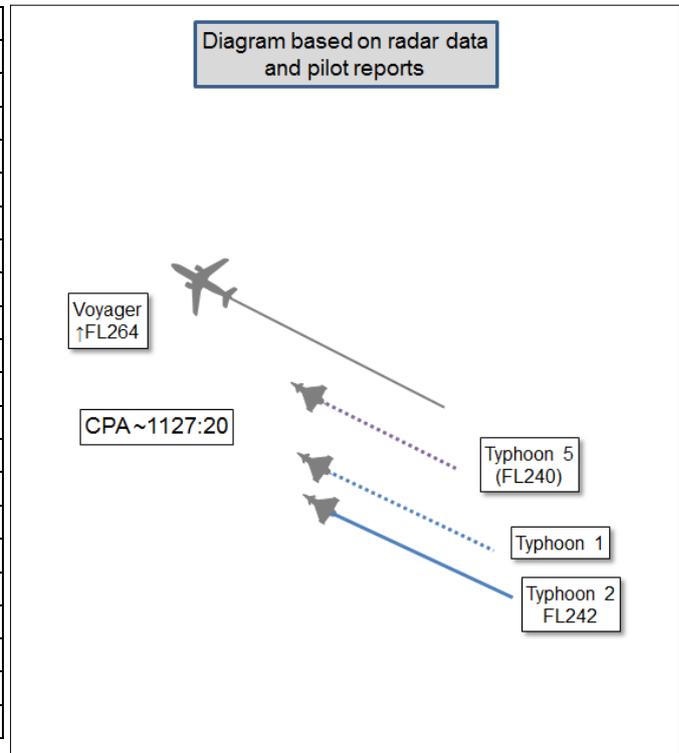


## AIRPROX REPORT No 2017026

Date: 28 Feb 2017 Time: 1127Z Position: 5516N 00129E Location: AARA7

### PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

Recorded	Aircraft 1	Aircraft 2
Aircraft	Typhoon 1	Typhoon 5
Operator	HQ Air (Ops)	HQ Air (Ops)
Airspace	London FIR	London FIR
Class	C	C
Rules	VFR/IFR	VFR/IFR
Service	Traffic	Traffic <sup>1</sup>
Provider	Boulmer	Boulmer
Altitude/FL	NK	NK
Transponder	Stby	Stby
<b>Reported</b>		
Colours	Grey	Grey
Lighting	NK	NK
Conditions	IMC	IMC
Visibility	NK	NK
Altitude/FL	FL241	FL240
Heading	NK	NK
Speed	NK	NK
ACAS/TAS	Not fitted	Not fitted
<b>Separation</b>		
Reported	0ft V/400m H	Not Seen
Recorded	NK	



**THE TYPHOON 1 PILOT** reports leading a formation pair to Tow Line 7 (TL7) to conduct air-to-air refuelling (AAR). Ahead was another Typhoon pair and Typhoon 5, a singleton. The tanker was established in TL7 at FL250 with a single Typhoon in contact and the preceding Typhoon pair alongside. Typhoon 5 was established at FL230 in IMC, attempting to gain visual with the tanker and other aircraft. Typhoon 1 flight were level at FL220 as the next in order to join. Typhoon 1 flight were cleared to FL240, in radar trail of the tanker, with FL240 being confirmed as clear by the tanker on the tactical (join) frequency, which was being controlled by HOTSPUR [a Boulmer controller]. Whilst closing to the tanker in IMC for the join, Typhoon 1 pilot became visual with a Typhoon in his right, 2 o'clock, co-height, assessed to be within 0.25nm. Typhoon 1 flight ceased their join on the tanker and informed HOTSPUR on the tactical frequency that he was visual with a Typhoon, at FL240, in trail of the tanker. HOTSPUR asked the tanker if FL240 was clear, to which the response was 'FL240 should be clear'. Typhoon 1 pilot then informed the tanker that he was visual with a Typhoon at FL240 and ensured no follow on conflict by maintaining visual. Typhoon 1 flight then ceased their join and returned to base due to fuel. On subsequent post-flight tape review, Typhoon 1 and Typhoon 5 were assessed to have been as close as 1100ft, co-level, prior to Typhoon 1 pilot gaining visual with Typhoon 5. Of note, Typhoon 5 had inhibited transponder M3/C and data-link transmissions iaw Typhoon AAR checks.

