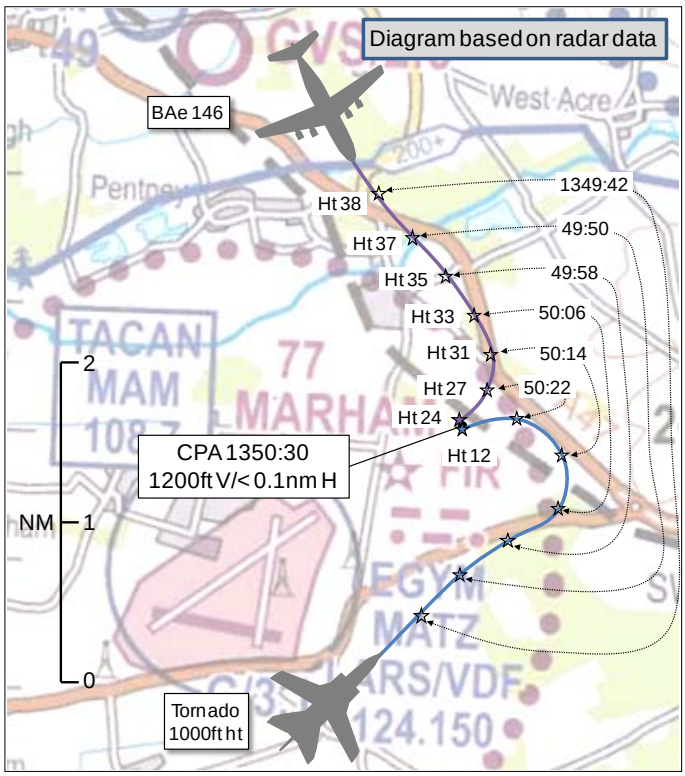
AIRPROX REPORT No 2013133

Date/Time: 16 Sep 2013 1351Z

Position: 5240N 00036E (RAF Marham)

Airspace: Marham MATZ (*Class*: G)

	Reporting Ac	*Reported Ac*
Type:	Tornado	BAe 146
Operator:	HQ Air (Ops)	HQ Air (Ops)
Alt/FL:	1000ft QFE (996hPa)	3000ft NK
Conditions:	VMC	VMC
Visibility:	>10km	30km
Reported Separation:	<1000ft V/NK H	1000ft V/0.5nm H
Recorded Separation:	1200ft V/0.1nm H	



PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

THE TORNADO PILOT reports joining the visual circuit, having gone around from a GCA. The grey camouflaged aircraft had navigation lights and HISLs selected on, as was the SSR transponder with Modes A, C and S. The aircraft was not fitted with a TAS or ACAS. The pilot was operating under VFR in VMC, within the Marham ATZ, in Class G airspace. The pilot requested to join the visual circuit. Marham Tower (TWR) cleared him to join, stating "circuit clear". Immediately prior to making the downwind call, he heard the BAe 146 pilot requesting to join. The tower cleared the 146 to join, clearly stating "one in". The 146 pilot then requested to join 'right base' as the Tornado pilot called downwind. The Tornado pilot received the surface wind in reply, but was not told there was "one ahead". Immediately following this, the BAe 146 pilot called "right base, gear down to touch and go" and was cleared as requested by TWR. The Tornado pilot was about to 'tip finals'[1] but was not visual with the 146 and therefore initiated a go around at circuit height, requesting the tower to confirm the position of the 146. In reply, TWR advised the Tornado pilot that the 146 was "2 miles from the airfield, 1 mile left of the centreline, in a descent passing 4000 feet, crossing your nose right to left". The 146 was then sighted descending through a break in the cloud, converging with the Tornado, rolling out directly above. At this stage the 146 pilot lowered the nose sharply to begin an approach. Assuming that the 146 crew had still not seen him, the Tornado pilot transmitted on TWR frequency that the 146 was descending on top of him and initiated a turn to the left to avoid a potential collision. The 146 pilot, having lowered the nose, then transmitted that he was visual with the Tornado. The Tornado was flown clear of the approach lane and the 146 completed its approach.

He assessed the risk of collision as 'Medium'.

