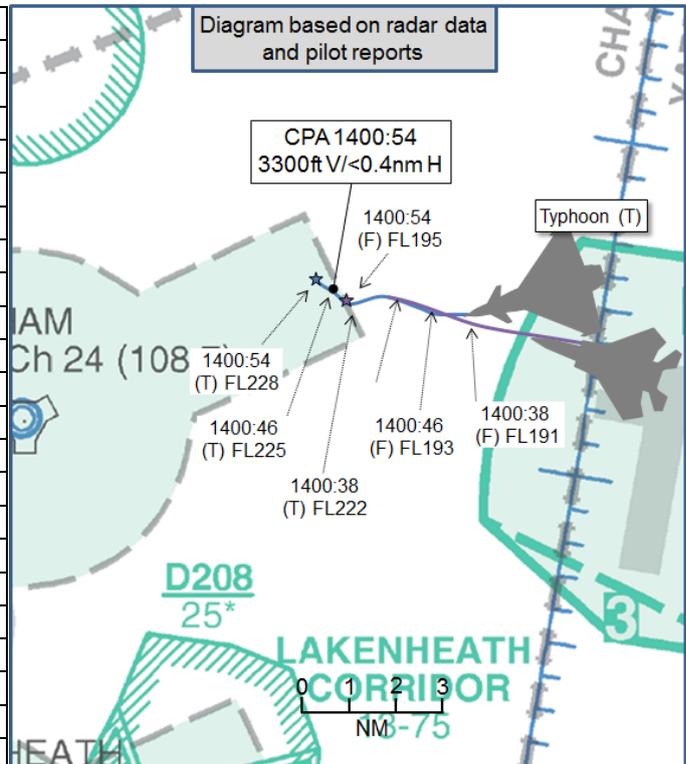


**AIRPROX REPORT No 2016166**

Date: 20 Jul 2016 Time: 1400Z Position: 5242N 00047E Location: NE Marham

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

Recorded	Aircraft 1	Aircraft 2
Aircraft	Typhoon	F15
Operator	HQ Air (Ops)	Foreign Mil
Airspace	London FIR	London FIR
Class	C	C
Rules	VFR	VFR
Service	Traffic	Traffic
Provider	Swanwick Mil	Swanwick Mil
Altitude/FL	FL228	FL195
Transponder	C on, S off	C, S
Reported		
Colours	NK	Grey
Lighting	NK	Standard
Conditions	VMC	VMC
Visibility	10km	>10km
Altitude/FL	20,000ft	FL190
Altimeter	RPS (1000hPa)	QNH (1013hPa)
Heading	270°	270°
Speed	300kt	330kt
ACAS/TAS	Not fitted	Not fitted
Alert	N/A	N/A
Separation		
Reported	700ft V/NK H	1000ft V/NK H
Recorded	3300ft V/0.4nm H & 700ft V/2nm H	



**THE TYPHOON PILOT** reports that he was part of a formation of three Typhoons conducting air combat manoeuvring (ACM). During a Radar Assisted Trail Departure, it became apparent from ATC that their planned operating area (AAR area 8) was now unavailable and a decision was made to transit to the East Anglia Military Training Area (EAMTA) instead. The formation lead ascertained from ATC that EAMTA was currently quiet but that they did have a formation of F15s pre-noted for its use from Lakenheath. He proceeded to the West, with the other two Typhoons anchoring in the East. A quiet frequency was requested for the exercise but, due to controller workload, the frequency became very congested; manoeuvring was terminated on two occasions due to excessive radio chatter. After 5mins, the frequency once again became quiet and manoeuvring was continued at 13:56Z. The other two Typhoons descended into a height block of 21,000 to 24,000 feet and proceeded to merge with him. The fight continued level at approximately 20,000 feet until 14:00:16Z when Swanwick called "traffic east 2 miles, tracking west, indicating FL180, climbing". The fight was immediately terminated again and visual contact was made with one of a pair of F15s approximately 2000ft below. The F15s continued to climb until being called at 700ft below him and he subsequently became visual with both F15s. The Typhoon formation then transited to a different operating area and the sortie continued without further incident.

He assessed the risk of collision as 'Medium'.

**THE F15 PILOT** reports that he was the lead for a 2-ship of F15Es cruising to the western portion of the EAMTA to fight 2 v 1 in the clearest/least congested airspace East Anglia had to offer. In a climb to FL190 for the cruise, Swanwick Mil passed Traffic Information on Typhoons above FL210. Through Link 16, own ship radar, and controller call-out, both aircraft in his formation were tally all 3 Typhoon players during their ACM fight. SA was high on them the entire time. No avoiding actions were provided by Swanwick because the F15s were visual with the Typhoons without a conflict developing. The F15s continued westbound as the Typhoons ceased turning, levelled out and then proceeded in

the opposite direction. The F15s continued to the western third of the airspace and fought N-S 2v1 fights accepting MARSAs with a singleton additional F15E. One of those fights was terminated for a separate aircraft in the vicinity, but no hazards or incidents were noted during the entire sortie.

He assessed the risk of collision as 'None'.