He assessed the risk of collision as 'Very High'.

**THE TYPHOON 5 PILOT** reports that he gained visual with the tanker and all aircraft alongside, began a visual join and switched across [from the join] to the boom frequency. During this process he lost visual with the tanker as it entered cloud. He descended back to FL240 and ceased overtake whilst maintaining 2.5nm radar trail. The pilot communicated this to the tanker on the boom frequency which was acknowledged by the tanker crew, who stated they would commence a climb to FL270 in

<sup>1</sup> Once the Typhoon 5 pilot was in communication with the tanker on the boom frequency he became a member of the formation led by the tanker and subject to the Air Traffic Service agreed with the tanker crew, initially a Traffic Service and then Radar Control above FL245.

order to clear the weather. Due to being on the boom frequency throughout, he was not aware of Typhoon 1's presence at any point, and was not aware of the proximity of Typhoon 1 until his sortie debrief.

**THE TANKER PILOT** did not complete an individual report but contributed fully to the safety investigation.

**THE HOTSPUR CONTROLLER** reports that, on check in, the Tanker struggled to find an appropriate tanking level in AARA7 due to adverse weather and, after a descent to FL100 to assess the cloud, climbed to FL250 and established in the block FL220-260 on a Traffic Service with Radar Control above FL245. A single Typhoon and a pair of Tornados were behind the tanker on the boom frequency prior to a 5 aircraft Typhoon formation checking in as 3 separate formations, 2 pairs and a singleton. The tanker was called to all 3 formations and the aircrew were made aware of the number of aircraft in behind. The Typhoon formation discussed their fuel priorities and gave the order of priority as numbers 3 and 4 (a pair) followed by Typhoon 1 and 2 (a pair) and then Typhoon 5 (a singleton). The Typhoons 3 and 4 joined the tanker with no issues, squawked standby and were pushed to the boom frequency. Typhoon 5 then called visual with the tanker and requested join. He was instructed to squawk standby within 3nm and to switch to the boom frequency. The Tornados then departed the tanker and checked in with HOTSPUR for departure; they were vectored away and handed over for their subsequent transit. Typhoon 1 flight then called that they were in IMC and requested a climb to the joining level. The controller asked the tanker crew if FL240 was clear, to which the response was affirmative, and the tanker requested a climb to establish the block FL230-270. The controller approved both Typhoon 1 flight to climb to FL240 and the tanker combine to FL260. As the Typhoon 1 flight approached the tanker, they informed the controller that there was a single Typhoon at FL240. The controller then asked the tanker crew to confirm whether FL240 was clear, to which they responded, 'FL240 should be clear'. Typhoon 1 flight were then instructed to maintain visual with the single Typhoon [Typhoon 5] as HOTSPUR had no contact on the non-squawking aircraft in combine with the tanker. Typhoon 1 flight then returned to base. The controller noted that he was unable to listen to the boom frequency due to a lack of available radios.