THE BAE 146 PILOT reports positioning from the north of the airfield, from 14000ft amsl, to conduct a tactical, steep approach for a touch and go on RW24 at Marham. The white and red aircraft had navigation, landing and strobe lights selected on, as was the transponder with Modes A, C and S. The aircraft was fitted with TCAS. The pilot was operating under VFR in VMC in Class G airspace, descending into the Marham ATZ. The pilot stated that the weather was scattered cloud in the vicinity, with cumulous developing, with excellent visibility. On reaching a position abeam the landing threshold, at approximately 5000ft, a call was made to Marham TWR stating the aircraft's position and his intentions for a right base join. He was fully aware of a Tornado in the circuit in the vicinity of

[1] Start a continuous descending 180° turn from the end of the downwind leg to short final.

the downwind leg. The Tornado pilot called finals', was told about '146 traffic ahead' and sought information on its position. The 146 pilot called that he was on a right base. The 146 pilot maintained sight of the Tornado throughout and carried on its flight path of gliding around a high finals before a commitment to the runway with more flap was made. The 146 pilot ensured height deconfliction was honoured throughout by remaining at a height above the normal circuit pattern, which coincidentally happened to be the ideal flight path for the tactical steep approach and therefore no additional manoeuvring was necessary. Lateral deconfliction was honoured when the Tornado passed through the 146 pilot's intended flight path, thereby moving rapidly away from the approach lane. The 146 pilot committed to the steep approach from just below 3000ft, with a steeper flight path adopted. The Tornado went around at circuit height and the 146 continued for a successful touch and go. At no point was circuit SA or visual sight of the Tornado lost or a threat perceived by the 146 crew as to the proximity of the other aircraft.

He assessed the risk of collision as 'Low'.

THE MARHAM TWR CONTROLLER reports carrying out a practical examination of a trainee controller in the ADC local operating endorsement. The BAe146 had previously been making tactical approaches to RW24, approaching along the approach lane with steep descents from approximately 14000ft QFE. The Tornado had joined the visual circuit upon completion of a ground controlled approach, when The 146 pilot called TWR, requesting to join. The controller under examination gave instructions for an overhead join, which was read-back and corrected by the 146 pilot, who requested a right base join. The Tornado pilot called downwind, but was not given traffic information on the 146, other than what was heard on the ADC frequency. The 146 pilot was instructed to report right base and he immediately responded that he was at right base with gear down to touch and go. The ADC under examination placed the 146 on a continue whilst setting up the RWY. The 146 pilot was subsequently cleared to touch and go. At this point the Tornado pilot requested traffic information on the 146, which was given. The Tornado pilot stated he was at circuit height and was given further traffic information, using the clock ray method, at which point he reported visual with the 146. The Tornado pilot then stated that the 146 was now pointing at his aircraft and descending. The 146 pilot immediately reported visual with the Tornado prior to conducting his touch and go. The Tornado pilot reported deadside to reposition and, after the 146 departed, continued in the visual circuit without further incident.

He assessed the risk of collision as 'Low'.

THE MARHAM DEPUTY SATCO reports the 146 had been booked into Marham for tactical circuit work, including steep descent profiles simulating approaches used overseas. The 146 pilot had already completed several approaches and required integrating into the visual circuit on a radar to visual profile against the Tornado, intending to join the visual circuit upon completion of a GCA. The controller under examination could have passed more traffic information to the 146 and Tornado pilots upon joining and once established downwind respectively, in order to maximise their situational awareness of each other with respect to position and height. Greater positive control of the visual circuit (e.g. instructing the Tornado pilot to extend downwind as number 2 to the BAe146 on right base, descending from 4000ft) and appraising the respective pilots of the order of recovery may have prevented this situation developing.

Factual Background

The weather at RAF Marham was recorded as follows:

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METAR EGYM 161350Z 27017KT 9999 VCSH FEW025CB SCT035 13/08 Q0999 BLU TEMPO 7000 SHRA
BKN020CB WHT
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Analysis and Investigation

Military ATM

This incident occurred within the visual circuit at RAF Marham, at 1350:37 on 16 Sep 13, between a Tornado and a BAe146. The Tornado pilot had joined the visual circuit after conducting a GCA. The BAe146 pilot was conducting Tactical Steep Approach training, commencing visual approaches from 14,000ft. Both pilots were VFR, under Aerodrome Control from Marham Tower, where the Aerodrome Controller was undergoing endorsement examination under the supervision of a Local Examining Officer. There were no other aircraft involved and only one other aircraft on frequency which was not a factor.

