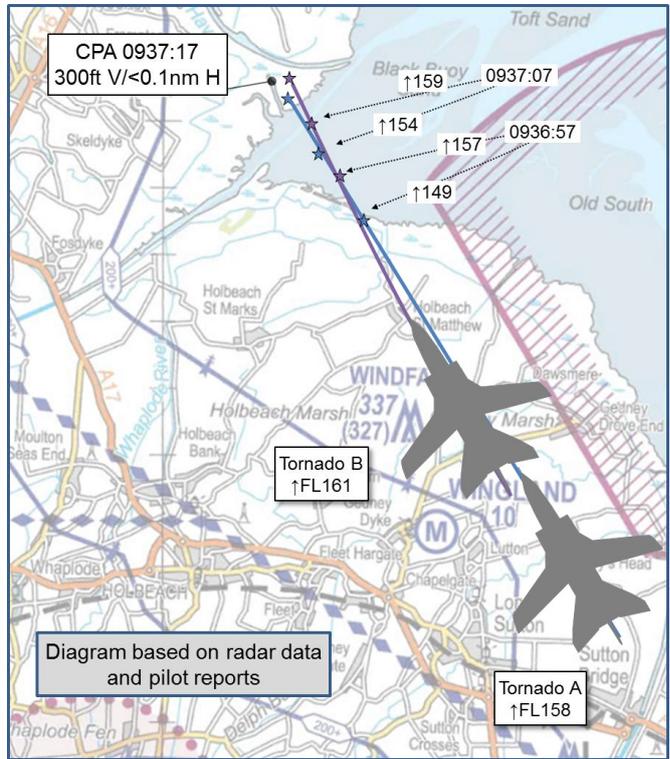


AIRPROX REPORT No 2015110

Date: 14 Jul 2015 Time: 0937Z Position: 5256N 00002E Location: 10nm NW Holbeach

PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

Recorded	Aircraft 1	Aircraft 2
Aircraft	Tornado A	Tornado B
Operator	HQ Air (Ops)	HQ Air (Ops)
Airspace	Lon FIR	Lon FIR
Class	G	G
Rules	IFR	IFR
Service	Traffic	Traffic
Provider	Marham App	Marham App
Altitude/FL	FL158	FL161
Transponder	A,C,S	A,C,S
Reported		
Colours	Grey	Grey
Lighting	HISLs	
Conditions	IMC	IMC
Visibility	In cloud	20m (in cloud)
Altitude/FL	FL150	FL170
Altimeter	1013hPa	1013hPa
Heading	330°	330°
Speed	350kt	250kt
ACAS/TAS	Not fitted	Not fitted
Separation		
Reported	0ft V/0.2nm H	0ft V/~75m H
Recorded	300ft V/0.1nm H	



THE TORNADO(A) PILOT reports he was No2 in a formation of two Tornados. They had departed from Marham and were conducting a snake climb through IMC layers.¹ As the aircraft broke cloud at FL060, the he called ‘visual’ to the leader but briefed that he would maintain the snake climb. Shortly afterwards, Marham ATC informed them that they would have to be a single speaking unit within the next 10nm for their radar handover to Swanwick if they wished to remain as a formation. The lead pilot (in Tornado(B) ahead) briefed that he would slow to 250kts and the No2 pilot then selected reheat to close up on the leader . The No2 aircraft Weapons System Officer (WSO) was “heads-in” to try to establish radar lock on the leader; however, when he looked up he noticed they were IMC again, and asked the pilot to confirm he was still visual with the lead. The pilot replied negative, and the WSO called for a bunt to increase separation. As they bunted, the crew fleetingly gained visual with the lead aircraft on their right, co-altitude and close aboard (subsequent on-board tape analysis indicated 0.2nm separation). They then continued to descend, received a separate squawk from ATC and continued as a separate unit until the formation was able to rejoin visually.

He assessed the risk of collision as ‘High’.