**THE SWANWICK MIL CONTROLLER** reports that he took a handover of the East TAC left position with 8 aircraft (5 F15s and 3 Typhoons) on 2 frequencies all in the vicinity of the EAMTA. The Typhoons were operating in the block 5000ft to 40000ft on the Barnsley RPS of 1000. The 2 F15s in question were restricted in the block FL120 to FL240 due to an imminent Norwich outbound aircraft. He became aware that the airspace in the 323 complex had just been vacated by aircraft that had booked it [not part of the Airprox] and he asked the Supervisor if it was available for the Typhoons because he was aware that the Typhoons were being hampered by the continual TI calls on frequency. He offered them this airspace as an alternative to the busy EAMTA but they said they would get back to him in about 5 minutes. All aircraft involved were aware the others were operating in the airspace and had previously had traffic information passed about each other. The F15s had tracked West to East through the EAMTA and turned back to the West at Approximately FL160 climbing. He passed TI to the F15s that the Typhoons were manoeuvring 8 miles west of them indicating FL200 to FL250 but operating up to high-level. The F15s acknowledged the traffic information and, he believes, called system contact on the traffic (this could have been a different TI call). The F15s continued to track west and climb towards the manoeuvring Typhoons. TI was passed to the Typhoons as the F15s were FL180 climbing and updated as passing FL185 climbing by the time he finished the transmission. He went back to the F15s and updated their traffic information as the traffic was now overhead indicating FL200 to FL250, they called tally with 2 tracks and he restated it was a 3 ship. He had to de-clutter the SSR labels to ensure he had the clearest picture of what was going on while passing generic TI as the flight of Typhoons were operating in very close proximity. He then continued this TI with a specific update to the Airprox Typhoon that he had traffic in his 6 o'clock by half a mile indicating only a few hundred feet below, the Typhoon pilot called visual with 1 and he called the 2nd F15 as 2 miles south 700ft below which allowed him to become visual with both. Shortly after the Typhoon flight stated that they would be filing an Airprox, which is unsurprising given the circumstances and he would potentially have come to the same conclusion given the time to process the situation. The Typhoon flight then took up the offer to move to D323D.

He perceived the severity of the incident as 'High'.

**THE SWANWICK MIL SUPERVISOR** reports that East Bank was running at full capacity during this period. He was not on the roster for the day because he had just finished instructing in the simulators for a new intake of trainees but he took over Supervisor role to allow the rostered Supervisor a break. The other East qualified instructor in the simulators was also being used on console in order to provide some relief to the shift. The CRC's had both been declared u/s but primacy had not been given to RAF(U) Swanwick of any of the MDA's and there was no clear plan in place so he had been authorising military aircraft into the D323 complex tactically until the FA returned to the Boulmer Ops Room and returned his call in order to hand over Level 3 Management. Following a protracted phone call, firstly with the FA (Fighter Allocator) and then the MC (Mission Commander) he was handed primacy of the D323 complex but with very little plan for the aircraft inside the airspace and his priority was to reduce the workload on the sector. The Overload console was also running at this point. He called Lakenheath and informed them that they would be working on a 'one-in, one-out' basis then received a call from BM HQ to inform him that the RAF Main Operating Bases (MOB) were being instructed by the CRC's to warn out with RAF(U) Swanwick in advance of sorties in order to aid his planning and manage traffic loading. It was at some stage during these calls that the Airprox occurred. Due to the administrative burden he was under (trying to obtain Level 3 Management as well as finding a way to reduce the workload the Sector was under with the aircraft inside the MDA's now on frequency), he did not see the Airprox. He also could not immediately release the controller who was on console during the Airprox because he had no relief available; the controller was relieved approximately 10 minutes later as soon as practical. Had a more robust plan been in place for the occurrence of both CRC's going U/S with regard to Level 3 Management of the MDA's, the sector would not have found itself with so much traffic on frequency. As the supervisor, he would have

anticipated keeping the traffic on frequency, taking primacy of the MDA's and refusing other traffic such as EAMTA general handling aircraft, this plan was enforced as soon as he had an awareness from the MC that both CRC's were out of action and the task had been passed to RAF(U) Swanwick. It was not safe to begin offloading traffic in the EAMTA to other Units because the area was far too busy and it was safer to keep all the traffic for SA of both the aircrew and the RAF(U) Swanwick controllers. This Airprox is a clear indication of how busy the airspace was at the time.

## Factual Background

The weather at Marham was recorded as follows:

METAR EGYM 201350Z 23015G27KT 9999 FEW030 SCT160 28/20 Q1007 BLU NOSIG

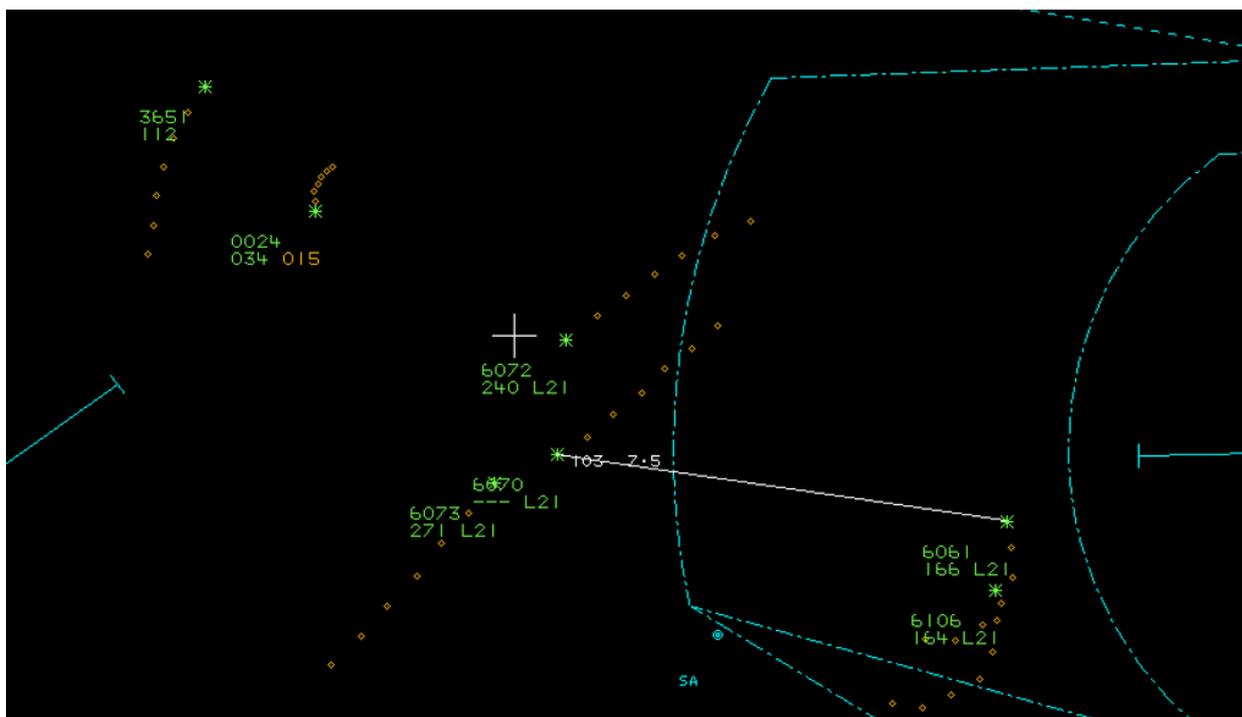
## Analysis and Investigation

### Military ATM

Portions of the tape transcripts between Swanwick Mil, the Typhoon flight and the F15 flight:

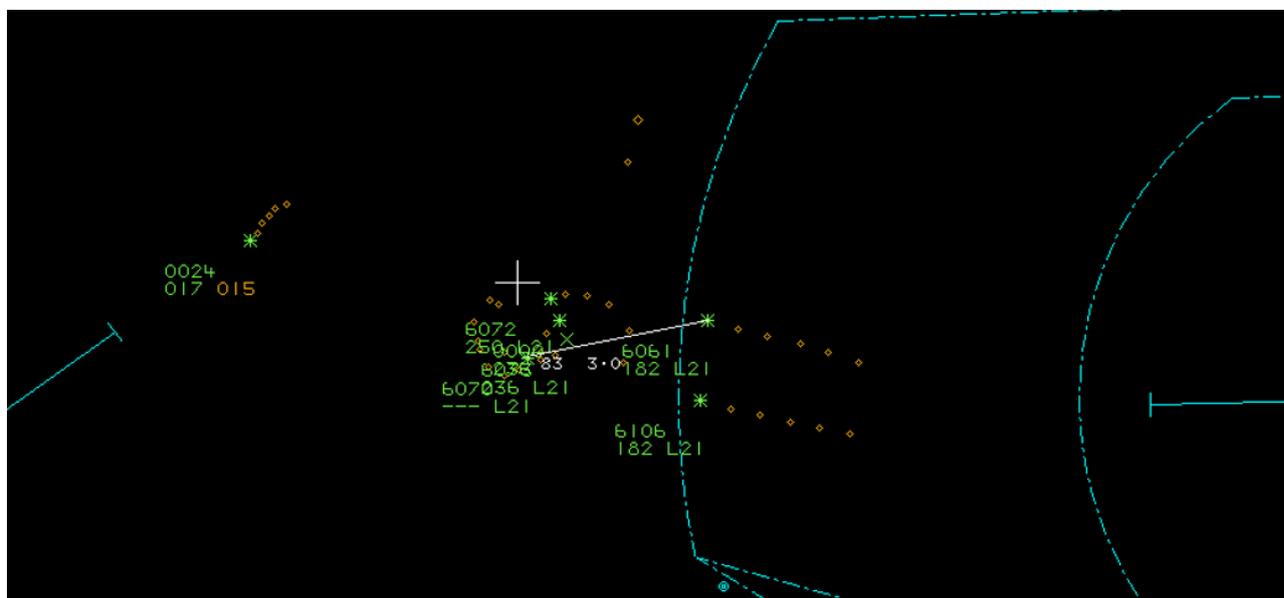
From	To	Speech Transcription	Time
SME	F15 Flt	[F15 Flt c/s] roger, further traffic north west, 5 miles manoeuvring indicating flight level 110, possibly a Tornado or Typhoon.	13:57:49
F15 Flt	SME	[F15 Flt c/s] systems contact.	13:57:58
SME	F15 Flt	[F15 Flt c/s] traffic west, 8 miles manoeuvring, a 3 ship of Typhoons indicating flight level two four to 270, operating up to high level.	13:59:26
F15 Flt	SME	[F15 Flt c/s].	13:59:38
SME	Typhoon Flt	[Typhoon Flt c/s], Swanwick, traffic east, 2 miles tracking west, a pair of F15's indicating flight level 180 climbing, now indicating flight level 185 climbing.	14:00:15
SME	F15 Flt	[F15 Flt c/s] previously reported traffic is now overhead indicating flight level 220 to flight level 250.	14:00:27
F15 Flt	SME	[F15 Flt c/s]'s tally 2 ship.	14:00:35
SME	F15 Flt	[F15 Flt c/s] that's a 3 ship.	14:00:37
SME	Typhoon Flt	[Typhoon Flt c/s] traffic west, 2 miles, tracking west. A pair F15's indicating flight level 188 flight level 195, [Airprox Typhoon c/s] the F15's are in your 6 o'clock 1 mile 1000' below.	14:00:54
Airprox Typhoon	SME	[Airprox Typhoon c/s] is tally single ship only, above them.	14:01:11
SMR	Airprox Typhoon	Roger, the other's south by 2 miles 700' below	14:01:14
Airprox Typhoon	SME	Looking [Airprox Typhoon c/s], tally 2.	14:01:19

At 1359:27 (Figure 1), the Typhoons are engaged in a 2v1 Air Combat Manoeuvres (ACM) and are merging; indicated height block for the fight was reported as 21,000-24,000ft. The F15s are 7.5nm to the east, in a left-hand turn to track west to join up with another F15 for ACM. The Swanwick controller at this point is passing traffic information to the F15s on the Typhoons.



