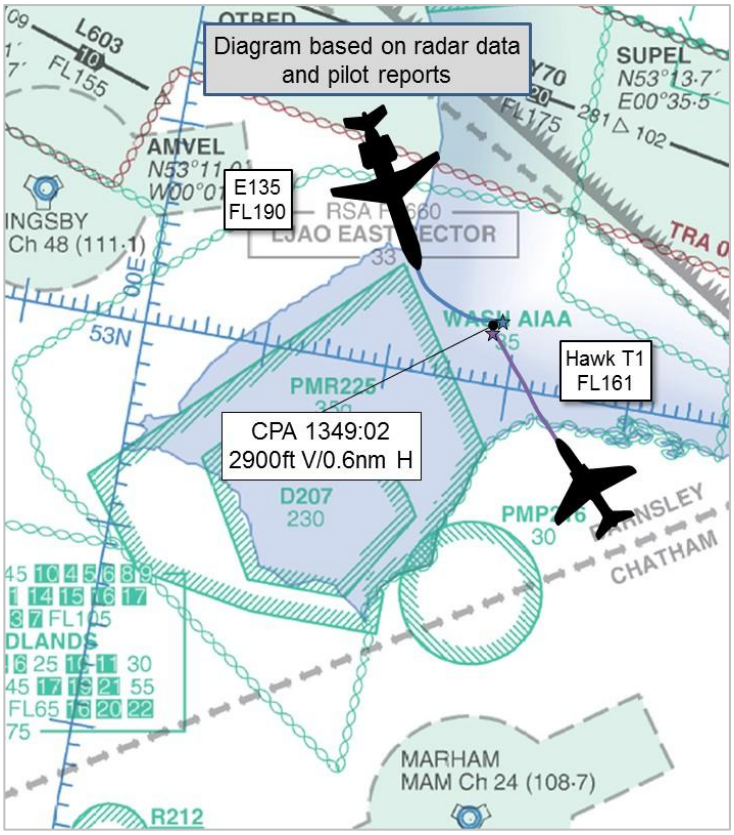
AIRPROX REPORT No 2016188

Date: 22 Aug 2016 Time: 1349Z Position: 5303N 00029E Location: 36nm NW Norwich airport

PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

Recorded	Aircraft 1	Aircraft 2
Aircraft	EMB135	Hawk T1
Operator	CAT	HQ Air (Trg)
Airspace	London FIR	London FIR
Class	G	G
Rules	IFR	VFR
Service	'Deconfliction' (but not agreed with pilot)	Traffic
Provider	Norwich	Marham
Altitude/FL	FL190	FL161
Transponder	A,C,S	A,C,S
Reported		
Colours	Company	Black
Lighting	Beacon, strobes, nav	Nav, nose, white HISLs
Conditions	VMC	VMC
Visibility	>10km	>10km
Altitude/FL	FL180	NK
Heading	140°	Manoeuvring
Speed	270kt	NK
ACAS/TAS	TCAS II	Not fitted
Alert	RA	N/A
Separation		
Reported	800ft V/1nm H (TCAS)	Not seen
Recorded	2900ft V/0.6nm H	



THE EMBRAER EMB135 PILOT reports that the Scottish controller advised them to maintain their cleared level of FL180 due to military traffic and to contact Norwich Approach. He contacted Norwich for a Deconfliction Service, who confirmed the requirement to maintain FL180 [UKAB Note: in fact the type of service was never formally agreed although the Norwich controller was applying Deconfliction Service procedures]. Their track was approximately 140°. Shortly afterwards, they were given 'avoiding action, left turn 090 degrees' in an urgent tone by the Norwich Radar controller. The autopilot was disconnected, and the Commander/PF commenced the turn at which point they received an aural TCAS RA 'climb, climb'. The aircraft was rolled wings level and the TCAS-commanded vertical speed followed, which was at the top of the scale. The non-flying pilot called 'TCAS RA' to ATC. During the TCAS RA, they were still given avoiding action headings. TCAS aurally advised 'clear of conflict' at about FL190, when they then followed further avoiding action headings which were noted as left 360° followed by right 180° during the event. He did not see the other traffic. A normal landing was made at Norwich. He commented that they were operating in Class G airspace which is unavoidable descending into Norwich. Their planned route took them over the Wash area, which is busy with military traffic. He thought that the airline should review a routing where they descend in airway Y70 with a lower limit of FL175 until further east of the Wash area before turning for Norwich.

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

THE HAWK T1 PILOT reports that he was unaware of the Airprox until he was informed on the 12 September 2016 and therefore he was unable to fill out much of the detail on the Airprox form. During the sortie he was the back-seat pilot, instructing the front-seat pilot on how to conduct Low-

Level Close Air Support (CAS) at Sculthorpe Airfield in Norfolk. They would have been working a block of around surface to 5000ft around the airfield. Because these sorties involved a large amount of focus on the ground, an Air Traffic Service is often used in order to help with air-to-air deconfliction. They were using Marham Approach for a Traffic Service, although when pilots drop below the base of their radar cover that can become reduced or even unavailable. He reported that he did not see the other traffic. [UKAB Note: in fact the Hawk pilot reports traffic in sight on the RTF.]

THE MARHAM RADAR CONTROLLER reports that she was working the Hawk. During the period she was also bandboxing 4 frequencies and had approximately 6 speaking units on 2 frequencies. The Hawk pilot informed her one minute to completion and passed her his intentions. At the same time a Helimed callsign called on VHF frequency on a 'red' call towards the Marham MATZ. She prioritised gathering information from the Helimed pilot routeing towards the Marham MATZ and departure lane, and passed these details onto Tower. Once complete she went straight to the Swanwick Mil line to pre-note the Hawk. During the pre-note, the Hawk pilot reported complete and requested to Return To Base (RTB) at FL190. She stopped his climb at FL170 to route under the airway. She requested from Swanwick Mil to change the pre-note to a handover. During the handover she identified conflictors at FL200 15nm away and called the traffic to the Hawk pilot. Swanwick requested her to stop the Hawk pilot's climb at FL160; this was passed. During the end of the handover an additional track was seen coming onto the screen tracking south and wearing a civil squawk. The aircraft was called at FL195 in the Hawk pilot's 12 o'clock, he reported visual. Her report had been submitted 5 weeks after the event.

She perceived the severity of the incident as 'Low'.

