MINISTRY OF DEFENCE

Military Aircraft Accident Summary

MILITARY AIRCRAFT ACCIDENT SUMMARY

OF RAF BOARD OF INQUIRY

Aircraft:	**Tornado GR1 ZD846**
Date of Accident:	**11 January 1996**
Place of Accident:	**5nm south-west of Münster, Germany**
Casualties:	**1 slight & 1 Major**

Synopsis

1. ZD846 was one of three RAF Brüggen-based Tornado GR1s conducting a routine evasion sortie over northern Germany. During the course of one of the engagements, control was lost and the crew ejected successfully, the aircraft crashing into a wooded area. The pilot suffered slight injuries whereas the navigator's back injury was classed as major. The Inquiry concluded that the accident was caused by the pilot, who mishandled the aircraft and exceeded its flight limitations; this led him to lose control of the aircraft at a height from which recovery was not possible.

Background

2. The pilot was an Italian Air Force exchange officer who was training to become an 'aggressor' pilot; this flight was to have been his final check sortie.

Circumstances

3. Tornados are fitted with a Spin Prevention and Incidence Limiting System (SPILS) which improves the aircraft's resistance to departure from controlled flight. This it does by sending signals to the fly-by-wire system which both limit the maximum Angle of Attack (AOA) attainable and to reduce control authority in roll and yaw at high AOA. The Central Warning Panel in the front cockpit has a SPILS caption that illuminates when the system is switched off or in the event that it fails; the caption is not, however, repeated in the rear cockpit.

4. Weather conditions in the area were satisfactory with adequate visibility and minimal cloud cover. The crew attended the sortie brief, which covered the rules of evasion and aircraft operating limits, and took off ahead of the other two Tornados. The pilot left SPILS switched off for the take-off, and did not switch it on once airborne, as required by the after take-off checks.

5. The pilot positioned the aircraft at 8,000 ft and, once in visual contact with the other two Tornados, descended to 3,000 ft for a simulated missile attack on one of the aircraft. The target aircraft began evasive manoeuvring and the pilot of ZD846 broke off the attack by executing a climbing turn to the left. With the aircraft still climbing at 12 units of AOA and the wings swept fully forward, the pilot rolled the aircraft rapidly to the left. The aircraft reached 120° of left bank before the pilot abruptly reversed the turn, the aircraft achieving a roll rate of 76° per second. With the aircraft at 6,500 ft, the pilot increased the AOA to at least 25 units - 8 units more than the permitted level for the configuration ZD846 was in at the time. As the aircraft reached 100° of bank and 220 knots, the pilot attempted to stop the roll by moving the stick fully to the left; however, this only served to

exacerbate the situation and the roll and yaw rates both increased markedly. At this point, the aircraft departed controlled flight, rolling through the inverted with a steep nose down attitude before flicking upright and nose-up. The AOA was now greater than 25 units and the aircraft was in a high rate of descent. The pilot took initial recovery action but was unable to regain control and, as the aircraft passed 700 ft, the navigator initiated a command ejection.

Rescue/Salvage operation

6. Both ejection seats functioned correctly and the German police and ambulance services were quickly on the scene to offer assistance. Subsequently, a German Air Force Search and Rescue helicopter and an RAF Chinook took the navigator and pilot respectively to hospital for further medical examination.

Aircraft Damage

7. The aircraft was destroyed, although some items were recovered for inspection by the Department of Transport's Air Accidents Investigation Branch (AAIB).

Investigation

8. The Inquiry was able to draw upon evidence from the Accident Data Recorder (ADR), Cockpit Voice Recorder, statements from the crews involved and the AAIB technical report. The high quality of the ADR information enabled the final sequence of events to be reconstructed with confidence and precision and this, allied with the AAIB report allowed the Inquiry to discount the possibility of technical malfunction, structural failure or electromagnetic interference with the fly-by-wire system. The Inquiry therefore concentrated on the human aspects and, from a review of the ADR, it was evident that the pilot had exceeded the aircraft's AOA limits and had used high rates of roll. The Inquiry considered that, without the protection of SPILS, the pilot's aggressive flying style

would inevitably lead to a departure from controlled flight. The Inquiry noted that the pilot had consciously taken off with SPILS turned off and went on to disregard advice on the potential hazards of missing the check to switch SPILS on as part of routine after take-off checks. These factors led the Board to conclude that the accident was caused by the pilot. The Inquiry also considered that the pilot's failure to switch on SPILS was a contributory factor, as were the navigator's failure to monitor adequately the after take-off checks and the lack of a SPILS caption in the rear cockpit.

Safety recommendations

9. Policy on the use of SPILS now states that the system should be switched on before take-off. In addition, rear cockpit warning panels are to be modified to incorporate a SPILS caption.