**THE HOTSPUR SUPERVISOR** reports he listened to the controller's check-in and initial admin procedures with the tanker as it came on channel. The supervisor was aware of his block, the IMC conditions and the stipulated services, all of which he judged as satisfactory and safe. He was informed by the controller when the 5 aircraft Typhoon formation were en-route to the tanker and was briefed the sequencing order, and that all aircraft had been given sufficient SA of each other's positions, routing and the tanker block. Of the 4 positions he was supervising, he concentrated on the AAR controller whilst he carried out the joining of the first 2 pairs and then, deeming that he was clearly on top of things, moved his attention to the other sorties, leaving the position monitor function and AAR primary radio selected. When the tanker requested to change block due to IMC the controller informed him, confirmed that the tanker had passed that FL240 was clear, and the supervisor therefore approved the block change. Due to concentrating on another sortie's radio at the time, he did not directly hear Typhoon 1 communication about being visual with the other Typhoon. He was briefed on what had occurred by the controller immediately afterwards. Based on his report and the narrative, the supervisor was satisfied that the controller performed the correct actions upon realising there was an issue, and all appropriate actions were taken on lead-up to the AAR. A boom frequency would have provided useful SA in this incident, probably enabling realisation that FL240 was not clear as the tanker had stated, but unfortunately due to serviceability, an appropriate radio was not available.

## Factual Background

A transcript of the HOTSPUR frequency was provided, as follows:

From	To	Speech Transcription	Time
HOTSPUR	Typhoon 1	[Tanker C/S] BRAA 340, 4 miles, tracking 290, FL250.	11:23:20
Typhoon 1	HOTSPUR	Copied, we're currently I M C. Going to need to climb into the joining block when able.	11:23:27
HOTSPUR	Typhoon 1	Roger.	11:23:33
HOTSPUR	Tanker	[Tanker C/S] is FL240 clear?	11:23:37
Tanker	HOTSPUR	Affirm, 240 is clear and request the block up 270, [Tanker C/S].	11:23:44
HOTSPUR	Tanker	[Tanker C/S], Hotspur approved block up to FL270, Break Break, [Typhoon 1 C/S] flight climb FL240.	11:23:52
Typhoon 1	HOTSPUR	Copied, and confirm [ <i>other Typhoon pair C/S</i> ] is still at FL230?	11:23:55
HOTSPUR	Tanker	[Tanker C/S], Hotspur confirm level of [ <i>other Typhoon pair C/S</i> ]?	11:24:02
Tanker	HOTSPUR	Err, [ <i>other Typhoon pair C/S</i> ] is now level with us, [Tanker C/S].	11:24:09
HOTSPUR	Tanker	Hotspur.	11:24:10
Typhoon 1	HOTSPUR	Climbing FL240 [Typhoon 1 C/S] flight.	11:24:17
HOTSPUR	Tornado	[Tornado C/S] flight, Hotspur standby for handover.	11:24:36
Tornado	HOTSPUR	[Tornado C/S]	11:24:38
HOTSPUR	Tornado	[Tornado C/S] flight, Hotspur squawk 5151.	11:25:08
Tornado	HOTSPUR	5151, [Tornado C/S]	11:25:10
Typhoon 1	HOTSPUR	Hotspur, [Typhoon 1 C/S] confirm the BRAA of the tanker to me please?	11:25:25
HOTSPUR	Typhoon 1	[Typhoon 1 C/S] flight, Hotspur apologies say again?	11:25:29
Typhoon 1	HOTSPUR	Request the BRAA from the tanker to me please?	11:25:32
HOTSPUR	Typhoon 1	[Typhoon 1 C/S], tanker BRAA 340, 4, 20 correction FL260.	11:25:38
Typhoon 1	HOTSPUR	Copied, [Typhoon 1 C/S] flight are now level FL240.	11:25:42
HOTSPUR	Typhoon 1	Hotspur.	11:25:43
HOTSPUR	Tornado	[Tornado C/S] flight, Hotspur re-contact this agency TAD 148, TAD 148, POGO.	11:25:56
Tornado	HOTSPUR	TAD 148 for [Tornado C/S]	11:26:01
Tanker	HOTSPUR	Hotspur, from [Tanker C/S] can you confirm [Tornado C/S] are routing to the Southwest and clear of us?	11:26:07
HOTSPUR	Tanker	Affirm [Tanker C/S], [Tornado C/S] are BRAA 200, 12 miles, tracking West.	11:26:15
HOTSPUR	Typhoon 1	[Typhoon 1 C/S] flight, Hotspur are you visual with [Tanker C/S] yet?	11:26:20
Typhoon 1	HOTSPUR	Negative [Typhoon 1 C/S] flight.	11:26:22
HOTSPUR	Typhoon 1	Roger, [Tanker C/S] on your nose 5 miles.	11:26:26
Typhoon 1	HOTSPUR	Copied, have they elevated through 250?	11:26:30
HOTSPUR	Tanker	[Tanker C/S], Hotspur confirm FL250 is clear?	11:26:35