THE EAST TAC CONTROLLER reports that he was the screen for a trainee controller during the incident. Shortly after taking position they took a telephone call from Marham with what was initially a pre-note for the Hawk. The Marham controller decided to turn this into a handover so his trainee began the process of making out a strip. Once the aircraft was called to them they correctly identified it and allocated a squawk. He could see that there were two conflicting tracks; a pair of, possibly, Typhoons just departing the Tanker at FL170 and a civil aircraft inbound to Norwich. This incident had occurred over two weeks ago but he believed that the civil aircraft was at FL190 with its Mode S Selected Flight Level showing FL180. If his memory serves the Hawk was passing FL150 so he advised a stop at FL160. This took some insistence with the Marham controller. When he pointed out the conflicting civil traffic, Marham stated that it had been called; however, they were trying to handover the Hawk heading straight for the Norwich inbound and climbing through its level. As the Hawk pilot was in receipt of a Traffic Service, traffic had been called and, because he had stopped at FL160, there was no danger of a collision. Norwich then attempted to coordinate and seemed rather flustered. However, if his memory served him correctly the Hawk was maintaining FL160 and the Norwich inbound was showing Mode C of FL190.

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

THE EAST BANK SUPERVISOR reports that 9 days after the event he had been informed that, what was at the time believed to be a very late request for co-ordination from Norwich (resulting in their aircraft manoeuvring under a TCAS RA), had been filed as an Airprox. He commented that there was 2000ft vertical separation against the Hawk, which he believed to have caused the TCAS RA. He recalled being on the telephone discussing operational matters with the CRC and on completion of the call he walked behind the Bank control positions to monitor and reassess the traffic loading. There was Air-to-Air Refuelling (AAR) activity on 'East Tac' right within AARA8 and limited traffic on 'Tac left'; as best he could recall, a Planner was in situ. He paused behind the 'Tac left' because he was a trainee and he observed him answer the Marham landline and begin to generate an electronic flight strip for a Hawk to RTB from a CAS exercise at Muckleburgh. Almost immediately, the pre-note changed into a handover and he observed the Hawk begin to climb to the north-west, the rate of climb throughout did not seem excessive, and he assessed that the Hawk pilot was complying with the 8000 fpm restriction despite being in Class G. During the handover, there were 2 aircraft to affect the Hawk's projected flight path at approximately 10-15nm; one had just come off the Tanker minutes before and was heading towards the Hunstanton area at FL170, and just to the north-west of

Hunstanton was a civil aircraft just leaving Controlled Airspace (CAS) descending inbound to Norwich indicating FL180. Both were in close proximity to each other. During the handover he heard his Tac controller instruct Marham to stop the Hawk at FL160, and after what he perceived to be some hesitancy on Marham's part, the Tac's mentor intervened and insisted that Marham stop the Hawk at FL160 against both the traffic from the Tanker at FL170 and the civil aircraft at FL180. Once the handover was complete, he enquired what level Marham had been climbing to and his Tac stated that Marham were climbing the Hawk pilot to FL170 because both the other aircraft had been called to him under Traffic Service. Very shortly afterwards Norwich called and there was a very flustered request for co-ordination regarding their civil aircraft and the Hawk. Their request was far too late because the returns were merging albeit with 2000ft separation. The Tac assured the Norwich controller that the Hawk was maintaining FL160 although he did not believe any legal co-ordination was achieved because by then the aircraft had "passed through each other" and were separating. He then rang the Marham Supervisor and questioned the wisdom of Marham climbing an aircraft straight at another aircraft to the same level with no confirmation that the pilot was visual with the other aircraft. He believed that that there was zero risk of a collision as the Swanwick Tac had implemented a stop climb of FL160, well before the aircraft got within 5nm of each other and the minimum vertical distance between the Hawk and the civil aircraft was never less than 2000ft. With hindsight it might be suggested that his Tac could have stopped at FL150 to give Norwich the 3000ft minima they were aiming for under a Deconfliction Service, but he did not believe it was the Tac's responsibility to control his aircraft in a manner that he builds in Deconfliction Service minima in his control actions pre-emptively in case other airspace users were operating thus.

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

THE NORWICH APPROACH RADAR CONTROLLER reports that as the E135 pilot came onto frequency from ScACC descending to FL180, the 'LJAO' [Swanwick Mil] called to coordinate southbound military traffic at FL170. Whilst coordinating, the STCA alerted the controller to fast-moving opposite-direction traffic 5nm south-east of the E135 and climbing. The controller immediately gave the E135 pilot avoiding action and Traffic Information on the conflicting traffic, and the pilot reported following a TCAS RA. The pilot's RA report was not heard because the controller was trying to coordinate on the landline, further avoiding action was passed until the conflicting traffic had passed.

Factual Background

The weather at Norwich was recorded as follows:

```
EGSH 221350Z 23016KT 9999 FEW029 SCT040 23/18 Q1021 NOSIG=
```

Analysis and Investigation

CAA ATSI

The E135 was on an IFR flight to Norwich. At the time of the Airprox, an ATC service had not been formally agreed. The Hawk pilot, which had just completed a VFR training sortie over land to the east of The Wash, between the surface and 5000ft, was in the climb to FL190. The pilot was in receipt of a Traffic Service from Marham Zone, whilst being transferred to Swanwick Mil.

At 1347:32, the Norwich Radar controller received a telephone call from a controller at Swanwick Mil. The Swanwick Mil controller started to pass Traffic Information to the Norwich controller on a Typhoon to the north-east of the E135 but, during the conversation, at 1347:40**,** the E135 pilot contacted Norwich Radar (Figure 1).