THE TORNADO(B) PILOT reports he was the lead pilot of a pair of Tornados conducting a 30-second snake climb out of Marham. On passing FL120, climbing to FL180, ATC advised that the formation would need to be in standard formation to cross controlled airspace. As the lead pilot, he called slowing to 250kts from the SOP climb speed of 300kts to expedite the join, and noticed the Air-to-Air TACAN range reduce as the No2 closed up. On passing FL170, with the Air-to-Air TACAN reading 0.1nm, the aircraft entered patchy cloud. On exiting the cloud some 4-5 seconds later, the No2 aircraft was seen in the 9 o’clock position, slightly high, at approx 50-100m range moving away

¹ A snake climb is a military procedure whereby formations of aircraft follow each other during IMC climbs after take-off, normally separated at 30 second intervals. The leader calls each turn on the radio, and subsequent aircraft wait their specified separation time before they then turn to follow the same track. If still IMC at the top of climb, each aircraft levels at a their own Flight Level, stepped down from the leader.

from the lead aircraft, at which point the aircraft entered cloud again. With the formation now split again, and in IMC, a separate transit altitude through the airway was requested from ATC.

He assessed the risk of collision as 'Medium'.

Factual Background

The weather at Marham was reported as:

METAR EGYM 140850Z 29003KT 7000 HZ FEW010 SCT014 BKN015 18/15 Q1016 GRN NOSIG

Analysis and Investigation

Military ATM

The Airprox occurred between two Tornados (Fang formation) under a Traffic Service from RAF Marham. The Marham controller was in the process of handing over Fang to RAF (U) Swanwick at the time of the Airprox.

Portions of the tape transcript between Fang and Marham Approach (RA) are below:

From	To	Speech Transcription	Time
Fang	RA	Approach Fang one passing fifteen hundred feet requesting Deconfliction Service.	09:31:49
RA	Fang	Fang one Marham Approach identified Deconfliction Service reduced climb flight level one eight zero own navigation.	09:31:53
Fang	RA	Deconfliction service reduced climb flight level one eight zero own navigation Fang one flight.	09:31:59
RA	Fang	Fang one are you urgh happy MARSAS ² with Fang two?	09:32:07
RA	Fang	Fang one flight what heading are you rolling out on?	09:32:55
Fang	RA	Three three zero fang one flight.	09:33:00
RA	Fang	Fang one flight roger.	09:33:01
RA	Fang	Fang one are you happy with MARSAS Fang two?	09:33:51
Fang	RA	Affirm Fang one.	09:33:55
RA	Fang	Fang one roger, report holding hands. ³	09:33:57
Fang	RA	Wilco Fang one.	09:33:59
RA	Fang	Fang one flight I will need you holding hands within the next one zero miles to hand you over to Swanwick.	09:35:08
Fang	RA	Copied Fang one.	09:35:14
RA	Fang	Fang one flight there is traffic to the west one zero miles believed to be a threeship or fourship of Typhoons coordinated to the west.	09:36:42
Fang	RA	Copied and Fang one is holding hands.	09:36:50
RA	Fang	Fang one roger.	09:36:53
RA	Fang	Fang one flight traffic twelve o clock one five miles opposite direction indicating flight level one three zero.	09:37:05
Fang	RA	Looking Fang one.	09:37:12
RA	Fang	Fang two squawk standby.	09:37:20
???	???	Passing one seven zero now.	09:37:40
RA	Fang	Fang one flight continue with Swanwick mil two five nine decimal six zero.	09:37:44
Fang	RA	Two five nine six zero fang one flight.	09:37:48

² MARSAS - Military Accepts Responsibility for Separation of Air Systems.

³ 'Holding hands' is a military term for flying in formation.

At 0936:44 (Figure 1), Fang can be viewed in trail.

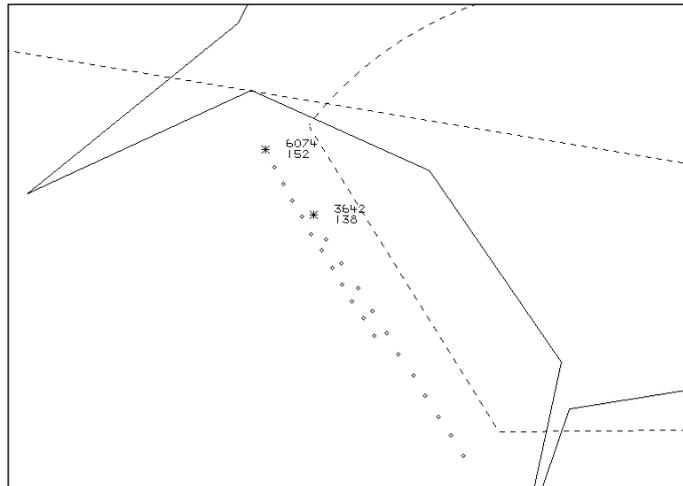


Figure 1: Geometry at 0936:44 (Fang 1 squawk 6074; Fang 2 squawk 3542).

