idling value but the JPT remained high. Therefore, he followed his emergency drills and shut down the engine. The JPT reduced significantly and the appropriate caution lights illuminated. The pilot considered jettisoning external fuel tanks but, having regard to the nature of the failure and the height available to him, he dismissed this option because of the risk of injury to the population below.

3. At approximately 20,000 feet, the pilot attempted to relight the engine for the first time. The RPM and JPT stabilised at normal values but, when the throttle was cautiously advanced from idle, the JPT rapidly increased with severe engine vibration. He therefore shut

down the engine again. Passing approximately 11,000 feet, the generator shut down and the aircraft AC electrical services were lost. Realising his deteriorating predicament and the likelihood of ejection, the pilot pointed the aircraft towards open water, before attempting another relight at around 7,000 feet. The engine again relit but was still vibrating severely with the throttle at idle and the JPT out of limits; he therefore shut down the engine once again. The pilot prepared for ejection and made a further 2 unsuccessful relight attempts before ejecting at between 2,000 and 3,000 feet, 2 minutes and 40 seconds after the first indications of engine failure. The aircraft crashed on open ground and was totally destroyed.

CAUSE

4. The accident was caused by a fatigue failure of a second stage Low Pressure Compressor rotor blade, which resulted in a catastrophic failure of the engine. The failure emanated from a damage mark on the leading edge of the blade. Expert opinion concluded that the object which caused the damage was of the same material as the Compressor blades. No pre-crash engine damage was found forward of the second stage rotor blades.

5. Due to the unusual nature of the damage, the possibility of ingestion of a foreign object was dismissed; the conclusion reached that the damage was probably sustained during engine maintenance. Over 100 hours before the blade failed, a sequence of deep engine maintenance had been carried out, involving the removal of the first stage Low Pressure Compressor assembly and replacement of a number of bolts. This work necessarily exposed the second stage Low Pressure rotor blades for inspection and also to potential damage. It would have been possible for a first stage blade to have hit the second stage rotor blades during their removal and refitment, although the tradesmen involved did not recall such an impact and were confident that the engine had not been damaged after the inspection. This explanation for the damage is thought the most likely, although not conclusively proven.

SUBSEQUENT ACTIONS

6. The techniques employed on compressor inspections, together with the periodicity of inspection have been reviewed. In addition, because of the Health and Safety concerns during the subsequent salvage operation, caused by the widespread scattering of Man Made Mineral Fibres (MMMF) used to manufacture major parts of the airframe, an Aircraft Crash Recovery Procedures Working Group was set up. This has reviewed the procedures to be adopted for all aircraft types, including those containing MMMF composite structure. The revised

policy, which covers all locations and aircraft types, has been adopted for use at all RAF and MOD(PE) aircraft crash sites.