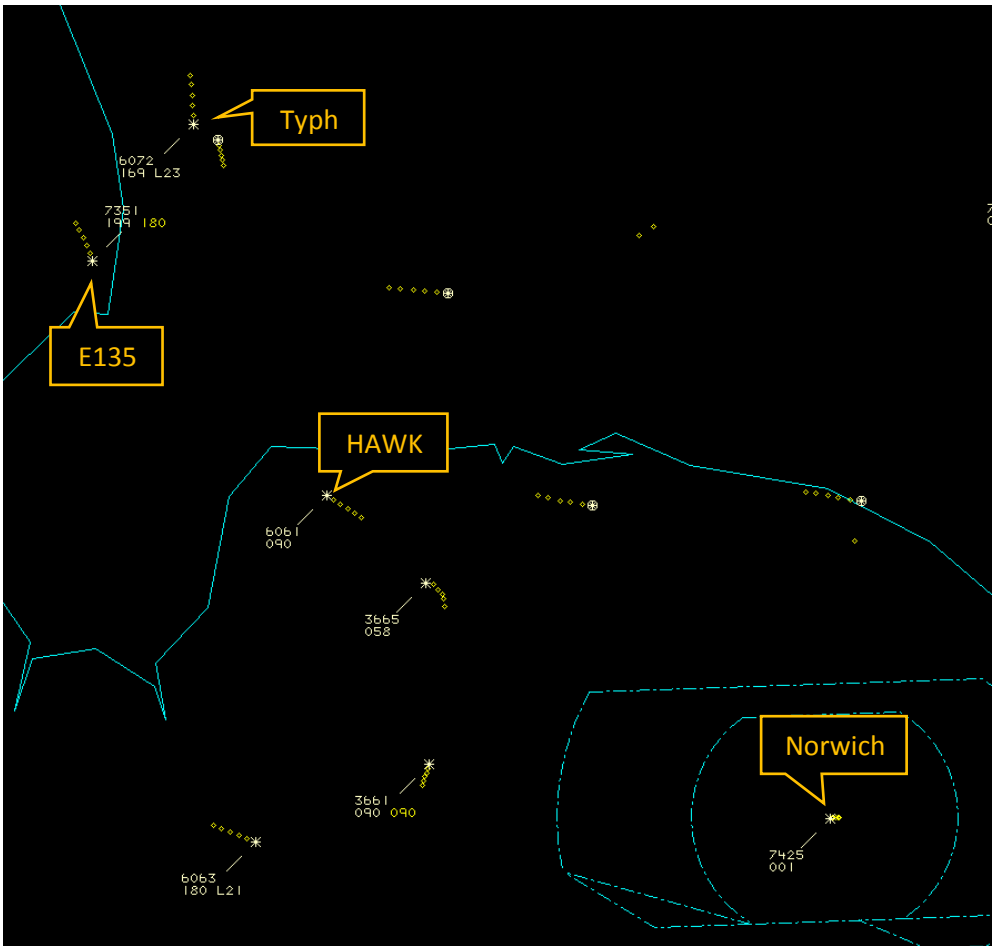


Figure 1 - Swanwick MRT – 1347:40.

The Swanwick Mil controller continued to pass the Traffic Information, based on which, at 1347:58 the Norwich controller instructed the E135 pilot to turn left onto a heading of 100° and to *"descend FL180 only"*. The Hawk was passing FL112, 12.2nm south-east of, and tracking towards, the E135 (Figure 2).

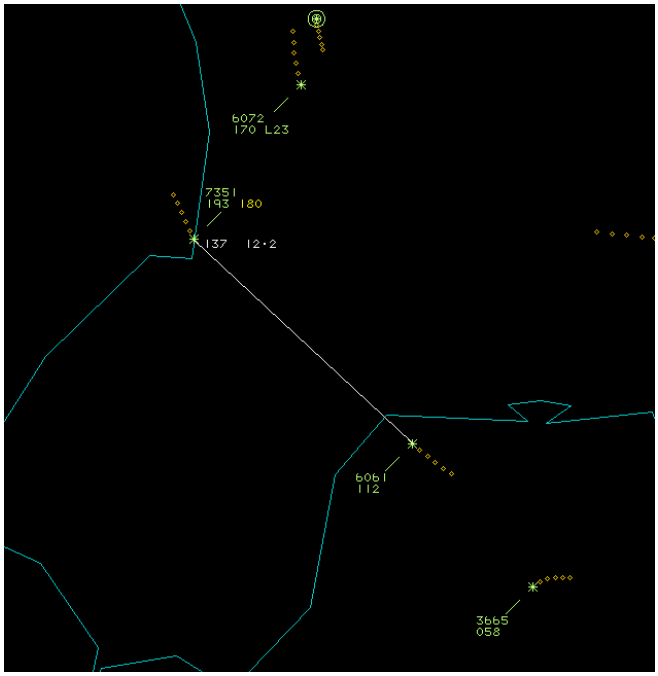


Figure 2 - Swanwick MRT – 1347:58

At 1348:17, the Norwich Radar STCA was activated and, at 1348:22, the Norwich controller issued an avoiding action left turn, onto a heading of 090° to the E135 pilot (Figure 3).

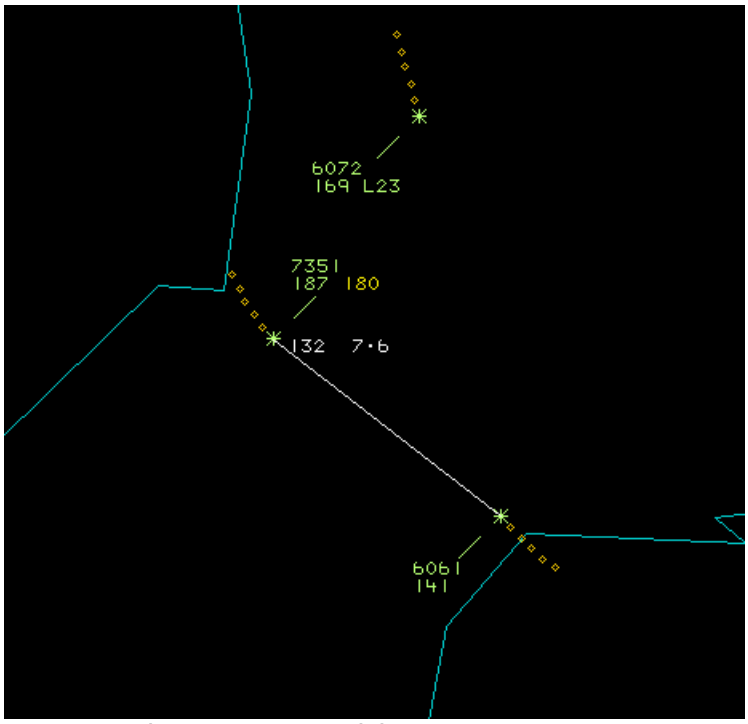


Figure 3 - Swanwick MRT – 1348:22.

At 1348:30 the Norwich controller passed Traffic Information to the E135 pilot on the Hawk, *"unknown military traffic south-east of you by 4 miles, opposite direction, indicating FL152, climbing".* This was acknowledged by the E135 pilot who, at 1348:35, reported a TCAS RA.

At 1348:40 the Norwich controller issued a further avoiding action instruction; *"turn right heading, correction, turn left heading 360 degrees"* which was read back by the E135 pilot (Figure 4).

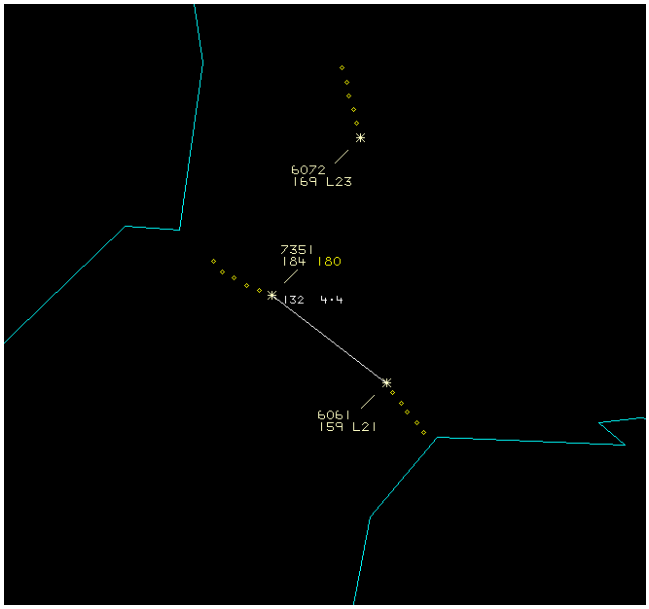


Figure 4 - Swanwick MRT – 1348:40.