From	To	Speech Transcription	Time
Tanker	HOTSPUR	Affirm 250 is clear, we are now passing through 261 climbing 270.	11:26:45
HOTSPUR	Tanker	Hotspur copied, [Typhoon 1 C/S] clear climb FL250.	11:26:48
Typhoon 1	HOTSPUR	Cleared climb FL250, [Typhoon 1 C/S]	11:26:53
Typhoon 2	Typhoon 1	Err, [Typhoon 2 C/S] request internal message to [Typhoon 1 C/S]?	11:27:00
Typhoon 2	Typhoon 1	[Typhoon 1 C/S] from [Typhoon 2 C/S] (... <i>indistinct</i> ...)	11:27:10
HOTSPUR	Typhoon 1	[Typhoon 1 C/S], Hotspur [Tanker C/S] right of nose 2, climbing through FL265.	11:27:18
Typhoon 1	HOTSPUR	Copied, and can you confirm that's [Typhoon 5 C/S] too that's low at FL240 in the trail of err the tanker?	11:27:26
HOTSPUR	Tanker	[Tanker C/S], Hotspur can you confirm your clear levels?	11:27:37
Tanker	HOTSPUR	Err [Tanker C/S], FL240 should be clear.	11:27:49
Typhoon 1	Tanker	That's a negative, there's a Typhoon in your trail 2 and half miles, FL240.	11:27:52
Unknown	Tanker	( <i>Clipped transmission</i> )	11:28:02
HOTSPUR	Typhoon 1	[Typhoon 1 C/S] flight, that Typhoon is non-squawking, maintain visual.	11:28:13
Typhoon 1	HOTSPUR	Maintaining visual [Typhoon 1 C/S].	11:28:14

## Analysis and Investigation

### Military ATM

An Airprox occurred on 28 Feb 17 at approximately 1130hrs UTC, in Air-to-Air Refuelling Area (AARA) 7, between 2 Typhoons. Typhoon 1 was receiving a Traffic Service from Hotspur while approaching the AARA before being transferred to the tanker's 'boom' frequency for the final join and Typhoon 5 had been transferred to the tanker.

The Hotspur controller provided regular updates to the Typhoon 1 pilot on the position of the tanker as he approached for the join. The controller was in regular communication with the tanker to confirm which levels were vacated prior to the Airprox and had no reason to believe that the information was incorrect. From the transcript, the tanker pilot was not aware of FL240 being occupied. With no squawk visible on Typhoon 5, HOTSPUR could not detect that there was an aircraft already at FL240.

### UKAB Secretariat

The Typhoon 1 and Typhoon 5 pilots shared an equal responsibility for collision avoidance and not to operate in such proximity to other aircraft as to create a collision hazard<sup>2</sup>. MoD AAR procedures are conducted in accordance with NATO STANAG 3971 Edition 7 dated 18<sup>th</sup> November 2013 (derived from ATP56-3.3.4.2 Edition C Version 1) as follows..

Chapter 1, Section II (Employment Considerations and Principles), paragraph 1.10 (Peacetime) c.(3)(d) states:

**Formation – ICAO.** ICAO does not recognize the [FAA definition] . However, Part 7 of NAT DOC 001, Guidance and Information Material Concerning Air Navigation in the North Atlantic, provides the following guidance:

<sup>2</sup> SERA.3205 Proximity.

