MILITARY AIRCRAFT ACCIDENT SUMMARY

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AIRCRAFT ACCIDENT INVOLVING ROYAL AIR FORCE TORNADO GR1 ZA368

Date:	**19 July 1994**
Parent Station:	**Royal Air Force, Lossiemouth**
Place of Accident:	**16nm NNE of RAF Lossiemouth, Scotland**
Crew:	**Instructor & Student**
Casualties:	**1 Major & 1 Slight**

CIRCUMSTANCES

1. The captain of ZA368, a Qualified Flying Instructor (QFI), was conducting a night handling check from the rear seat, on a student as part of the Tornado Weapons Conversion Course. The sortie began with a simulated single-engine radar approach, flown with the left hand engine at idle. Shortly after beginning descent on the final approach, the crew heard a slight bang and rumbling noise from the right hand side of the aircraft. The QFI, noting that the right Turbine Blade Temperature (TBT) was high and that engine related warnings were illuminated, approved his student's decision to overshoot. The student selected reheat on the left engine and throttled the right engine back to idle. The crew diagnosed a locked-in surge and shut down the right hand engine by closing the high pressure fuel cock. Each of the Tornado's two engines is fitted with a gearbox which drives a generator and a hydraulic pump. The gearboxes are connected via a Cross Drive Clutch (CDC) which is open during normal operation. If one of the engines is shut down, the CDC automatically closes so that the functioning engine can drive both gearboxes. Having stabilised at a safe height, the QFI elected to attempt to relight the shut down engine. As the student advanced the throttle to idle, the TBT rose rapidly and the QFI ordered the engine to be shut down again.

2. Thinking that the engine had suffered some kind of damage, the crew carried out the appropriate drills. Because of the risk of an

engine fire resulting from engine mechanical failure, the drills require the low pressure fuel cock to be closed and the CDC opened. The functioning left engine had been driving both generators and hydraulic pumps; however, with the CDC open, only the left generator and left hydraulic pump were operating. The crew completed the necessary drills and began fuel dumping. Four minutes later, just before turning onto base leg, the crew suddenly sensed the aircraft pitch up, then pitch down and roll left. The student noted that his control inputs did not correspond with the aircraft's movements and, with the aircraft now inverted and the nose 10° below the horizon, called that he was ejecting. Both crew ejected successfully but sustained injuries. The aircraft crashed into the Moray Firth.

DETERMINATION OF THE CAUSE

3. The cause of the accident was the failure of the Gamah Coupling. This is a rigid assembly used to connect two rigid alloy fuel pipes, which allows the Fuel Transfer and Dump Pipe to pass through a fuselage sub-frame. The forward part of ZA368's Gamah Coupling was recovered and half of the O-ring seal was found to be missing. When the crew began to dump fuel, the coupling failed and resulted in a fuel leak which ignited, probably on contact with a nearby air conditioning pipe.

4. An examination of the wreckage provided clear evidence that the resultant rear fuselage fire had affected the Command and Stability Augmentation System (CSAS) wiring looms and the Mechanical Mode (MM) control. The aircraft's taileron MM control rods had been heated by the fire to the point where they would have deformed easily with the application of the slightest load. Consequently, when the system attempted to revert to MM, the weakened control rods, fractured immediately resulting in the loss of control.

5. The Inquiry concluded that the CSAS may have better resisted the fire damage and might not have reverted to MM had cockpit Recirculation Change Over Valve (RCOV) indicators been installed and it was therefore considered that the lack of cockpit RCOV indicators which control the flow of surplus fuel within the engine may have contributed to the accident.

SUBSEQUENT ACTIONS

6. A new Servicing Instruction will be issued to include a check of the Gamah Coupling. Aircrew emergency check lists have been amended following post-surge engine damage assessment. All Tornados are to be equipped with RCOV indicators by the end of 1998.