The telephone line between the Norwich and Swanwick Mil controllers was still open and so the Norwich controller started to request Traffic Information on the Hawk from the Swanwick Mil controller, but was requested to standby because it was another controller they needed to speak to. At 1348:50 another Swanwick Mil controller, identifying themselves as "*Swanwick Mil East"*

came on the line, at which point, at 1348:55, the Norwich controller issued a further avoiding action instruction of "*right, heading 180 degrees"*. The radar replay indicated that the E135 pilot had commenced a climb, possibly as a result of the TCAS RA (Figure 5).

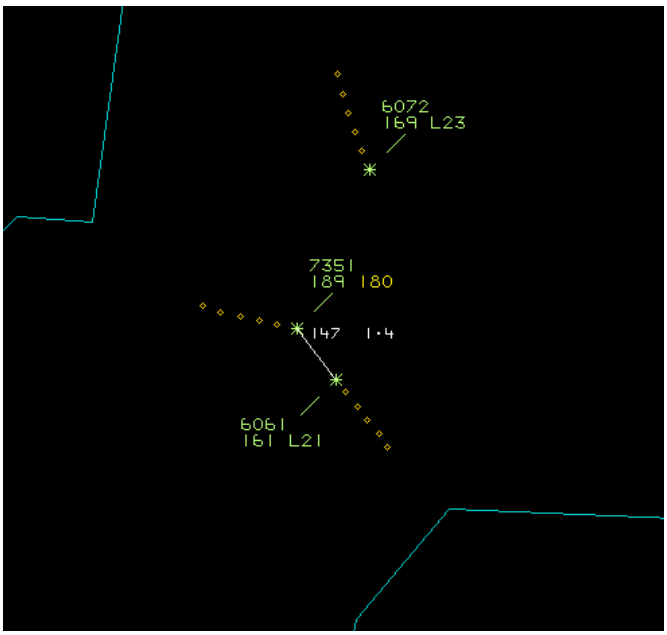


Figure 5 - Swanwick MRT – 1348:55.

The Norwich controller then attempted to resume the conversation with Swanwick Mil, and a third Swanwick Mil controller advised them that their traffic, (the Hawk) had just been handed over to them and that it was maintaining FL160. CPA took place during this conversation, at 1349:02, with the aircraft separated by 0.6nm laterally and 2900ft vertically (Figure 6).

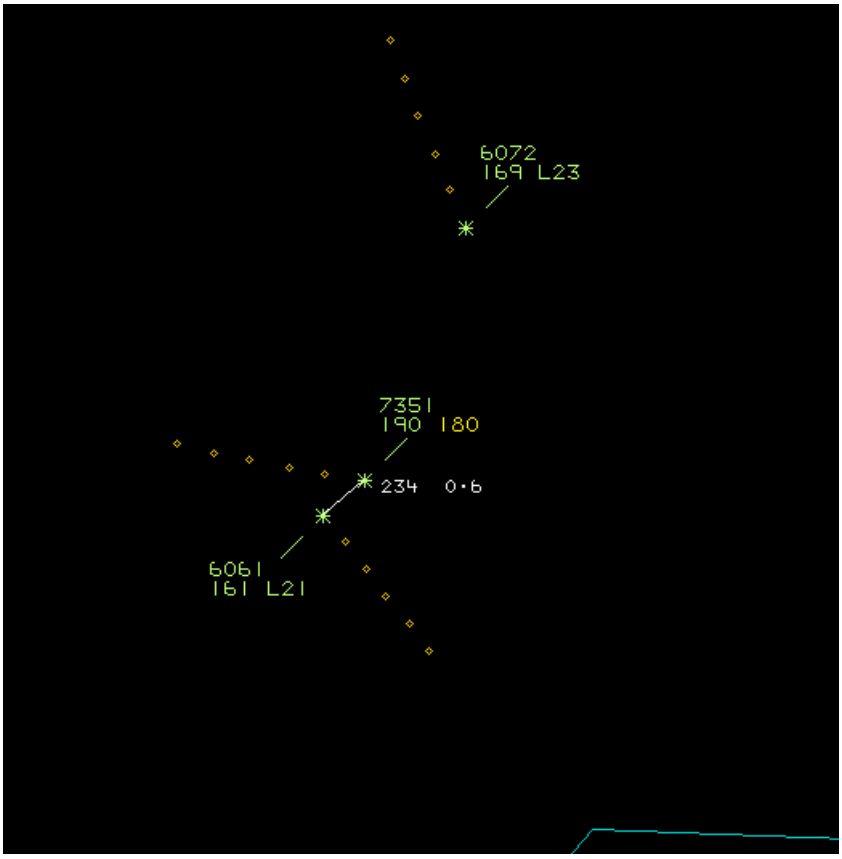


Figure 6 - Swanwick MRT – 1349:02.

The Norwich controller, with many years' experience as a radar controller at Norwich, confirmed that they had been aware of the Hawk, which was one of a pair which had been operating in the area for some time. Their initial plan had been to keep the E135 well north of the area occupied by the Hawk, possibly staying offshore to the north.

On learning from the telephone conversation initiated by the Swanwick Mil controller that the Typhoon to the north-east of their E135 was intending to maintain FL170, the Norwich controller initiated their plan to stay north of the area occupied by the two Hawk aircraft. They instructed the E135 pilot to make a left turn onto a heading of 100°, emphasising that the E135 pilot was to descend to FL180 only, to maintain a level 1000ft above the military (Typhoon) traffic. Although this executive action took place effectively before an agreement was reached with the Swanwick Mil controller, no objection was raised, and the Swanwick Mil controller confirmed that they would maintain "*not above 170 until 5 miles clear of your [E135 c/s]".*

This passing of Traffic Information and the subsequent coordination was taking place when the E135 pilot first contacted the Norwich controller. The telephone conversation was therefore somewhat disjointed, and had not been terminated before the Norwich controller was alerted to the confliction with the Hawk by their STCA software. The controller had not previously noticed that the Hawk pilot was now climbing-out, focussed as they were on the other Typhoon which was the subject of the coordination.