All heights/altitudes quoted are based upon SSR Mode C from the radar replay unless otherwise stated. 'Live-mic' recording from Marham was available to inform the investigation.

The incident sequence commenced at 1348.52 when the BAe146 pilot transmitted to Marham TWR, "*Tower,* [BAe 146 C/S] *request join, runway 24, 996 set*". The Tornado was already established in the visual circuit. At 1348:57, Marham TWR cleared the BAe146, "[BAe 146 C/S], *Marham Tower, overhead join approved runway 24, QFE 996 hectopascals, one in*". The one in was the Tornado. At 1349.08, the BAe146 pilot read-back "*Join 24, 996, we're on a right-base.*" This was understood as the BAe146 pilot requesting a right-base join rather than an overhead join, and was confirmed within the TWR and BAe146 Airprox reports.

Before Marham TWR could respond to the BAe146 pilot, at 1349:12, the Tornado pilot reported "[Tornado C/S] *downwind, Touch and Go*". The aircraft positions are depicted in Figure 1 (below) with the BAe146, Mode 3/A 3655, descending through FL62 (height 5700ft) and the Tornado downwind, Mode 3/A 3644, indicating FL15 (height 1000ft). In response to the Tornado pilot, at 1349:16, Marham TWR replied "[Tornado C/S] *surface wind 270/16*". At this time, the Marham TWR did not report any aircraft ahead of the Tornado, either because the controller believed the Tornado was sequenced ahead of the BAe146, or by omission from phraseology described within CAP413[2]. Without a notification of "one ahead," and as the aircraft established in the circuit, the Tornado pilot may have assumed he was sequenced ahead of the BAe146.

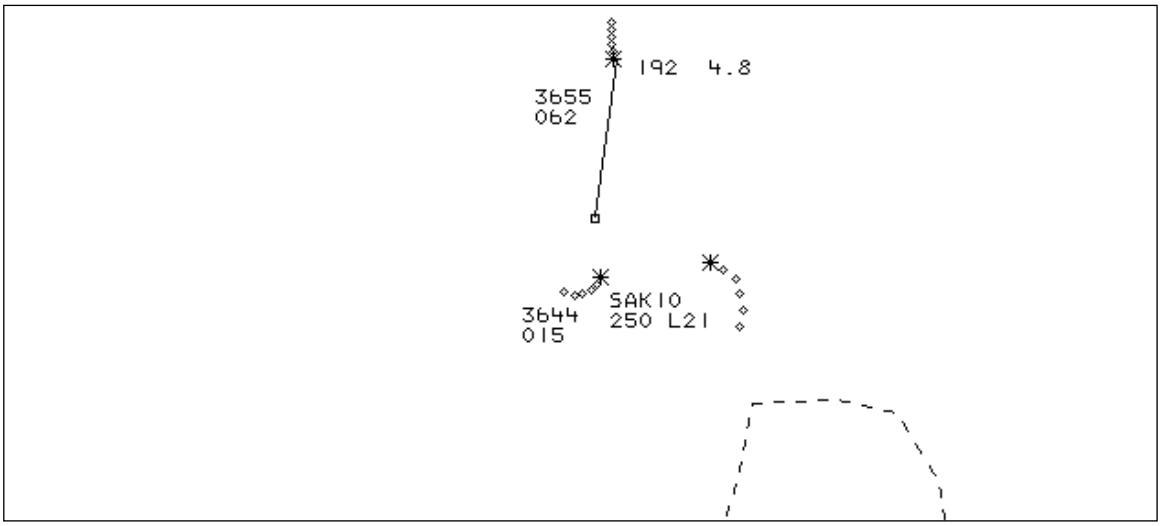

Figure 1

After the Tornado pilot's downwind call, Marham TWR returned their attention to the BAe146, instructing, at 14:49:19, "[BAe 146 C/S] *roger, report right base."* The BAe146 pilot replied that he was at right base "[BAe 146 C/S] *right base this time, gear down for touch and go.*" At 13:49:30,

[2] CAP413 Ch4 1.8.7 It may be necessary in order to co-ordinate traffic in the circuit, to issue a pilot his number in the sequence along with the position of the preceding aircraft and delaying action if necessary.

