



# MINISTRY OF DEFENCE

## Military Aircraft Accident Summaries

9/89

November 14, 1989

### ACCIDENT TO ROYAL AIR FORCE TORNADO GR1 ZD891

Date: January 13, 1989  
Parent airfield: RAF Bruggen  
Place of accident: Two miles south of Wiesmoor,  
West Germany  
Crew: Two  
Casualties: Two fatal

#### CIRCUMSTANCES

1. On 13 Jan 89, at approximately 0653Z, and RAF Tornado GR1, ZD 891, collided with a German Air Force (GAF) Alpha Jet, Serial No. 4087, just to the south of the village of Wiesmoor in West Germany. The Tornado was one of a stream of aircraft flying a pre-planned route; the Alpha Jet was the lead aircraft of a 4-aircraft tactical formation, tasked as the leading element of an 8-aircraft package to carry out a simulated attack on the GAF airbase at Wittmund. Both the Tornado and the Alpha Jet were destroyed in the collision. Although the pilot of the German aircraft was able to eject safely, the Tornado crew were killed.

2. ZD 891 had taken off from RAF Bruggen at 0801Z as the 23rd mission of a planned 30-aircraft launch on the last day of a station exercise. Once airborne, the crew were required to route through a holding pattern and a timing gate so as not to conflict with other participating aircraft before carrying out a simulated attack against a field target in German Low Flying Area (LFA) 5. After this target, common westerly routing across the North German Plain was planned to achieve 1 minute separation between aircraft before timed 'first-run' attacks (FRAs) at Nordhorn range and a pre-planned, sequenced recovery to Bruggen.

3. The crew of ZD 891 flew through the timing gate and attacked the field target in LFA 5, both on time. Having exited the LFA at its north-west corner, they took up a westerly heading for their next turning point, some 4 nms north west of the town of Brake. Established now on the same route as the other participating Tornados, they turned on to a heading of 270°T. Shortly afterwards, approximately 2 nms south of the village of Wiesmoor, ZD 891 struck Alpha Jet 4087. At the moment of collision, the Tornado was flying straight and level at 463 kts IAS and 500 ft above the ground.

4. Alpha Jet 4087, as lead of a 4-aircraft formation, took off from GAF airbase Oldenburg at approximately 0825Z. After a short route over the North German Plain, the 4 aircraft overflew a planned turning point near the town of Friesoythe before taking up northerly headings towards their Initial Points (IPs) for the final attack run against Wittmund airfield. The formation, with Nos 1 & 2 to the west of Nos 3 & 4, accelerated from 360 kts to 400 kts on this leg.

5. Approximately 2 minutes before his IP, and 1 minute before the collision, the pilot of Alpha Jet 4087 noted that he was about 1 nm to the left of his planned track. He therefore made a small heading change of 3 or 4 degrees to the right and rolled out on 004°T. On turning his head to the right to check the position of his No 2, he became fleetingly aware of another aircraft at extremely close quarters, just aft of the beam, which subsequently struck the rear of his aircraft. He ejected successfully, sustaining minor burns to the lower part of both legs and back injuries consistent with the ejection.

6. 1 or 2 seconds before the collision, the pilot of the No 2 Alpha Jet saw an aircraft in his 12 - 1 o' clock position at very close range. He pulled 5.3g in an attempt to avoid a collision, experiencing abrupt wing rock and yaw either as a result of the snatch pull or from the Tornado's slipstream. After avoiding the Tornado, he looked down to the left and saw a fireball on the ground, although he initially believed it to be coming from his left drop tank because of his line of sight. He declared an emergency and landed at Wittmund where his aircraft was subsequently found to be undamaged.

7. Examination of the aircraft wreckage revealed that the first point of contact in the collision had been between the Tornado's radome and the front lower section of the Alpha Jet's starboard drop tank. (The drop tank had been mounted on the Alpha Jet's out wing station.) Thereafter, the upper front fuselage and cockpit area of the Tornado had cut through the starboard wing and outboard pylon, the aft fuselage and the tailplane assembly of the Alpha Jet. Neither crew member had made any attempt to eject and death was instantaneous.