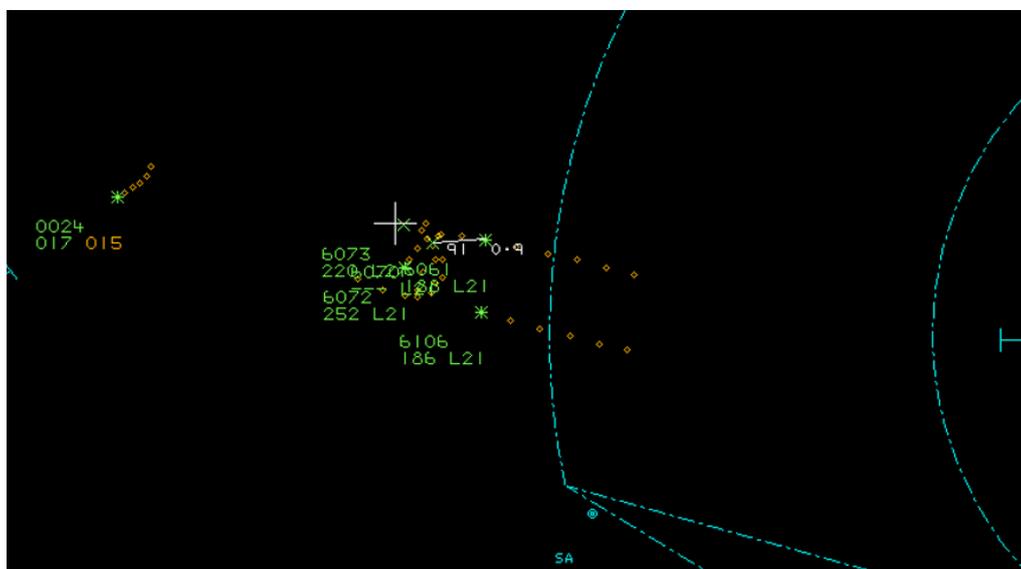
**Figure 1: Geometry at 1359:27  
(Typhoons squawking 6070/6072/6073; F15s squawking 6061/6106).**

At 1400:15 (Figure 2), the Typhoons are merged in a 2v1 fight; the F15s are east by 3nm and reported climbing in a cruise to FL190 to the west to join with a single F15. At this time the controller called the F15s to the Typhoons. Note the cluster of labels and difficulty working out which aircraft is where and the lack of mode/C on one of the Typhoons. The merging of aircraft is often associated with spurious SSR codes or lack of mode/C.



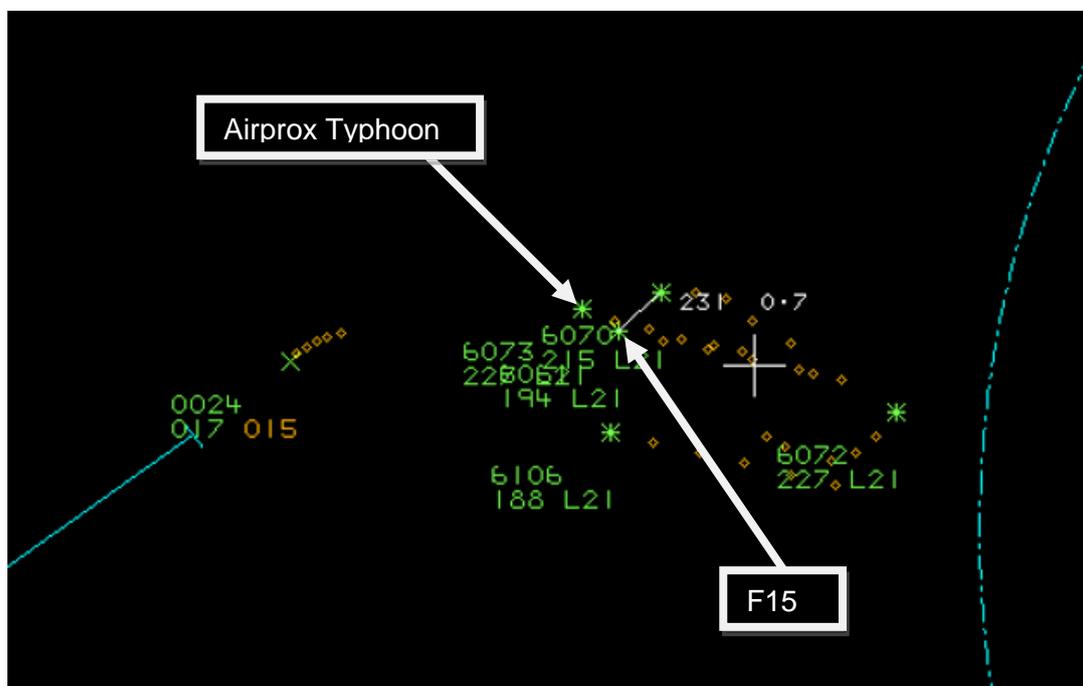
**Figure 2: Geometry at 1400:15  
(Typhoons squawking 6070/6072/6073; F15s squawking 6061/6106).**

At 1400:27 (Figure 3), the controller calls the Typhoons to the F15s '[F15 Flt c/s] previously reported traffic is now overhead indicating flight level 220 to flight level 250'. The F15s call visual on two of the Typhoons and the controller reinforces that it is a 3-ship. The F15s are indicating FL186 and the lowest Typhoon FL220, vertical separation is over 3000ft and lateral separation is within 1nm.



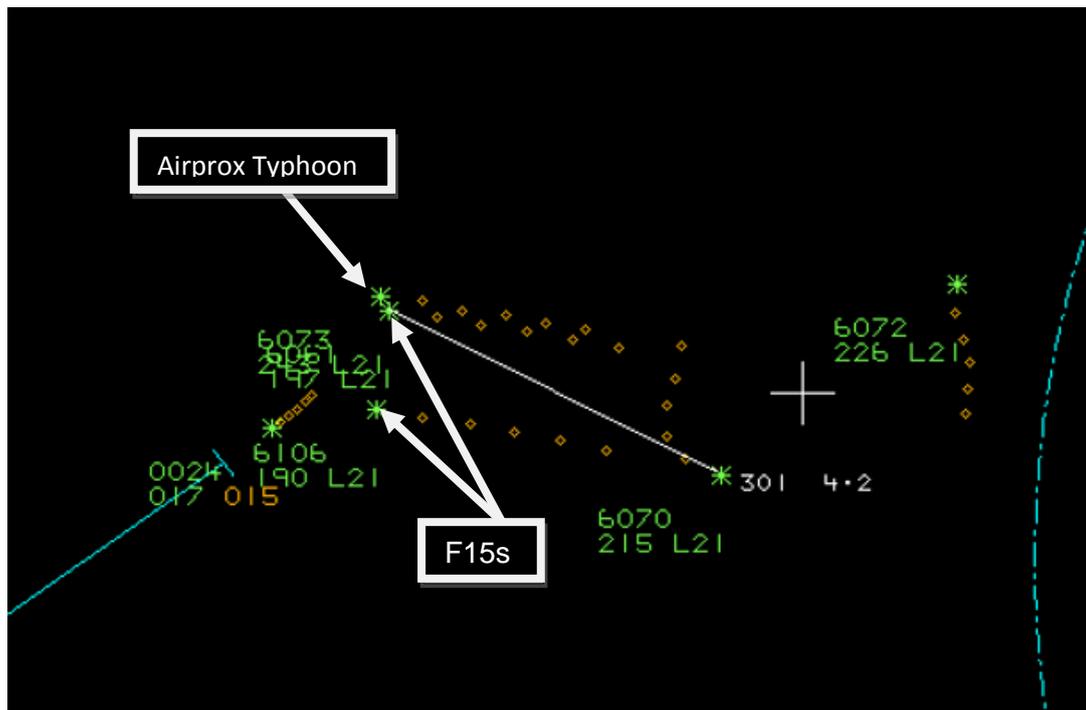
**Figure 3: Geometry at 1400:27**  
(Typhoons squawking 6070/6072/6073; F15s squawking 6061/6106).