(i) **Definition of a Formation Flight.** More than one aircraft, which, by prior arrangement between the pilots, operate as a single aircraft with regard to navigation and position reporting, are defined as a formation flight. Separation between aircraft within a formation flight remains the responsibility of the flight leader and the other pilots within it. This includes during transition periods when aircraft within the formation are manoeuvring to attain separation from each other in order to effect individual control, and during join-up and break-away.

Chapter 2 (Fixed Wing Procedures), Section I (Rendezvous Procedures), paragraph 2.2 (General Procedures) states:

- d. **Visibility.** Receivers will maintain altitude separation of at least 1000 ft until 1 nm from the tanker.
- (1) **Visual With Tanker.** Once the receiver(s) is visual with the tanker, receivers are clear to join and should initiate a progressive climb towards the tanker.
  - (2) **Not Visual With Tanker.** If receivers are not visual with the tanker, the subsequent actions will be in accordance with the capability of the receiver.
    - (a) **Receivers Without Radar or with Weather Radar.** Aircraft without radar or with only Weather Radar shall not proceed inside 1 nm unless the tanker is in sight.
    - (b) **Basic Airborne Intercept Radar.** Where receiver national limitations permit, aircraft with a basic airborne intercept radar (i.e., target search available but lock capability not available) may climb to 500 ft below base AAR altitude, maintain this level and close to ½ nm.
      - (i) **Loss of Radar Contact.** If radar contact is lost inside of 1 nm without visual contact with the tanker, the receiver is to descend to 1000 ft below tanker altitude.
    - (c) **Airborne Intercept (AI) Radar.** Where receiver national limitations permit, as long as radar lock is maintained, aircraft equipped with an AI radar may continue closure at no more than 10 kts of overtake inside of ½ nm maintaining 500ft vertical separation to a minimum range of 1500 ft.
      - (i) **Visual Contact Established.** When visual contact is established with the tanker, a progressive climb may be initiated in order to join the tanker.
      - (ii) **No Visual Contact by 1500 ft Range.** If visual contact is not established by a range of 1500 ft, closure is to cease.
      - (iii) **Loss of Radar Lock Inside ½ nm Range.** If radar lock is subsequently lost, the receiver shall re-establish at least ½ nm range and maintain a minimum of 500 ft vertical separation.
  - (3) **Visual Contact Not Established.** If visual contact is not achieved at the appropriate minimum closure range, the receiver(s) may:
    - (a) Stabilise at the appropriate minimum range and maintain it until the tanker manoeuvres into an area of improved visibility or,
    - (b) Descend to 1000 ft below the tanker, drop back to 1 nm and either maintain this position until the tanker manoeuvres into an area of improved visibility or terminate the RV.

### Occurrence Investigations

A HOTSPUR unit investigation found that the Airprox occurred while the 2 aircraft were on different frequencies with squawks off and that there was nothing the controller could have done to prevent the occurrence.

A Typhoon unit Occurrence Safety Investigation determined a number of causal factors:

1. Typhoon 1 flight was cleared to climb to FL250 by HOTSPUR when Typhoon 5 was already operating at FL240.
2. Typhoon 5 pilot turned off all transmitters iaw Typhoon SOPs, thereby denying SA to other aircraft and controllers.
3. Typhoon 5 pilot remained at FL240 when he lost sight of the tanker in cloud, but he did not reactivate his transponder or data link (iaw SOPs), thereby denying SA to other aircraft and controllers.
4. Typhoon 5 pilot informed the tanker crew of his level when he went into IMC but did not state explicitly that he would remain at FL240.
5. The tanker PF (controlling receivers) had limited experience of AAR ops and had never operated on a topline with that many receivers and consequent level of R/T.
6. The reordering of the Typhoon elements arrivals and the early arrival of another Typhoon singleton affected the tanker PF's SA and led him to assume, given the elapsed time since being cleared, that Typhoon 5 had completed his join and that FL240 was available for joining aircraft.
7. The tanker PF did not confirm visually that Typhoon 5 had completed his join before declaring FL240 available.
8. The tanker crew did not confirm Typhoon 5 pilot's intentions when the tanker commenced climbing from FL250 and assumed Typhoon 5 was climbing with them.
9. The tanker did not have data link connectivity.