#### CAUSE

8. The information available from the voice track of the Tornado's Accident Data Recorder (ADR), together with the statements of the 4 Alpha Jet pilots, revealed that none of the 5 crews involved had seen the impending collision in time to prevent it. Neither the Tornado pilot nor his navigator had seen any of the Alpha Jets at all. The No 2 pilot of the Alpha Jet formation had seen the Tornado at such a late stage he was forced to take violent avoiding action with no time to transmit a warning, while his leader had had only a fleeting glimpse of the Tornado just before impact. The other 2 Alpha Jet pilots had not seen the Tornado at all as it had passed across their noses from right to left at an approximate range of 4 nms.

9. In considering the failure of the crews to see each other, it was possible to discount both the weather and sun position as contributory factors; at the time of the accident, the weather and visibility were well in excess of the prescribed minima, with no significant cloud and an out-of-sun visibility of 8 - 14 kms. The sun, on an azimuth of 140°, was aft of the beam position for all the aircraft involved. Consequently, the effects of aircraft conspicuity, visual acuity, physical obscuration and workload on the crews' lookout were assessed.

10. Although the Tornado is considerably larger than the Alpha Jet, both aircraft represent small targets at the ranges required to ensure timely visual contact. Moreover, the Tornado and 4 Alpha Jets involved in the accident were camouflaged in paint schemes optimised to reduce to a minimum their conspicuity at low level, while the red low intensity strobe anti-collision lights, with which all the aircraft were equipped, would have done little to counteract this effect in the prevailing light conditions.

11. The human eye is ill-equipped to detect small stationary objects unless they appear directly ahead in the field of view. Displacement of an image from the centre of the retina (the fovea) causes an exponential decrease in visual acuity. For example, a displacement of 5° from the fovea occasions a 75% loss in visual acuity, while at a displacement of 45° the loss is 95%.

12. The extent of the physical obscuration caused by the metal canopy arches of the Tornado and Alpha Jet, assuming a fixed head and 'normal' eye position was determined. For the Alpha Jet, the 'worst case' blind arcs were between 30° and 50° relative to the aircraft's longitudinal axis while, for the Tornado, the arcs were between 30° and 53° for the pilot and between 36° and 45° for the navigator. Clearly, any change in head position from the assumed datum would change the pattern of this obscuration. As the 2 aircraft converged towards the collision, the relative bearing of the Alpha Jet from the Tornado was 40° left of the longitudinal axis, while that of the Tornado from the Alpha Jet was 47° to the right.

13. The effect of conflicting and competing workload priorities on the lookout of the crews was considered. The 4 Alpha Jets were preparing to attack Wittmund airfield; this may have concentrated their lookout in the 12 o' clock as they tried to identify their IPs. Certainly the workload of the Nos 1 & 2 was increasing with the No 2 concentrating much of his lookout towards his IP and to the left, towards his leader.

14. Analysis of the Tornado's ADR and its voice track suggests that, in the seconds before the collision, the navigator was probably 'head-in' taking a radar fix prior to the attack at Nordhorn while the pilot's attention may have been concentrated on the Head-Up Display (HUD), either to check weapon symbology or to monitor aircraft height. In the 3 minutes prior to the accident, the pilot had made several auto-pilot selections on the Auto-pilot and Flight Director System (AFDS) control panel. Although this would have detracted from the pilot's lookout scan, there was nothing to suggest that he had been distracted in any way in the 30 seconds prior to the collision.

15. Both aircraft were equipped with radar altimeters with height readouts displayed in their HUDs; over the flat North German Plain it was relatively simple for the pilots to maintain their height datum with precision. This considerably reduced the chances of the 2 aircraft being separated vertically. At the time of the collision the overall width of the Alpha Jet formation was between 3.5 and 4 nms and the fore and aft spacing was approximately 1.5 nms. The formation was flying at right angles to the track of a stream of Tornados planned to be 7 nms apart. This combined to produce a relative closing speed of about 620 kts. This geometry significantly increased the statistical chances of a collision between the Alpha Jet formation and the stream of Tornados.

16. In conclusion, the cause of the collision was the failure of the pilots involved to take avoiding action on each other because they did not see each other in time. However, despite the fundamental requirement to 'see and avoid', an exceptional combination of significant factors conspired to make the 2 pilots' lookout task unusually difficult.

#### SUBSEQUENT ACTIONS

17. Action to emphasise the overriding and fundamental need to lookout is in hand. High Intensity Strobe Lights will be fitted to Tornados as a priority. In the future, it has been arranged with the appropriate NATO tasking agency that they will issue Airspace Activity Warnings when launches of large numbers of aircraft are planned.

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