At 1400:54 (Figure 4), the controller passes traffic information to the Typhoons with specific reference to the Airprox Typhoon. '[Typhoon Flt c/s] traffic west, 2 miles, tracking west. A pair F15's indicating flight level 188 flight level 195, [Airprox Typhoon c/s] the F15's are in your 6 o'clock 1 mile 1000' below'.



**Figure 4: Geometry at 1400:54**  
(Typhoons squawking 6070/6072/6073; F15s squawking 6061/6106).

At 1401:14 (Figure 5), [Airprox Typhoon c/s] calls visual with one F15 below and so the controller again calls the traffic 'Roger, the other's south by 2 miles 700' below', to which the Typhoon acquires visually.



**Figure 5: Geometry at 1401:14  
(Typhoons squawking 6070/6072/6073; F15s squawking 6061/6106).**

The F15 pilot reported being the lead of a 2 ship of F15Es cruising to the western portion of the EAMTA in a climb to flight level 190 for the cruise. Swanwick passed information on Typhoons above at flight level 210. Through Link 16, own ship radar and controller call out both of the aircraft in formation were tally all three Typhoon players during their Air Combat Manoeuvres. The pilot reported situational awareness on the Typhoons was high the entire time. The report also indicates the pilots were operating under a traffic service and using the link / radar were aware of the Typhoons at 15-20nm and picked them up visually outside of 10nm. The F15 pilots assessed the risk of collision as none.

The Typhoon pilot reported selecting the EAMTA as it was currently quiet, but was informed of a formation of F15s pre-noted out of Lakenheath. A quiet frequency was requested for the exercise but, due to controller workload, the frequency become congested and, on two occasions, the fight was terminated. After around 5 minutes the frequency became discrete and the fight continued with all aircraft descending into a height block of 21,000-24,000ft and proceeded to merge. The fight continued level at 20,000ft until Swanwick called traffic, at which point the fight was terminated and visual contact made with a pair of F15s approximately 2000ft below. The F15s continued to climb until being called 700ft below [Airprox Typhoon c/s] who subsequently became visual with both F15s. Post the event the pilot reported transiting to a different operating area and continued their sortie. The pilot perceived the severity as medium.

The Swanwick Mil Tactical controller reported taking a handover of the east TAC left position with 8 aircraft on 2 frequencies all in the vicinity of the EAMTA, 5 F15s and 3 Typhoons. The Typhoons were working in a block 5,000-40,000ft and the 2 F15s were restricted in a block FL120-240 due to imminent civilian traffic outbound from Norwich. The controller reported becoming aware of segregated airspace over the North Sea (D323 Complex) being vacated and so requested the Supervisor to see if this was available, which it was. The controller then offered this airspace to the Typhoons as they were aware the aircraft were being hampered by continual traffic information calls. The pilots reported they would get back to the controller in 5 minutes (all

confirmed by the tape transcript). The controller reported the F15s had tracked west to east through the EAMTA and turned back to the west at approximately FL160 climbing; traffic information was passed to them that the Typhoons were manoeuvring 8 miles west, indicating FL200 to FL250 and operating up to high level. The F15s acknowledged the traffic information and the controller recalled them calling system contact on the traffic. The F15s continued to track west and climb towards the manoeuvring Typhoons. Traffic information was passed to the Typhoons as the F15s were FL180 climbing and updated as passing FL185 climbing by the time the transmission was finished. The controller went back to the F15s and updated their traffic information as the traffic was now overhead indicating FL200 to FL250, the F15s called tally with 2 tracks and the controller re-stated that it was a 3 ship. Due to the close proximity of the aircraft the controller had to de-clutter labels to ensure they had the clearest radar picture (this clutter can be seen in the radar replay images). The controller then continued passing traffic information with a specific update to [Airprox Typhoon c/s] on traffic in his 6 o'clock by half a mile indicating only a few hundred feet below. [Airprox Typhoon c/s] called visual with 1 and the controller called the 2nd F15 as 2 miles south 700ft below which allowed him to become visual with both. Shortly after the Typhoon flight stated that they would be filing an Airprox and then took up the offer to move to D323 Complex and transited there. The TAC controller perceived the severity as high.

The Swanwick Mil Planner reported a very busy period and had a TAC Left, TAC right and as soon as they took position called for an overload console. At the time of the reported Airprox TAC Left was working 8 General Handlers in East Anglia (3xTyphoon and 5xF15). The planner also noted that the TAC right was working at capacity with a tanker on frequency and 2xTyphoons general handling. The planner was conscious of the increase in workload and refused to accept any more traffic from Lakenheath and instructed the Supervisor of their decision. The overload console took the initial contact frequencies (ICF) to pick up free-calling aircraft from the D323 complex and several Norwich outbounds. The planner reported that at the time Swanwick had primacy of the D323 complex, and knew that it was free with the only aircraft due into the complex being another Typhoon formation who were conducting air-to-air refuelling. This Typhoon formation confirmed that they did not require D323D and the TAC left instructed the Typhoon Flt of its availability, to which they acknowledge and said they would respond in 5 minutes. The planner heard the TAC left call traffic to the Typhoon Flt and F15 Flt and noted both flights were on separate frequencies at the request of the Typhoon Flt lead. The planner reported that following the traffic information the typhoon Flt would begin transiting to D323D and as they transited the lead called an Airprox on the F15s. The planner perceived the severity as medium.

