



MINISTRY OF DEFENCE
MILITARY AIRCRAFT ACCIDENT SUMMARY

**AIRCRAFT ACCIDENT TO ROYAL AIR FORCE HARRIER GR7
ZD464**

AIRCRAFT:	RAF Harrier GR7 ZD464
DATE:	2 August 2002
LOCATION:	Lowestoft Seafront Air Festival
PARENT UNIT:	20(R) Squadron, RAF Wittering
CREW:	One
INJURIES:	One minor

Issued by: Directorate of Air Staff, Metropole Building, Northumberland Avenue, London WC2N 5BP



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SYNOPSIS

1. On 2 August 2002, Harrier GR7 ZD464 took off from Norwich Airport to take part in the Lowestoft Seafront Air Festival. During the display, while in a steady hover, the aircraft suddenly started to descend and began to move forwards. Between 4 and 5 seconds later the aircraft crashed into the sea. The pilot ejected successfully at a height of 64 ft above sea level. The Inquiry concluded that the accident was caused by the failure to select the nozzle control lever to the "Hover Stop" following an inadvertent nozzle lever movement.

BACKGROUND

2. The display comprised an aerobatic sequence followed by a vertical/short take-off and landing (VSTOL) capability display. The normal sequence for the latter part of the VSTOL display was a backwards movement into a steady hover, followed by a 90° turn towards the crowd, with a simultaneous selection of the landing gear down. During the movement backwards, the pilot's hand alternated between the throttle and the nozzle lever in order to maintain a constant height and groundspeed. The Thrust from a Harrier engine is expelled through the nozzles. The nozzle angle can be changed, and it is this that allows the Harrier to hover. The "master lever" to which the pilot normally returned his hand was the throttle. To stop the aircraft moving backwards, the pilot normally set a nozzle angle and then made further throttle inputs to maintain height. Once the movement had been stopped, the pilot normally moved his hand to the nozzle lever and, in one positive movement, selected the Hover Stop. The throttle and nozzle lever are 10cm apart laterally and would not usually be in a relative position such that they could be moved simultaneously, even with an open hand.

CIRCUMSTANCES

3. Harrier GR7 ZD464 took-off from Norwich Airport at 1429 hrs in suitable weather for the display at Lowestoft, which commenced at 1451 hrs. The display was uneventful until the pilot had completed the movement backwards, when the throttle was retarded and then advanced. However as the throttle was moved forward, the nozzles simultaneously moved backwards. The nozzles were then moved further backwards, and without sufficient downward thrust the aircraft began to descend and accelerate. At 64 ft above sea level the pilot initiated ejection. The aircraft hit the sea parallel to the beach at approx 1501 hrs.

RESCUE/SALVAGE OPERATION

4. On entering the water, the pilot successfully boarded his dinghy. He was transferred via a rescue boat to the Lowestoft Lifeboat where he was placed on a stretcher and a neck brace applied. He was then winched aboard a Search and Rescue (SAR) Sea King, which transported him to hospital in Great Yarmouth. The aircraft, which lay in 4.5 m of water, was lifted by crane onto a barge. It was substantially intact, except that the fuselage forward of the engine air intakes had become detached from the remainder of the fuselage. The wreckage was recovered to Lowestoft Fish Docks on 8th August 2002.

AIRCRAFT DAMAGE

5. The aircraft was damaged beyond economic repair by the impact.

INVESTIGATION

6. The Board had available to them the Accident Data Recorder, Head Up Display Video, video evidence from the crowd, the pilot's account and the aircraft wreckage. From these sources the Board concluded that the aircraft was serviceable when it impacted the sea. The Board determined that the pilot had suffered a cognitive failure having finished the movement backwards, when he inadvertently retarded the throttle instead of moving the nozzle lever to the Hover Stop. His hand had already moved to select the landing gear down for the next event, when he heard the engine note change and correctly, advanced the throttle. However, in doing so he unwittingly moved the nozzle lever forward at the same time. The aircraft began to descend and the pilot, not realising that he had already moved the nozzle lever, attempted to 'nozzle out' (by moving the nozzle control lever further forward) and accelerate away from the hover. The aircraft continued to descend and accelerate, and the pilot initiated ejection.

SAFETY RECOMMENDATIONS

7. The Board made the following recommendations, which are being actioned:
 - a. All Harrier Pilots are made aware that it is possible to move the nozzle control lever forward inadvertently if the throttle is advanced with an open hand.
 - b. The need for Harrier pilots to scan the nozzle angle during nozzle lever inputs in the VSTOL regime is reinforced.
 - c. Handling advice is introduced for 'loss of performance in the hover' as the current emergency procedure did not adequately cover this accident scenario.
 - d. Specific guidance is provided in HQ 3 Group Air Staff Orders on cumulative duty limits for display pilots.
 - e. The published Aircraft Accident Report becomes mandatory reading for all future Harrier display pilots and Harrier display supervisors.
 - f. The Accident Data Recorder sampling rate for nozzle angle is increased from one sample per second to a minimum of 4 samples per second. Had video evidence, which was supplied by members of the public, not been available then the Board would have been unable to determine precisely the details of the nozzle movements.