In addition, the investigation made a number of recommendations:

1. All units involved with AAR to design and introduce a 'Failed Join' procedure.
2. Appropriate authorities to review SOPs and liaise to establish whether there is a need for the Typhoon to turn off any of its emitters whilst carrying out AAR.
3. Voyager tanker data link issues to be investigated.
4. Issues concerning data link communications issues in UK airspace to be investigated.
5. Appropriate Voyager authority to explore use of co-operating squawks for AAR.
6. Review AAR procedures with a large number of receivers, including a maximum number of receivers allowed at any one time.
7. Review callsign allocation.

## Comments

### HQ Air Command

This incident was the subject of a thorough safety investigation instigated by the Typhoon pilot's home unit. At the time of writing the investigation is still ongoing; however, the convening authority is content that sufficient investigation has taken place to enable the UKAB to undertake its assessment.

A number of barriers were either weakened or rendered ineffective during this incident. Lookout was compromised due to the weather; indeed, the very reason that Typhoon 5 was at FL240 is that he had lost visual contact with the tanker and Typhoon 1 became visual with Typhoon 5 at a late stage. Electronic conspicuity and the Air Traffic Service were both compromised by the standard operating procedure (SOP) of squawking standby within 3nm of the tanker – this action

denied the tanker SA on the position of Typhoon 5 through the use of its TCAS display but also denied the controlling agency SA on the position and, importantly, height of Typhoon 5.

It is unsurprising that during a busy period of aircraft joining and departing a tanker things may get missed. Here, the crucial information was that FL240 was occupied by Typhoon 5 after he lost visual with the tanker. Whilst this appears to have been announced and acknowledged on the tanking frequency, the information did not get through to the agency controlling the joining aircraft and so a subsequent pair of aircraft was cleared to an already occupied level.

A number of recommendations have already been made, including a review of the Typhoon SOPs for AAR vis-à-vis the management of aircraft transmitters (radar/transponder/MIDS) during the join. Additionally it has been recommended that national and NATO SOPs for AAR consider the development of a 'failed join' procedure.

## Summary

An Airprox was reported when two Typhoons flew into proximity at 1127 on Tuesday 28<sup>th</sup> February 2017 when joining the tanker for AAR. Both pilots were operating under VFR, intermittently in IMC, both in communication with the tanker, one on the join frequency and one on the boom frequency.

## **PART B: SUMMARY OF THE BOARD'S DISCUSSIONS**

Information available consisted of reports from the pilots, 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 were first given a short brief by the military aircrew member on Voyager-specific AAR SOPs. It was established that, in the AAR role, the Voyager crew consisted of military crew only and comprised 2 pilots, the PF and PM, and a Mission Systems Officer (MSO). The PF task was to take the receivers from the controlling agency on the 'join frequency', and bring them to the left wing, on the 'boom frequency'. The MSO's task was then to cycle the receivers through the hoses and onto the right wing, or to control the receivers should non-standard manoeuvring be required. The military member concluded by stating that in this case there appeared to have been a break-down in procedure whilst the tanker was climbing in intermittent IMC. Members also noted that although the tanker organisation had taken a full part in the Occurrence Safety Investigation, it was disappointing that military regulation had not been complied with and an Airprox DASOR had not been submitted. Members considered that, had Typhoon 1 pilot notified an Airprox on the join frequency, doubt as to the requirement of those involved to report the incident under MRP RA1410 may have been eliminated.