The presentation of the traffic would suggest that an avoiding action turn to the right rather than to the left might have been more suitable. However, at interview, the Norwich controller confirmed that the left rather than right turn for avoidance was deliberate, and based on the premise that the E135 pilot, having already been issued with a left turn earlier, should already be in that left turn. Any cancellation of that turn with an opposing turn to the right would not have been as effective. ATSI noted that the avoiding action phraseology was incomplete, with the instruction to turn *"immediately"* having been omitted. Also, with the aircraft already on a heading of 100°, an avoiding action left turn of only 10° (on to 090°) was considered insufficient. The controller believed that they were thinking in terms of the nearest cardinal point, (East), which led to that 10° turn. They subsequently issued a further avoiding action left turn onto 360° (North).

The controller went on to explain that they issued a third avoiding action turn (right) on to 180° whilst continuing to try and avoid the Hawk. They had not noticed that the Hawk had levelled at an indicated FL162.

Having issued the first avoiding action turn, the controller did not hear the TCAS RA report from the E135 pilot and so, contrary to CAP493, continued to issue the subsequent avoiding action instructions:

> *'When a pilot reports a TCAS RA, controllers shall not attempt to modify the aircraft's flight path or reiterate previously issued instructions, until the pilot reports "Clear of Conflict". Once an aircraft departs from an ATC clearance in compliance with an RA, or a pilot reports an RA, the controller ceases to be responsible for providing separation between that aircraft and any other aircraft affected as a direct consequence of the manoeuvre induced by the RA'.*[1]

The Norwich controller admitted that they had struggled to stay calm during this scenario, and had been further distracted by the STCA alarm, which can be cancelled on the radar console, but re-arms and re-alerts the controller whilst the confliction remains. It was also reported that the initial audible alarm volume can at times be excessive. This issue of the volume has since been resolved by the unit.

The Norwich controller did not formally agree the type of ATC service with the E135 pilot until after the Airprox, but they had been focussed on the initial coordination and a desire to get the E135 clear of the Typhoon below, to enable descent inbound to Norwich. Because the

[1] CAP493 Section 1: Ch10: Airborne Collision Avoidance System – Page 3

coordination then ran into the avoiding action, there was no time, and the controller did not consider informing the E135 pilot as to what service he was receiving until after the confliction was resolved.

The Marham controller had passed Traffic Information to the Hawk on the E135. In the Swanwick Mil controller's report they stated that during the handover they requested that the Marham controller stop the Hawk at FL160 because of the E135, but that *"this took some insistence with the Marham controller"*. ATSI received a copy of the Marham Zone R/T transcript but this conversation was not evidenced there, only the Marham Zone controller's instruction to the Hawk pilots to stop their climb at FL160.

The pilot of the E135 reported not sighting the Hawk, the Marham R/T transcript indicated that the Hawk pilot was visual with the E135. The separation achieved between the two aircraft resulted from the Marham controller's instruction to the Hawk pilot to stop his climb at FL160 and the E135 pilot's response to the TCAS RA.

Initially distracted by the coordination being agreed with the Swanwick Mil controller in relation to the Typhoon, the Norwich Radar controller did not immediately see, nor recognise, the potential confliction with the Hawk. The initial turn of 10° was considered to be insufficient as an avoiding action turn, although the direction of turn was accepted as being the most appropriate, bearing in mind the initial left turn instruction issued 20 seconds earlier. Subsequent avoiding action was incorrectly issued whilst the E135 was subject to a TCAS RA.

Military ATM

Portions of the tape transcripts between the Marham Zone controller, Swanwick Mil East controller and the Hawk pilot are below:

To	From	Speech Transcription	Time
Marham Zone	Hawk	Marham, [Hawk C/S] will be complete in Sculthorpe in one Mike	13:45:47
Hawk	Marham Zone	[Hawk C/S] roger request your intentions	13:45:52
Marham Zone	Hawk	Err climb FL 190 direct track RAF Leeming please	13:45:54
Hawk	Marham Zone	Roger	13:45:58
Marham Zone	Swanwick Mil East	Swanwick Mil East	13:46:32
Swanwick Mil East	Marham Zone	Marham Approach prenote errr UHF Lower airspace transit back to Leeming [Hawk C/S]	13:46:33
Marham Zone	Swanwick Mil East	[Hawk C/S] standby	13:46:38
Marham Zone	Hawk	Marham Zone Marham Zone [Hawk C/S]	13:46:39
Hawk	Marham Zone	[Hawk C/S] Standby	13:46:43
Swanwick Mil East	Marham Zone	Errr Hawk RTB err in fact yeah hawk RTB Leeming FL190	13:46:45
Marham Zone	Swanwick Mil East	Hawk RTB Leeming FL190 Roger squawk 6061	13:46:52
Swanwick Mil East	Marham Zone	In fact can I hand him over	13:46:57
Marham Zone	Swanwick Mil East	Err yeah	13:46:59
Swanwick Mil East	Marham Zone	Standby	13:47:00
Hawk	Marham Zone	[Hawk C/S] err Rodger own navigation stop climb FL 170	13:47:01
Marham Zone	Hawk	Understand for [Hawk C/S] stop climb FL170 looking for direct track Leeming	13:47:08
Hawk	Marham Zone	[Hawk C/S] Roger squawk 6061	13:47:14
Marham Zone	Hawk	6061 coming now	13:47:16
Unk Callsign	Marham Zone	Station Calling Marham Zone UHF standby	13:47:18
Swanwick Mil East	Marham Zone	Errr [Hawk C/S] is Marham NE 1 8 Miles own navigation to Leeming squawking 3666 shortly to change to 6061	13:47:21
Marham Zone	Swanwick Mil East	Contact	13:47:34
Swanwick Mil East	Marham Zone	Climbing, re, request FL190 Hawk RTB Leeming Traffic service	13:47:35
Marham Zone	Swanwick Mil East	Standby, [other traffic] Squawk 0250	13:47:39