The Swanwick Mil Supervisor reported East Bank was running at full capacity and they had taken over as Supervisor to relieve the rostered Supervisor in order to afford them a break. They were not on the roster for the day and had just finished instructing in the simulators. The Supervisor reported that they had been authorising military aircraft into the D323 complex tactically due to issues with the Command Reporting and Control Centres (CRC). The Supervisor had made their priority to reduce the workload on the sector as overload was running at this point. They called Lakenheath and informed them that Swanwick would be working on a 'one in, one out' basis. They also received a call from BM HQ to inform them that RAF main operating bases were being instructed to warn out with RAF(U) Swanwick in advance of sorties in order to aid planning and manage traffic loading. Due to the administrative burden the Supervisor reported they did not see the Airprox. The Supervisor perceived the severity as high.

The TAC controller provided the F15s and Typhoons with traffic information on each other allowing the F15s to gain radar contact initially and then visual acquisition. The traffic information passed to the Typhoons may have been within 3 miles laterally, however the F15s were only just climbing into the 3000ft vertical guidelines stated in CAP774. Given that the controllers workload at the time was high and they were working two separate frequencies the traffic information they provided was timely, accurate and updated as the situation developed.

The requirement for separate frequencies contributed to limiting situational awareness and raising controller workload. Understandably a quiet frequency is required for ACM; however, it may have

limited the Typhoons situational awareness of the F15s. Switching between frequencies to pass traffic information would also have added to the controller's workload.

The issues relating to the CRCs added to the workload of Swanwick Mil during this incident. The fast-jet formations that would normally be controlled in segregated airspace, the D323 Complex in this instance, were unable to receive a service from the CRCs and as such Swanwick Mil provided a service. All the Swanwick controllers' reports state high workload on the unit at the time and the requirement for an overload console as well as restrictions on Lakenheath traffic. Given the high workload the TAC, planner and Supervisor managed to effect the use of a portion of segregated airspace for the Typhoons and made them aware of this option 5 minutes prior to the Airprox.

This incident highlights three effective barriers; traffic information from the controller to both formations of aircraft, radar contact and visual acquisition from the F15s and lookout from all the pilots. The Airprox highlights the busy nature of the EAMTA and the difficulties associated with multiple fast-jet formations conducting high-energy manoeuvres in close vicinity to one another.

The local investigation conducted by RAF(U) Swanwick identified the requirement for increased engagement with the Coningsby Squadron Execs to encourage Squadron authorisers and RAF(U) Swanwick Supervisors to discuss requirements and limitations for sorties. The engagement was specific to aircraft that may require special handling or discreet frequencies.

### **UKAB Secretariat**

The Typhoon and F215 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>1</sup>. If the incident geometry is considered as converging then the Typhoon pilot was required to give way to the F15s<sup>2</sup>. If the incident geometry is considered as overtaking then the Typhoon pilot had right of way and the F15 pilot was required to keep out of the way of the other aircraft by altering course to the right<sup>3</sup>.

## **Comments**

### **HQ Air Command**

This incident led to a thorough investigation and several recommendations have been made. A lack of availability of suitable segregated airspace led to both formations attempting to operate similar mission profiles in the same airspace. The controllers should be commended for their efforts in dealing with an extremely busy radar picture – timely and accurate TI was passed to both formations permitting appropriate actions to be taken by the pilots. The unforeseen circumstance of both CRCs being inoperative at the same time led to a vastly increased workload for the Swanwick controllers with little or no prior warning – agreements are now in place with the flying squadrons to pass pertinent mission information to Swanwick(Mil) in future such that controller workload can be better managed should the situation of multiple CRC unavailability arise again. Notably, neither aircraft type is currently fitted with an ACAS – work continues to address this need for Typhoon aircraft though it is likely to be in the order of years before any embodiment is likely to take place.

### **USAFE**

The Typhoon flight lead made a misjudgement in not taking up the offer of the North Sea segregated airspace (the D323 complex) when it became available, particularly given that the airspace was established for just such sorties. Swanwick Mil, in trying to accommodate the Typhoons' requirements, did well in a very busy and dynamic situation by ensuring that all of the

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<sup>1</sup> SERA.3205 Proximity.

<sup>2</sup> SERA.3210 Right-of-way (c)(2) Converging.

<sup>3</sup> SERA.3210 Right-of-way (c)(3) Overtaking.

aircraft involved received relevant traffic information. In addition, the 2 F15s had both electronic and visual contact with the 3 Typhoons to the extent that they considered that no risk of collision was present.

## Summary

An Airprox was reported when a Typhoon and a 2 F15s flew into proximity at 1400 on Wednesday 20<sup>th</sup> July 2016. The Typhoon pilot was operating under VFR in VMC and the F15 pilots under VFR in VMC, the Typhoon pilot in receipt of a Traffic Service from Swanwick Mil and the F15 pilots in receipt of a Traffic Service from Swanwick Mil.

## **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 began their deliberations by looking at the Typhoon operating location and whether this afforded them any specific protection as they conducted their ACM activities. The Military ATC member explained that the EAMTA had a base level of FL245 and, being at FL210-240 for their ACM, when the Typhoon crews said they were operating within the MTA in this incident they were actually referring to its horizontal confines rather than its vertical confines. They went on to explain that the Typhoons were actually operating in TRA003 at the levels they were using, and were thus bound by the VFR rules of the air rather than under IFR per se. The Board then turned to the Typhoon pilot's actions. They wondered why, when they had been offered an alternative and protected operating area, the Typhoon formation had not relocated to the new area. The Military aircrew member explained that there are many reasons why they may not have deemed the move would be immediately practical; these include remaining fuel, transit time between areas, suitability of the airspace, and the stage of combat for the engagement they were involved in at the time.