Figure 2 at 0937:01 shows Fang 2 closing at 450 knots.

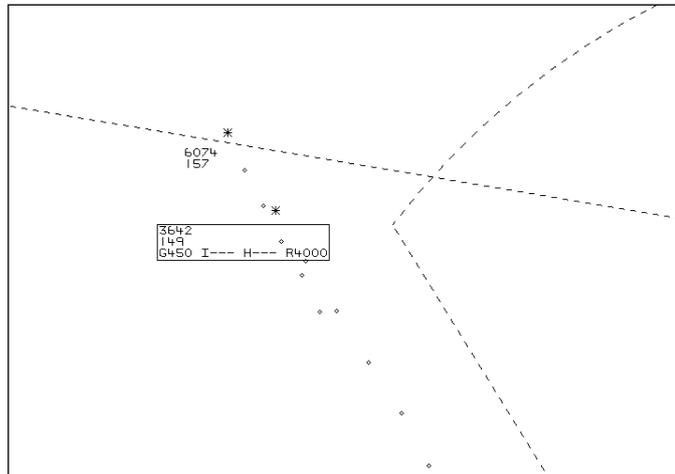


Figure 2: Fang 2 closing at 0937:01.

At CPA, the aircraft were showing 0.1nm horizontal separation and 300ft vertical separation, at 0937:18 (Figure 3).

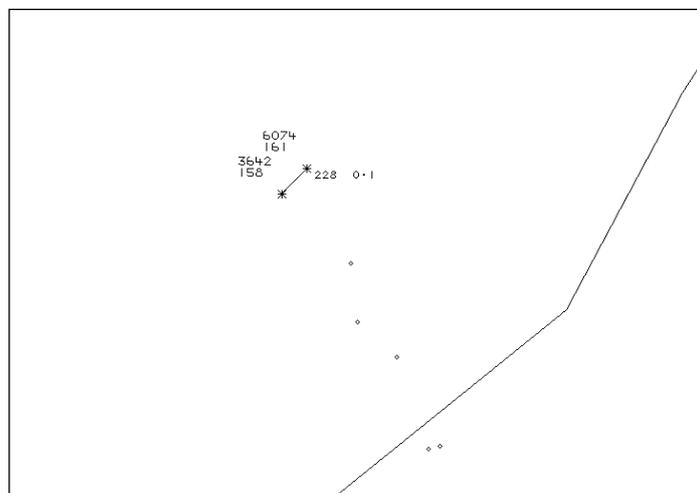


Figure 3: CPA at 0937:18.

Marham Approach applied a reduced Deconfliction Service in the climb to FL180. The controller checked that the flight were content with Military Accepts Responsibility for Separation of Air Systems (MARSAs). MARSAs are defined as, "Within a formation of military Air Systems the formation leader is responsible for separation between units comprising the formation."⁴ Following agreement of MARSAs, the controller would not be expected to deconflict the two elements within Fang formation. The regulations also state that, "Prior to a formation entering CAS, controllers will obtain confirmation on RT that all formation elements are contained within 1 nm laterally and longitudinally for military Air Systems and are at the same level."⁵ By confirming that the formation were 'holding hands', the controller was confirming that the crew were complying with formation procedures for controlled airspace.

The controller's responsibility was for deconflicting Fang with other aircraft and not within the formation. The request for the formation to close was based on the requirements to cross controlled airspace.

UKAB Secretariat

Both pilots shared an equal responsibility for collision avoidance and not to operate in such proximity to other aircraft as to create a collision hazard⁶. SERA rules for formation flights are as follows:

Aircraft shall not be flown in formation except by pre-arrangement among the pilots-in-command of the aircraft taking part in the flight and, for formation flight in controlled airspace, in accordance with the conditions prescribed by the competent authority. These conditions shall include the following:

- (a) one of the pilots-in-command shall be designated as the flight leader;
- (b) the formation operates as a single aircraft with regard to navigation and position reporting;
- (c) separation between aircraft in the flight shall be the responsibility of the flight leader and the pilots-in-command of the other aircraft in the flight and shall include periods of transition when aircraft are manoeuvring to attain their own separation within the formation and during join-up and breakaway; and
- (d) for State aircraft a maximum lateral, longitudinal and vertical distance between each aircraft and the flight leader in accordance with the Chicago Convention. For other than State aircraft a distance not exceeding 1 km (0,5 nm) laterally and longitudinally and 30 m (100 ft) vertically from the flight leader shall be maintained by each aircraft.⁷

Comments

HQ Air Command

This incident led to a detailed investigation on the Unit concerned and a number of recommendations have been made. The snake climb procedure, when correctly flown, is a valid IMC formation procedure. However, deviation from pre-briefed parameters will invariably increase the likelihood of misunderstanding unless clear direction is forthcoming from the formation leader. Furthermore, as the joining aircraft there should always be an 'escape plan' (lateral or vertical separation) and this should be vocalised within the crew. Following the investigation, a review of the Tornado Force handbook covering snake climb and radar trail procedures has been undertaken and snake climbs are being considered for inclusion within the Tornado simulator syllabus. This incident is also used as an example when delivering Human Factors and Crew Resource Management training to the Tornado Force.

⁴ MAA RA 3234(1) para2.

⁵ MAA RA 3234(1) para 8.

⁶ SERA.3205 Proximity.

⁷ SERA.3135 Formation Flights

Summary

An Airprox was reported on 14 July 2015 at 0937 between two Tornados. The Tornados were trying to effect a formation join between cloud layers but did not achieve this before entering IMC. Both aircraft were receiving a Traffic Service from Marham ATC but were operating as a single entity responsible for their own intra-formation separation. Tornado (A) was the No2 in the formation and was rapidly closing on his leader from behind as they entered cloud. As the aircraft broke through the cloud, the No2 pilot saw the lead aircraft in close proximity.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

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

The Board heard from the military members that the snake climb had been used successfully for many years in the Tornado force, there were specific procedures involved to ensure it's safe use, but that it did need a fair amount of time and track miles to effect a join up after achieving VMC; they emphasised that the join up was not intended to be in IMC.

Some Board members wondered whether ATC had enticed the formation to rush their join by asking them to be in close formation to cross controlled airspace; however, other pilots with military experience opined that they would have been well aware of the need to join up before they crossed through controlled airspace, and that this would undoubtedly have been briefed during their mission planning, as would a contingency plan should they be unable to do so.

Ultimately, members agreed that the weather conditions had not been suitable for the join up, and the Board opined that it was fundamentally the lead pilot's responsibility to make that decision, and for the No2 pilot not to try to attempt to do so if he could not be sure that he would remain VMC throughout. The Board heard that it was a relatively junior pilot in Tornado(A), and wondered whether he felt pressured by the more experienced crews around him into continuing a course of action which was clearly not ideal, when in fact he should have broken out of formation using an escape manoeuvre before he went IMC during the closure. They also wondered about the wisdom of the WSO focusing on achieving a radar lock on the leader, helpful though that might have been in providing a relative position for the pilot to use as a reference, when his inexperienced pilot was trying to effect a visual join in what were clearly marginal conditions. The Board heard that since the Airprox the Standard operating Procedures for snake climbs have been rewritten to specifically state that formations should go into trail positions should they go IMC whilst trying to join up. Furthermore, in the future the RAF intended to include snake climbs as part of simulator training.

When determining the cause, the Board agreed that the root cause was that the Tornado(A) pilot flew into conflict with Tornado(B) during the formation join. However, they assessed that it was a contributory factor that Tornado(B) pilot had instructed Tornado(A) pilot to close up in conditions that were not suitable. The Board discussed whether to make any recommendations with regard to snake climbs but, in the end, agreed that the Unit OSI had made sufficient recommendations which would only be repeated by the Board. When discussing the risk, the Board agreed that neither pilot had taken avoiding action and, although Tornado(A) had bunted, this was thought to have been after CPA and so the risk was assessed as Category A, chance had played a major part in events.

PART C: ASSESSMENT OF CAUSE AND RISK

Cause: Tornado(A) pilot flew into conflict with Tornado(B) during the formation join.

Contributory Factor(s): Tornado(B) pilot instructed Tornado(A) pilot to close up in conditions that were not suitable.

Degree of Risk: A.