Hawk	Marham Zone	[Hawk C/S] traffic right 1 o'clock 1 5 miles crossing right left FL100 descending	13:47:43
Swanwick Mil East	Marham Zone	FL 100	
Hawk	Marham Zone	[Hawk C/S] apologies FL195 descending	13:47:50
Unk Callsign	Swanwick Mil East	[Other traffic] contact correction continue with Scottish control133.8	13:47:53
Marham Zone	Swanwick Mil East	Sorry go ahead Marham	13:48:01
Hawk	Marham Zone	[Hawk C/S] stop climb FL 160	13:48:12
Marham Zone	Hawk	FL 160 [Hawk C/S]	13:48:16
Marham Zone	Helimed	Marham Zone Helimed [C/S A] changing call sign to Helimed [C/S] stood down from task and returning to Wyton	13:48:20
Hawk	Marham Zone	[Hawk C/S] further traffic is errr right 2 o'clock 8 miles crossing right left at FL170	13:48:29
Marham Zone	Hawk	Looking [Hawk C/S]	13:48:36
Hawk	Marham Zone	Traffic in your 12 o'clock FL185 now crossing left right 3 miles	13:48:38
Marham Zone	Hawk	Visual with that traffic	13:48:43
Hawk	Marham Zone	[Hawk C/S] contact Swanwick Military 259.6	13:48:45
Marham Zone	Hawk	Roger Swanwick Military now 259.6	13:48:49
Helimed	Marham Zone	Helimed [C/S A] stepped on say again	13:48:53
Marham Zone	Helimed	Yeah Helimed [C/S] stood down from task returning to RAF Wyton Helimed [C/S]	13:48:55
Helimed	Marham Zone	Helimed [C/S] Acknowledged	13:49:00

At 13:45:47, the Hawk pilot informed the Marham Zone controller that he would be complete in one minute, with intentions to route to RAF Leeming at FL190. The Marham Zone controller called Swanwick to prenote the Hawk but converted to a handover as the aircraft called complete.

At 13:47:01 (Figure 7), the Marham Zone controller instructed the Hawk pilot to proceed under own navigation, stopping climb at FL170.

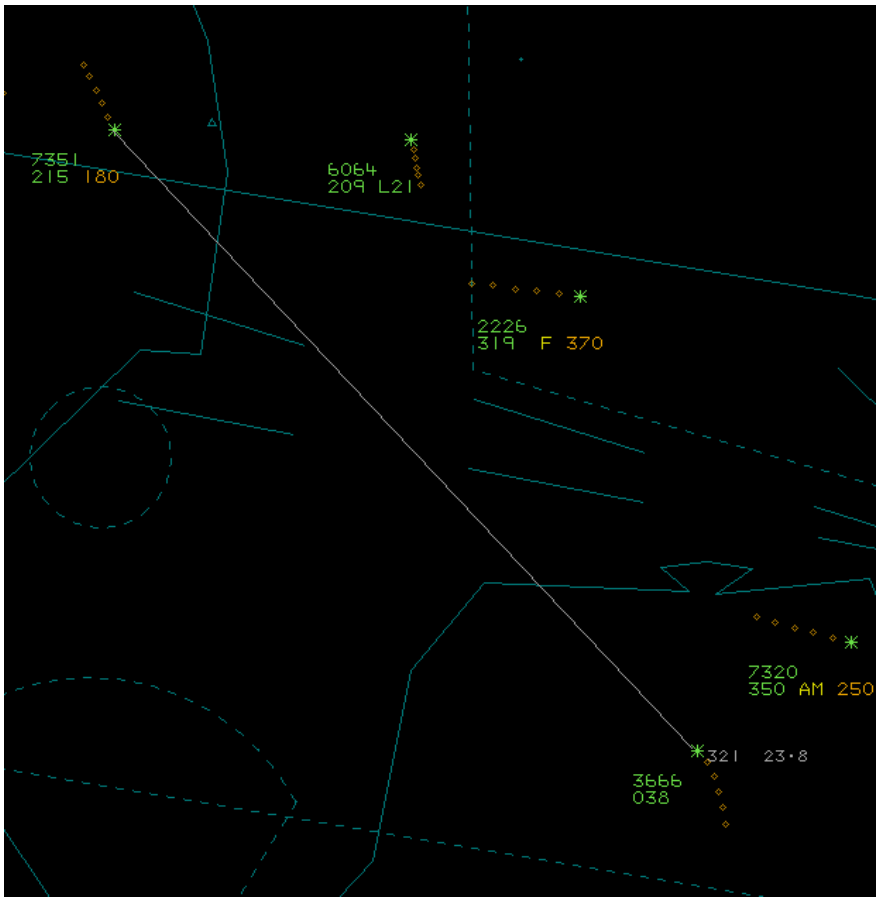


Figure 7: Geometry at 13:47:01 (Hawk SSR 3666; E135 SSR 7351).

At 13:47:43 (Figure 8), during the handover, the Marham Zone controller passed Traffic Information to the Hawk pilot on traffic in his right, 1 o'clock, 15nm, crossing right to left, FL100 descending. After a query from the Swanwick controller, the Traffic Information was corrected from FL100 to FL195 descending. From the Marham controller's narrative, it is not clear which traffic was actually being called.

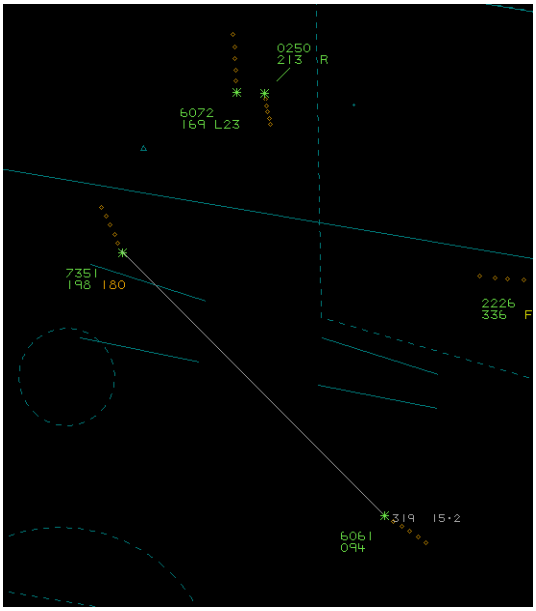


Figure 8: Geometry at 13:47:43

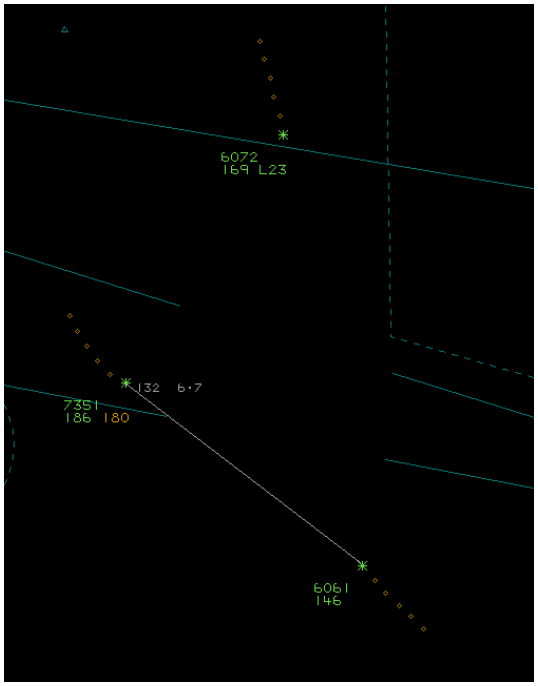


Figure 9: Geometry at 13:48:29

(Hawk SSR 6061; E135 SSR 7351).