The Board then looked at the F15 crew's actions. They agreed that the F15 crew were visual at all times with the Typhoons and had good situational awareness on these aircraft. Some members with previous fast-jet military experience opined that although they themselves may have been comfortable with their level of situational awareness, good airmanship dictated that they give the manoeuvring Typhoons a wide berth because they could not know where the Typhoons might fly, especially if they were not visual with the F15s themselves. Rather than continuing on their planned course, a small turn to route further away from the Typhoons would have been more prudent.

Finally, the Board looked at the actions of the Air Traffic Controllers and agreed that both formations had been given adequate Traffic Information on the other formation. Members noted that the controllers workload was exacerbated by the unusual circumstances of the unforeseen closure of two agencies that normally have oversight of the operational areas, and that this had resulted in a significant increase in the workload of the Swanwick Mil controllers without a plan being in place to accommodate such a situation. The Board were heartened to hear that the Military had now put in place a procedure to ensure that if this situation recurred there would be robust measures to ensure a smoother transition to and from normal operations.

The Board then looked at the barriers that were relevant to this Airprox and decided that the following were key contributory factors:

- **Airspace Design and Procedures** was considered only **partially effective** because the local procedures were not robust enough for the situation that had occurred - the unplanned closure of two controlling agencies.
- **ATC Strategic Manning and Planning** was **partially effective** because, notwithstanding that the Swanwick controllers coped well in a difficult situation, Swanwick was not manned to

meet the circumstances of the closure of two controlling agencies and there was no plan for them to do so.

- **Flight Crew Pre-Flight planning** was **partially effective** because the Board believed that the Typhoon crews had not gained a full awareness of the other booked airspace users in their planned operating area, or that their planned operating area (AAR area 8) was active at the time.
- **Onboard Warning/Collision Avoidance Equipment** was **inapplicable** because neither aircraft was fitted with CWS equipment. The Board agreed that, because both aircraft were transponding, if this barrier had been available to at least one of the pilots it could have alerted them to the presence of the other aircraft early enough to carry out any actions to increase separation. Notwithstanding, the Board recognised that the F15 pilots had contact with the Typhoons at all times using their other onboard systems as a substitute for CWS.

The Board then considered the cause and risk of the incident. They agreed that both pilots were fully informed by ATC of the others presence, and that the F15 pilots had full situational awareness of the Typhoons and their manoeuvres. Some members thought that, in light of this latter aspect, the F15 pilots had effectively flown into conflict with the Typhoons that they could have avoided by a greater margin. Others commented that the F15 pilots had achieved 700ft separation and that, although perhaps less than ideal, this was sufficient. After considerable debate, the Board finally agreed that safety had not been reduced below the norm, and that the incident was probably best described as the Typhoon pilot being concerned by the proximity of the F15. Turning to the risk, members noted that the F15 pilot had had the Typhoon visual at all times and, as a result, the Board agreed that this was a benign incident in which there had been no risk of collision; they therefore assessed the risk as Category E.

### **PART C: ASSESSMENT OF CAUSE AND RISK**

Cause: The Typhoon pilot was concerned by the proximity of the F15.

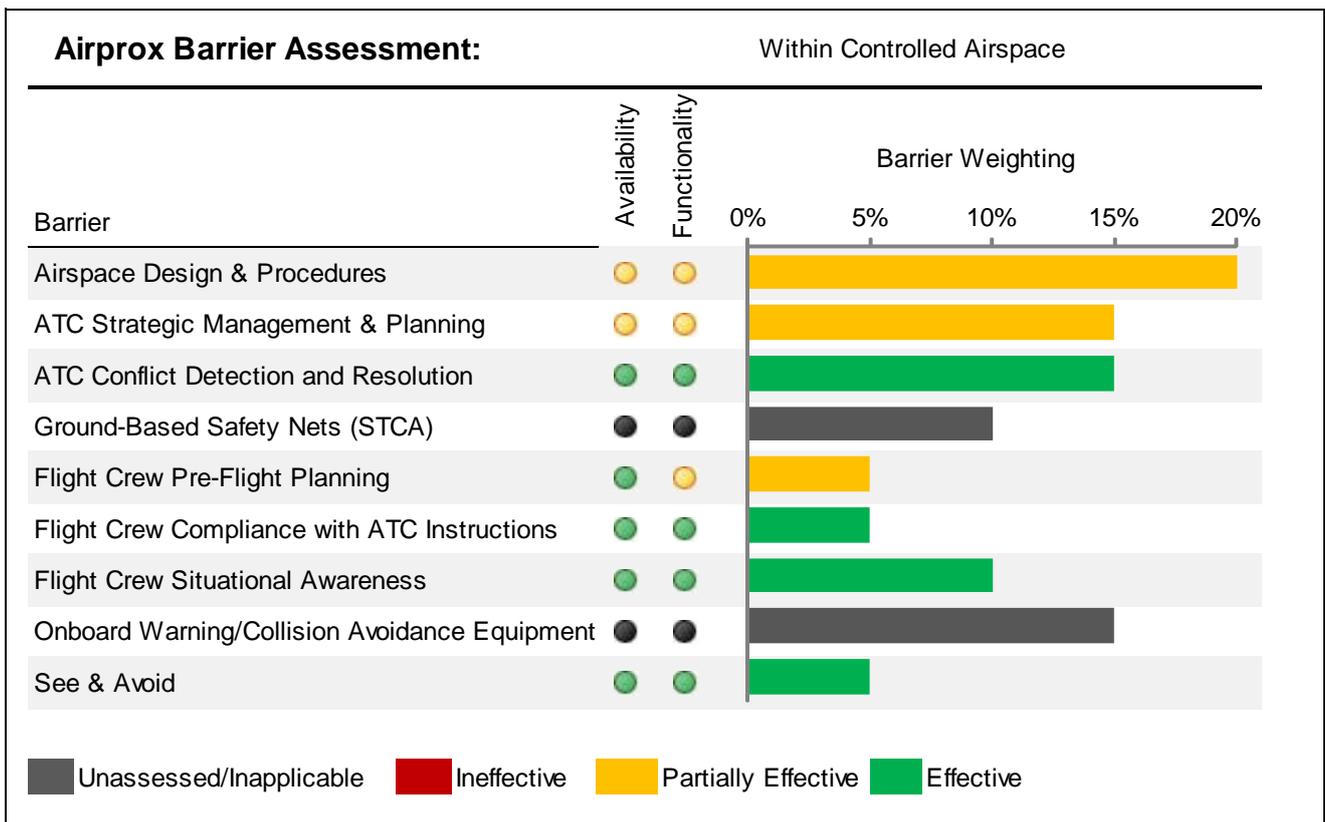
Degree of Risk: E.