Marham TWR instructed the BAe146 pilot, "[BAe 146 C/S] *continue approach*", to allow time to configure the runway for BAe146 use. BAe146 acknowledged the instruction to continue.

At 13:49:44, Marham TWR cleared the BAe146 pilot, "[BAe 146 C/S]*, clear to touch and go, barrier down*" and the BAe146 pilot acknowledged, "*Clear to touch and go,* [BAe 146 C/S]*. Thanks*". ATC's issuance of the landing clearance sequenced the BAe146 ahead of the Tornado for use of the runway. The scene is depicted in Figure 2 (below) with the BAe146, Mode 3/A 3655, descending through FL43 (height 3800ft) and the Tornado, Mode 3/A 3644, downwind indicating FL15 (height 1000ft).

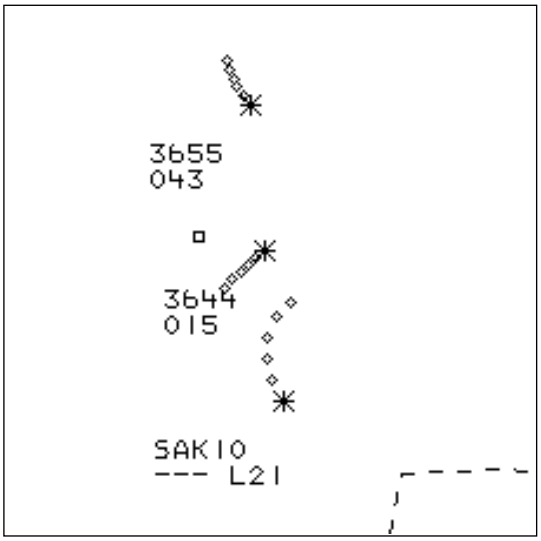

Figure 2

At 13:49:54, the Tornado pilot asked Marham TWR for a position report on the BAe146, "*Tower,* [Tornado C/S]*, any chance…where is the Northolt callsign please?*". This question indicated that the Tornado pilot was not visual with the BAe146, which was cleared to use the runway, and sequenced ahead of the Tornado. Marham TWR informed the Tornado pilot, "[Tornado C/S]*, Northolt callsign is 2 miles, 1 mile left of centre line, descending through two, er, four thousand feet*". At 13:50:06, a transmission, believed to be the Tornado pilot, replied "*That's copied. We are maintaining circuit height".* At 13:50:12, Marham TWR updated the traffic information to the Tornado pilot, "[Tornado C/S]*, roger, he's in your 12 o'clock, 1 mile, crossing right left.*" The Tornado pilot replied "*Yeah, we're visual with him now*", indicating that the Tornado pilot was visual with the BAe 146, which was 2300ft above the Tornado, as depicted in Figure 3 below.

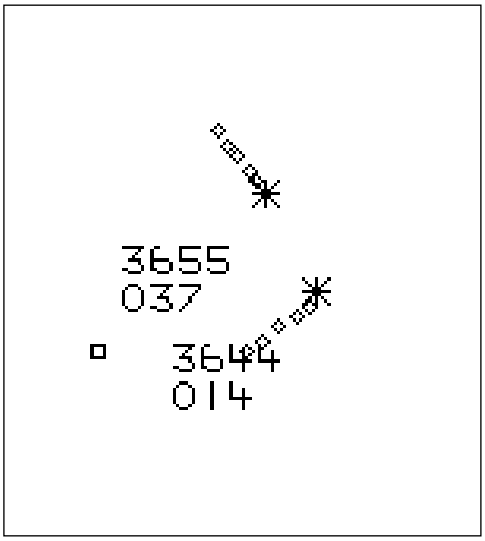

Figure 3

At 13:50:37, the Tornado pilot reported "*Tower* [Tornado C/S*], it looks like the 146 is now pointing his nose and diving down into us*". Seven seconds later the BAe146 pilot replied "[BAe 146 C/S] *is visual with the Tornado*". The aircraft positions are depicted in Figure 4 below. This is determined to be the point of the Airprox and CPA is recorded as less than 0.1nm and 1100ft.