The Board then turned to the chronology of events, aided by information from the Typhoon aircraft R/T recordings. The 5 aircraft Typhoon formation was joining the tanker as 3 elements and not in numerical order due to differing fuel states. The agreed joining order was Typhoons 3 and 4 as a pair, followed by Typhoons 1 and 2 as a pair, followed by Typhoon 5, a singleton. In the event, the geometry of the join resulted in Typhoon 5 joining ahead of the Typhoon 1 and 2 pair. The tanker already had a single Typhoon on the wing, along with 2 Tornados refuelling. Typhoons 3 and 4 joined the tanker visually and Typhoon 5 pilot called visual with the tanker and requested join. He was switched to the boom frequency and was cleared to join but lost sight of the tanker in cloud before he could establish on the wing; he descended back to his last cleared level, FL240, transmitting that he was 'Now india mike level 240 ...'. This call occurred at the same time as Typhoon 1 flight, on the join frequency, was confirming the level occupied by Typhoon 3 flight (already on the tanker wing). Typhoons 1 and 2 were in IMC and requested a climb. The tanker crew confirmed to HOTSPUR that FL240 was clear and Typhoons 1 and 2 were cleared to FL240. Meanwhile, the Tornados had departed and the tanker crew, having requested the block to FL270, were in the climb to FL270. Typhoon 1 pilot queried whether the tanker had climbed through FL250, which the tanker pilot confirmed to HOTSPUR they had, so HOTSPUR then cleared Typhoon 1 and 2 to FL250. Coincident with that transmission on the join frequency, Typhoon 5 pilot, on the boom frequency, told the tanker

pilot that he was 'currently still 2.5 miles trail India Mike at 240'. Shortly after this, Typhoon 1 and 2 broke out of cloud and saw Typhoon 5 co-altitude at a lateral range estimated to be 0.25nm (1500ft) initially and confirmed to be of the order of 1100ft after data analysis.

Members agreed that this incident was fundamentally a result of imperfect situational awareness; a flawed appreciation of the levels of the joining aircraft compounded by the tanker climbing to a higher level; and the inhibition of electronic systems (due to SOPs) which could have provided SA. It was acknowledged that activity around a tanker could result in a rapid escalation of workload, as was the case in this incident, and hence strict adherence to procedure was essential, especially when the final stage of the join (predicated on the receiver being visual with the tanker), was not possible due to cloud. Members felt that the intermittent IMC had led to the breakdown in SA during what was essentially a join procedure designed for VMC, and that this was a contributory factor. Discussing this breakdown in SA, members noted that several electronic systems designed to provide information on separation were inhibited and they queried whether the Typhoon SOPs covering inhibition of transmitting systems were sufficiently optimised. The Board was heartened to learn that Air Command had instigated a review of emitter handling whilst joining the tanker which would consider, inter alia, the relative safety impact of transponder code garbling vs providing available altitude information; the EMC implications of using transmitters at reduced ranges; the use of 'formation mode' with ETCAS equipped tanker aircraft; and improvements to the data-link capability of tanker platforms. Members agreed that, although entirely iaw SOPs, the Typhoon 5 pilot's de-selection of all means of electronic conspicuity had been contributory to the incident.

Members discussed the role of the tanker crew and agreed that their formation leading and handling of joining receivers was fundamental to the safe execution of the AAR task. In this instance, it was apparent that the tanker crew was faced with a task which rapidly increased in complexity, to the point where they did not assimilate the information from Typhoon 5 pilot that he had returned to FL240 after losing sight of the tanker. It was thought likely that the climb to FL270, although made with the best of intentions, had added to the tanker crew workload and probably contributed to their not assimilating the Typhoon 5 pilot's calls. Members wondered whether recent flying rates were such that tanker crews were less often exposed to multiple concurrent receivers than was historically the case, and noted that other complex aviation tasks were often subject either to recency and currency requirements or had a limit to the maximum number of participants to prevent operator overload. It was agreed that although Typhoon 1 and 5 pilots had been on different frequencies, and hence could not directly communicate their levels, this situation could not be changed due to the requirement for joining traffic R/T not to impinge on a dedicated 'boom frequency', not least for potential emergency calls whilst receivers were in contact. In the event, the Board agreed that the tanker crew had not effectively controlled the joining Typhoons, and that this was contributory to the Airprox.