#### Barrier Assessment:

Modern safety management processes employ the concept of safety barriers that prevent contributory factors or human errors from developing into accidents. Based on work by EASA, CAA, MAA and UKAB, the following table depicts the barriers associated with preventing mid-air-collisions. The length of each bar represents the barrier's weighting or importance (out of a total of 100%) for the type of airspace in which the Airprox occurred (i.e. Controlled Airspace or Uncontrolled Airspace).<sup>4</sup> The colour of each bar represents the Board's assessment of the effectiveness of the associated barrier in this incident (either Fully Effective, Partially Effective, Ineffective, or Unassessed/Inapplicable). The chart thus illustrates which barriers were effective and how important they were in contributing to collision avoidance in this incident.

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<sup>4</sup> Barrier weighting is subjective and is based on the judgement of a subject matter expert panel of aviators and air traffic controllers who conducted a workshop for the UKAB and CAA on barrier weighting in each designation of airspace.



Barrier	Availability			Functionality			Unassessed / Inapplicable
	Fully (3)	Partially (2)	Not Available (1)	Fully (3)	Partially (2)	Non Functional (1)	
<b>Airspace Design and Procedures</b>	Appropriate airspace design and/or procedures were available	Airspace design and/or procedures were lacking in some respects	Airspace design and/or procedures were not appropriate	Airspace design and procedures functioned as intended	Airspace design and/or procedures did not function as intended in some respects	Airspace design and/or procedures did not function as intended	The Board either did not have sufficient information to assess the barrier or the barrier did not apply; e.g. ATC Service not utilised.  Note: The Board may comment on the benefits of this barrier if it had been available
<b>ATC Strategic Management and Planning</b>	ATM were able to man and forward plan to fully anticipate the specific scenario	ATM were only able to man or forward plan on a generic basis	ATM were not realistically able to man for or anticipate the scenario	ATM planning and manning functioned as intended	ATM planning and manning resulted in a reduction in overall capacity (e.g. bandboxed sectors during peak times)	ATM planning and manning were not effective	
<b>ATC Conflict Detection and Resolution</b>	ATS had fully serviceable equipment to provide full capability	ATS had a reduction in serviceable equipment that resulted in a minor loss of capability	ATS had a reduction in serviceable equipment that resulted in a major loss of capability	The controller recognised and dealt with the conflict in a timely and effective manner	The controller recognised the conflict but only partially resolved the situation	The controller was not aware of the conflict or his actions did not resolve the situation	
<b>Ground-Based Safety Nets (STCA)</b>	Appropriate electronic warning systems were available	Electronic warning systems is not optimally configured (e.g. too few/many alerts)	No electronic warning systems were available	Electronic warning systems functioned as intended, including outside alerting parameters, and actions were appropriate	Electronic warning systems functioned as intended but actions were not optimal	Electronic warning systems did not function as intended or information was not acted upon	
<b>Flight Crew Pre-Flight Planning</b>	Appropriate pre-flight operational management and planning facilities were deemed available	Limited or rudimentary pre-flight operational management and planning facilities were deemed available	Pre-flight operational management and planning facilities were not deemed available	Pre-flight preparation and planning were deemed comprehensive and appropriate	Pre-flight preparation and/or planning were deemed lacking in some respects	Pre-flight preparation and/or planning were deemed either absent or inadequate	
<b>Flight Crew Compliance with Instructions</b>	Specific instructions and/or procedures pertinent to the scenario were fully available	Instructions and/or procedures pertinent to the scenario were only partially available or were generic only	Instructions and/or procedures pertinent to the scenario were not available	Flight crew complied fully with ATC instructions and procedures in a timely and effective manner	Flight crew complied later than desirable or partially with ATC instructions and/or procedures	Flight crew did not comply with ATC instructions and/or procedures	
<b>Flight Crew Situational Awareness</b>	Specific situational awareness from either external or onboard systems was available	Only generic situational awareness was available to the Flight Crew	No systems were present to provide the Flight Crew with situational awareness relevant to the scenario	Flight Crew had appropriate awareness of specific aircraft and/or airspace in their vicinity	Flight Crew had awareness of general aircraft and/or airspace in their vicinity	Flight Crew were unaware of aircraft and/or airspace in their vicinity	
<b>Onboard Warning/Collision Avoidance Equipment</b>	Both aircraft were equipped with ACAS/TAS systems that were selected and serviceable	One aircraft was equipped with ACAS/TAS that was selected and serviceable and able to detect the other aircraft	Neither aircraft were fitted with ACAS/TAS or their systems were not selected on or unserviceable or systems incompatible	Equipment functioned correctly and at least one Flight Crew acted appropriately in a timely and effective manner	ACAS/TAS alerted late/ambiguously or Flight Crew delayed acting until closer than desirable	ACAS/TAS did not alert as expected, or Flight Crew did not act appropriately or at all	
<b>See and Avoid</b>	Both pilots were able to see the other aircraft (e.g. both clear of cloud)	One pilots visibility was uninhibited, one pilots visibility was impaired (e.g. one in cloud one clear of cloud)	Both aircraft were unable to see the other aircraft (e.g. both in cloud)	At least one pilot takes timely action/inaction	Both pilots or one pilot sees the other late and one or both are only able to take emergency avoiding action	Neither pilot sees each other in time to take action that materially affects the outcome (i.e. the non-sighting scenario)	