At 13:48:12, with the handover still ongoing, the Marham Zone controller instructed the Hawk pilot to stop climb FL160. At 13:48:29 (Figure 9), the Marham Zone controller passed further Traffic Information to the Hawk pilot on traffic in his right 2 o'clock, 8nm, crossing right to left at FL170 (6072).

At 13:48:36 (Figure 10), the Marham Zone controller passed Traffic Information to the Hawk pilot on civil traffic in his 12 o'clock, FL185, crossing left to right, 3nm. The Hawk pilot reported visual with the traffic and was then instructed to contact Swanwick Mil.

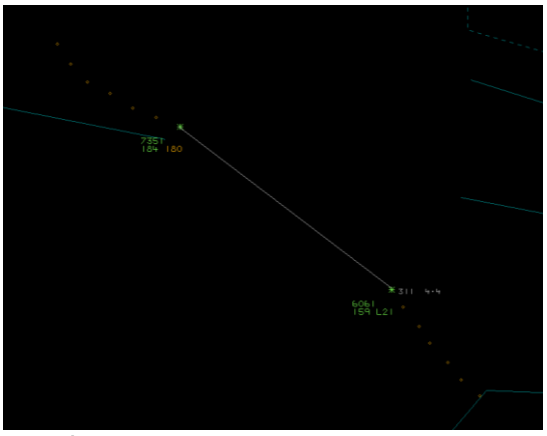


Figure 10: Geometry at 13:48:38

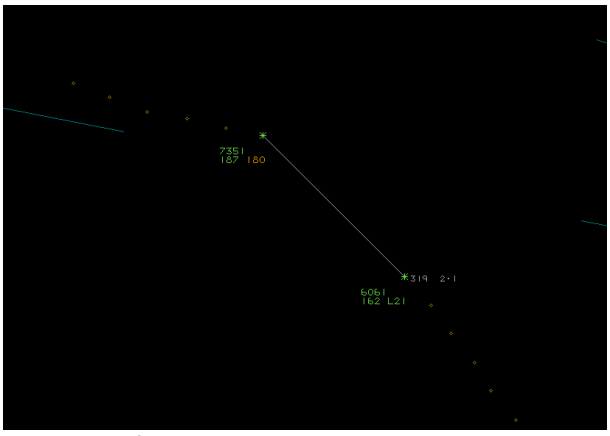


Figure 11: Geometry at 13:48:51

(Hawk SSR 6061; E135 SSR 7351).

At 13:48:51 (Figure 11), the Norwich Approach controller, whilst on the landline attempting to effect coordination with the Swanwick controller, gave avoiding action (turn right heading 180° to the E135 pilot).

At 13:49:02 (Figure 12), the two aircraft were at their closest, passing 0.6nm laterally with 3000ft vertical separation.

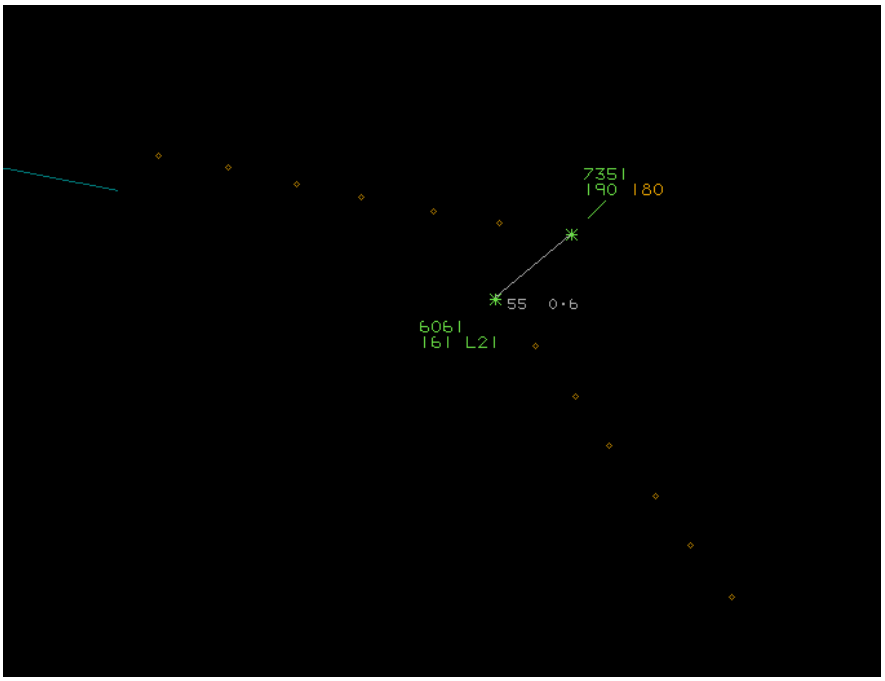


Figure 12: Geometry at 13:49:02 (Hawk SSR 6061; E135 SSR 7351).

As agencies involved were not made aware of the Airprox at the time, controller and pilot narratives were provided several weeks after the incident.

The Swanwick 'East Tac' left controller was under training. They reported receiving a call from Marham to prenote, and then handover, the Hawk. As the Hawk, which was climbing to FL170, was identified, two conflicting tracks were present; a pair of fast-jets departing a tanker at FL170 and a civil inbound to Norwich descending to FL180. A request was made to the Marham controller for the Hawk pilot to stop climb at FL160 to deconflict. The Swanwick controller reported that the Marham controller appeared reluctant to stop the climb, stating that the conflicting traffic had been called.

The Marham Zone controller reported that they were working 6 speaking units over two frequencies. Although the Hawk pilot had reported one minute to completion with intentions, dealing with a HEMS call on VHF took priority. On completion, the Hawk pilot requested a climb to FL190 and to route direct Leeming but was not given a positive control instruction. During the handover, the Hawk pilot was instructed to stop climb FL170 to remain beneath the airway Y70 to the north. Traffic Information was passed to the Hawk pilot on conflicting traffic 15nm away at FL200, though it is not clear which aircraft the traffic was. The climb was stopped at FL160 at Swanwick's request to remain beneath conflicting traffic. At the end of the handover, Traffic Information was given on 'additional' conflicting civil traffic, range 3nm, on an opposite direction heading at FL195, which was the E135. The Hawk pilot called visual with the traffic.

The Norwich controller had two conflictions for their aircraft, the E135, which would require Deconfliction Service outside of CAS. Coordination was effected with the Swanwick 'East Tac' Right; however, its protracted nature meant that, by the time they were transferred to Swanwick 'East Tac' Left to coordinate the Hawk, standard separation had been eroded.