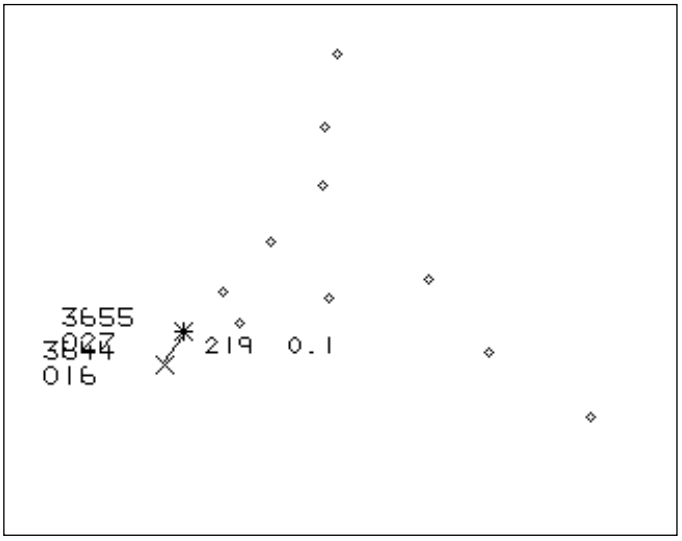

Figure 4

BAe146 aircraft often conduct "Tactical Approach Training" at RAF Marham. The aircraft captain will confirm their requirements with the ATC Supervisor when seeking prior permission to make approaches at the airfield. Although, the procedure is practised "often", Marham ATC did not publish orders or training guidance to advise controllers how to integrate the Tactical Approaches with circuit traffic. To cater for the BAe146 approaches, Marham ATC reported adopting guidance for a similar procedure that is employed by Tornado that concludes with a straight-in approach. There was an opportunity to provide guidance with regards sequencing when the Tornado reported downwind by indicating whether the Tornado or BAe146 was ahead. By not reporting one ahead to the Tornado, he may have assumed priority for the runway. However, the subsequent clearance for the BAe146 to use the runway confirmed order of priority. At no point was there an indication to the Tornado pilot that the BAe146 was commencing a right-base join from a height differing from circuit height.

The BAe146 pilot was conducting "Tactical Visual approaches" commencing from 14,000ft QFE, and on this occasion requested a right-base join. The Tornado crew was conducting visual circuits at 1000ft QFE. Immediately prior to the Airprox, both aircrew reported being visual with each other. 21sec later, the Tornado pilot reported that he believed the BAe146 was diving onto him. The BAe146 pilot maintains he was visual with the Tornado, and that there was adequate separation, and was not concerned by the proximity of the Tornado.

Comments

HQ Air Command

From the RT exchanges there appeared to be sufficient information to allow the Tornado crew to recognise that the BAe146 was a factor to them. Two important items were not included, however: the height profile of the 146 pilot's approach and the sequencing of each aircraft by number. With the Tornado already established in the visual circuit, the crew would expect the 146, as the joining aircraft, to be responsible for collision avoidance. Due to the 146 pilot joining via an unfamiliar (and largely un-communicated) procedure, the Tornado crew were faced with interpreting the 146 pilot's intentions primarily by visual means, which did not occur until the finals turn. In this situation, the Tornado crew did their best to understand the situation and deconflict. ATC's inaction here contributed to the low SA of the Tornado crew; what was expected by the

controller was not expected by the Tornado crew. Had the Tornado been instructed to vacate the circuit out to Initials, or similar, the ac would have remained deconflicted throughout.

Summary

This incident occurred at 1351 on 11th September 2013 when a BAe146 and a Tornado flew into confliction. Both pilots were operating under VFR in VMC in communication with Marham TWR, the Tornado pilot in the RAF Marham visual circuit and the BAe146 pilot conducting a 'tactical visual approach'.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

Information available included reports from the pilots of both ac, transcripts of the relevant RT frequencies, radar video recordings, reports from the air traffic controllers involved, and reports from the appropriate ATC and operating authorities.

