



MINISTRY OF DEFENCE
MILITARY AIRCRAFT ACCIDENT SUMMARY

**AIRCRAFT ACCIDENT TO ROYAL AIR FORCE TORNADO F3
ZE830**

AIRCRAFT:	RAF Tornado F3 ZE830
DATE:	17 November 1999
LOCATION:	1km off the East Lothian coast, near Torness Point
PARENT UNIT:	F3 Operational Evaluation Unit, RAF Coningsby
CREW:	Two
INJURIES:	One major, one slight

Issued by: Directorate of Air Staff, Ministry of Defence, Northumberland Avenue, London, WC2N 5BP

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SYNOPSIS

1. Whilst conducting a night low-level navigation exercise as the lead aircraft of a 2-ship formation, the crew of Tornado F3 ZE830 heard unusual noises from their left engine followed by cockpit indications of left engine failure. Shortly afterwards, the right-hand engine bay fire caption illuminated and the crew saw signs of a fire to the rear of the aircraft. A "Mayday" was declared and, ensuring the aircraft was clear of Torness Nuclear Power Station, the crew ejected. The aircraft crashed into the sea approximately 1km off the coast, and was totally destroyed by the impact.

2. The Inquiry concluded that the loss of ZE830 was caused by the failure of the left engine, due to the probable failure of a High Pressure Compressor (HPC) stage 1 stator vane, which led to an uncontained titanium fire and a subsequent secondary fire in both engines.

3. The crew were commended for demonstrating exceptional levels of airmanship and awareness in the most adverse of conditions.

BACKGROUND

4. On the evening of 17 November 1999, ZE830 was tasked to fly from RAF Coningsby as the lead aircraft of a 2-ship formation. The crew, comprising two experienced Tornado F3 pilots, planned to use Night Vision Goggles (NVG) and operate at low-level in the Northumberland and Scottish Borders area. The weather forecast for the sortie was good with no significant cloud at low level and a visibility of between 25 and 40 km.

CIRCUMSTANCES

5. After completing the transit to the planned low-flying area, and operating at 500 feet above ground level and 420 knots for several minutes, the crew suddenly heard a machine gun-like noise coming from the left engine. Eight seconds later they heard a similar noise followed by a large bang, and the left throttle and left reheat Central Warning Panel (CWP) captions illuminated. The left engine High Pressure (HP) spool speed (N_h) reduced to sub flight-idle (an indication of engine failure). Whilst the crew were reacting to this, the right engine bay fire CWP caption illuminated and the front-seat pilot initiated a turn to point the aircraft out to sea. Shortly afterwards, the left engine bay fire CWP caption also illuminated and the rear-seat pilot stated that he could see signs of fire coming from the rear of the aircraft. The front-seat pilot shut down the left engine and operated both engine bay fire extinguishers. However, with no signs of the fire diminishing, the crew prepared to eject. After ensuring that the aircraft was clear of Torness Nuclear Power Station, and once they were content that the aircraft would land in the sea, the crew ejected. ZE830 struck the sea approximately 1km from the coast - outside the mandatory avoidance zone around Torness Nuclear Power Station.

RESCUE OPERATION

6. Both crewmembers landed in open farmland. Shortly afterwards they were met by a local farmer who called the Police, the Ambulance and the Fire Service. The crewmembers were flown to Edinburgh Royal Infirmary by RAF Search and Rescue helicopter which later transferred them to the Queen's Medical Centre in Nottingham. Medical examinations of the crew determined that the front-seat pilot had suffered a compression fracture of the vertebra and the rear-seat pilot had minor facial lacerations.

INVESTIGATION

7. An extensive salvage operation managed to recover the Accident Data Recorder, both engines and 80% of the remainder of the aircraft. ZE830's engines were taken to Rolls-Royce's Engine Failure Department at Bristol. The remainder of the wreckage was examined by BAe Systems and by an inspector from the Aircraft Accidents Investigation Branch. From the engine damage present, the Board concluded that a left engine HPC stage 1 stator vane had probably failed, and that this had led to catastrophic engine damage and a titanium fire within the engine. The fire became uncontained when it then burned through the engine's outer casing and caused an adjacent reheat fuel pipe to split. This caused a secondary fire when some of the leaking fuel from this split pipe ignited in a localised fire in the left engine bay, whilst some fuel pooled and was subsequently drawn into the right engine bay where it, too, ignited.

8. The Board's investigation also revealed that the localised fire within the left engine bay was in an area not covered by the firewire. This explained why the left engine bay fire CWP caption did not illuminate for some time despite the presence of a fire there.

SAFETY RECOMMENDATIONS

9. The Board made a number of recommendations including that the Tornado's engines be modified to prevent High Cycle Fatigue of HPC stator vanes, and that increased titanium fire protection be provided. The Board also recommended that the Tornado engine bay fire detection system should be modified to provide an increased probability of detecting localised fires.