Turning to the cause and risk, members discussed the joining procedure and agreed that, although it was obviously not their intention, the Tanker crew had allowed Typhoon 1 flight to climb through the level occupied by Typhoon 5 and that this had been the cause of the Airprox. Some members felt that collision had only been prevented by providence, given that both aircraft were IMC until shortly before CPA, but it was agreed by the majority that, in the event, the Typhoon 1 pilot had seen Typhoon 5 whilst still astern the other aircraft and that he had been able to take effective avoiding action. Nevertheless, the Board felt that safety had been much reduced and commented that the potential for disaster was self-evident.

## PART C: ASSESSMENT OF CAUSE, RISK AND SAFETY BARRIERS

Cause: The Tanker crew allowed Typhoon 1 flight to climb through the level occupied by Typhoon 5.

Contributory Factors:

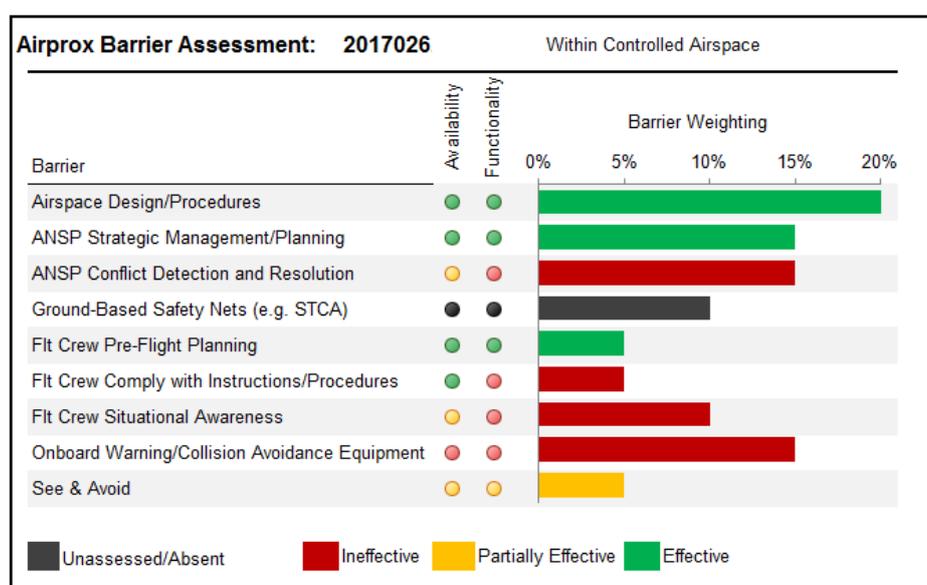
1. Using a join procedure designed for VMC whilst intermittently IMC.
2. Typhoon 5 pilot had selected all means of electronic conspicuity off, iaw SOPs.
3. The tanker crew did not effectively control the joining Typhoons.

Degree of Risk: B.

### Safety Barrier Assessment<sup>3</sup>

In assessing the effectiveness of the safety barriers associated with this incident, the Board concluded that the key factors had been that:

- **ANSP Conflict Detection and Resolution** was assessed as **ineffective** because HOTSPUR were not able to detect the confliction.
- **Flight Crew Compliance with Instructions/Procedures** was assessed as **ineffective** because the tanker crew allowed Typhoon 1 flight to climb to FL250 whilst FL240 was occupied by Typhoon 5.
- **Flight Crew Situational Awareness** was assessed as **ineffective** because the tanker crew and Typhoon 1 flight were not aware that Typhoon 5 was level at FL240.
- **Onboard Warning/Collision Avoidance System** was assessed as **ineffective** because all equipment associated with traffic awareness/collision avoidance had been selected to standby.
- **See and Avoid** was assessed as **partially effective** because neither Typhoon pilot was able to see the other, due to cloud, until at a very late stage.



<sup>3</sup> The UK Airprox Board scheme for assessing the Availability, Functionality and Effectiveness of safety barriers can be found on the [UKAB Website](#).