The Board first considered the Tornado pilot's actions. He had just overshot from a radar approach and therefore was not aware of the BAe146 pilot's previous steep approaches or intentions. The lack of traffic information or explicit direction from ATC as he established himself downwind resulted in ambiguity in the Tornado pilot's mind. This ambiguity was resolved to some extent by the controller issuing a clearance for the BAe146 pilot to 'touch and go' as the Tornado pilot passed abeam the RW23 threshold just prior to his final turn; this was 46sec before CPA (with the BAe146 in the Tornado pilot's left 10 o'clock position, 2800ft above and at a range of about 2½nm). The Tornado pilot requested traffic information about 10sec later, no doubt prompted by his inability to see the BAe146 which, given the sparse content of the radio calls and his lack of SA, was at an altitude that he was neither expecting nor could reasonably have been expected to know of. Further description by ATC or the BAe146 pilot of his position, e.g. 'high right base', would have been reasonable at this point and would have highlighted the Tactical Approach profile. The Tornado pilot started to turn finals, albeit remaining level, before eventually gaining visual contact with the BAe146 on his nose at about ¾nm and 2000ft above. Members opined that, given his lack of situational awareness and the fact that the BAe146 had been cleared 'touch-and-go' ahead of him, the Tornado pilot would have been better advised to have either departed the visual circuit for 'Initials' at the end of the downwind leg (before he had sighted the BAe146) or, on sighting the BAe146 during his final turn, have gone around behind the BAe146 onto the deadside; both actions would have removed the risk of confliction. In the event, he continued the level, final turn and flew along the same final track as the BAe146. Members discussed the likely mind-set of the Tornado pilot and agreed that, in light of the parametric data from the radar recording, he probably only felt threatened when the BAe146 pilot lowered his aircraft's nose into a steep descent and pointed directly at him.

The BAe 146 pilot was conducting Tactical Approach training and had already made a number of approaches to the airfield. His flight profile necessarily did not conform to that of a visual circuit, which highlighted the need for explicit RT and the passing of appropriate traffic information. Furthermore, it appeared to the Board that the tactical approaches had been conducted in an ad hoc manner without any formal procedures or appropriate RT phraseology in place. After some discussion, the Board felt that an appropriate course of action would be to establish proper procedures for the integration of Tactical Approaches with visual circuit traffic at RAF airfields, and the Board made a recommendation to HQ Air Command to that effect.

Turning to the TWR controller, some ATC members observed that the conduct of control in the visual circuit at a civilian airfield with ATCO control was markedly different from that in a military airfield visual circuit. It was observed that civilian control was more directive, whereas a military visual circuit relied to a greater degree on decision making by the military pilots. Nonetheless, it was the unanimous opinion of the Board that the TWR controller could have passed much more timely and comprehensive information to the Tornado pilot given the unusual nature of the BAe146 pilot's activities. As a side issue, members also noted the potential for confusion should a civilian pilot be operating in a military ATCO controlled visual circuit and vice versa, caused by the conflicting expectations alluded to previously.

In the event, the Tornado pulled ahead of the BAe146 from CPA onwards, and the BAe146 pilot conducted a touch and go behind the Tornado progressing upwind. In light of the achieved separation distance and the fact that both pilots had each other visual well before CPA, the Board agreed that normal safety standards had applied.

PART C: ASSESSMENT OF CAUSE AND RISK

Cause: The BAe 146 pilot's flight profile caused the Tornado pilot concern.

Contributory Factor(s): 1. Insufficient traffic information on the BAe 146 flight profile from ATC to the Tornado pilot.
2. No recognised procedure for the integration of traffic conducting Tactical Approaches at RAF Marham.

Degree of Risk: E.

ERC Score[3]: 1

Recommendation: HQ Air Command develops SOPs and phraseology for Tactical Approaches.

[3] Although the Event Risk Classification (ERC) trial had been formally terminated for future development at the time of the Board, for data continuity and consistency purposes, Director UKAB and the UKAB Secretariat provided a shadow assessment of ERC.