Due to high workload on the part of both Marham Zone and Swanwick Tac East, the handover was protracted, taking over 2 minutes. The Hawk pilot was climbed to FL170 to remain beneath CAS and then stopped off at FL160 to remain beneath conflicting traffic once both controllers had reassessed the traffic situation, therefore control instructions did not introduce the risk of collision. Although the initial Traffic Information passed appears to correlate with the E135's position, the

controller's narrative suggests that the E135 was not identified as a conflictor until late in the handover. Based on this, it is difficult to determine whether or not Traffic Information was timely, however, the traffic was called and the Hawk pilot called visual, therefore both barriers were effective.

UKAB Secretariat

The E135 and Hawk pilots shared an equal responsibility for collision avoidance and not to operate in such proximity to other aircraft as to create a collision hazard[2]. If the incident geometry is considered as head-on or nearly so then both pilots were required to turn to the right[3].

Due to late notification, the military controllers only found out about the Airprox some time after the event, initially it was believed to be a TCAS event. Consequently, their recollection of events was affected.

Comments

HQ Air Command

This incident serves as a reminder that no barrier to MAC is 100% effective. The controllers involved were working quite hard at agreeing coordination on multiple tracks whilst also dealing with handovers and priority traffic (the HEMS aircraft that Marham Zone controller quite rightly prioritized). It would appear that the Norwich controller's attention was focussed on coordinating his inbound against the Typhoons and, by the time he noticed the Hawk climbing out of Sculthorpe, his options were very limited. He could not have known that the Hawk pilot was visual with his traffic and so attempted to achieve lateral separation which, by the time the STCA activated, was going to be very difficult to achieve. The aircraft were never in danger of colliding as the Hawk was visual with the Embraer throughout, though it is unsurprising that the Embraer's TCAS issued an RA against the traffic climbing directly at it. A combination of TI issued to the Hawk pilot, the Norwich controller's reaction to the STCA and the Embraer's TCAS issuing an RA led to this encounter being nothing worse than a loss of separation (acknowledging that the Embraer was not in receipt of any *formally* agreed ATS).

Crews should also note that an Airprox should be declared on frequency whenever it is safe to do so, and that they should give as much notice of their intentions to controllers as is reasonably practicable in order to give ATC time to coordinate handovers etc.

Summary

An Airprox was reported when an E135 and a Hawk flew into proximity at 1349 on Monday 22nd August 2016. The E135 pilot was operating under IFR in VMC and the Hawk pilot under VFR in VMC. The E135 pilot was in receipt of a Deconfliction Service from Norwich (although this had not been formally agreed) and the Hawk pilot in receipt of a Traffic Service from Marham. The E135 pilot reported climbing in reaction to a TCAS RA; the Hawk pilot reported visual with the E135. CPA was 2900ft vertically and 0.6nm horizontally.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

Information available included reports from the pilots and controllers concerned, area radar and RTF recordings and reports from the appropriate ATC and operating authorities.

The Board first discussed the actions of the Norwich Radar controller. The Board noted that it was not possible for flights using Norwich airport to remain within CAS because it was not connected to the Airways system. When clear of the airway, Norwich ATC routinely provide a Deconfliction

[2] SERA.3205 Proximity.
[3] SERA.3210 Right-of-way (c)(1) Approaching head-on.

Service to inbound commercial flights and, in accordance with normal operating procedures the E135, which was inbound to Norwich IFR, was released to them at FL180. A Civil ATC member with operational experience at Norwich, reported that the controller involved was very experienced and, on this occasion, because of the traffic situation the controller took immediate action with the pilot before formally agreeing a service in order to try to achieve 3000ft vertical or 5nm horizontal separation. When the E135 pilot contacted Norwich, the controller was receiving a telephone call from Swanwick Mil (East Tac right) about fast-moving southbound military traffic to the north-east of the E135 at FL170 (the Typhoons that were off the tanker). Based on this information provided by Swanwick, the controller instructed the E135 pilot to turn left heading 100° and to maintain FL180. At the time, the Airprox Hawk, undetected by the Norwich controller, was climbing through FL112 and tracking towards the E135 from the south-east. The ATC Member explained that, shortly after instructing the E135 pilot to turn, the Short Term Conflict Alert (STCA) activated between the E135 and the Hawk. The ATC Member commented that the STCA took the controller by surprise; although he had been aware of the Hawk operating at low-level to the south around Sculthorpe, the controller had not observed the Hawk set course to the north-west and climb towards the E135, mainly because his attention was on the traffic at FL170. Now slightly unnerved, the controller's first action was to instruct the E135 pilot to make an avoiding action left turn, albeit by only 10°, which was followed shortly by Traffic Information to the E135 pilot on the Hawk at 4nm, climbing through FL152. At the time, the controller was unaware that the Hawk would only be climbing to FL160. The E135 pilot acknowledged the call and then reported receiving a TCAS RA. Once a pilot reports an RA, no further instructions should be issued by ATC; however, on this occasion, the Norwich controller, still on the telephone to Swanwick, did not assimilate the E135 pilot's call and continued to pass avoiding-action instructions to him (initially left heading 360°, then right 180°). The Norwich controller did try to coordinate this action with Swanwick, but this involved talking to a different military controller (East Tac left), and by the time contact had been made CPA had occurred.

The Board then turned their attention to the Swanwick 'East Tac' left controller's actions. The Board noted that the controller was monitoring a trainee and reported receiving a telephone call from Marham, initially to pre-note the Hawk and then to arrange to handover the aircraft to them climbing to FL170. They were aware of the Typhoon traffic at FL170, and the E135 at FL180, and accordingly requested Marham to stop the Hawk's climb at FL160; the Board commended the Tac left's actions, which had ensured that the three aircraft involved were vertically separated. Members noted that the Swanwick controller had commented that the Marham controller seemed reluctant to stop the Hawk's climb because the pilot was in receipt of only a Traffic Service and had been advised of the E135.

Turning to the Marham controller's actions, the Board noted that the controller reported that she was bandboxing 4 frequencies, with 6 speaking units on 2 frequencies at the time. Several members wondered if that meant that she had been overloaded. Controller members pointed out that it really depended on the complexity of the traffic, and there was no indication in her report to show how she thought her workload had been affected. That being said, they noted that at the same time as the Hawk pilot reported one minute to completion of his task, a Helimed pilot had called on a 'red' flight. Rightly prioritising this flight, it was only subsequently that she telephoned Swanwick Mil to pre-note the Hawk, by which time it was already climbing. During the call to Swanwick Mil, the Hawk pilot requested to return to base at FL190 so she stopped the pilot's climb at FL170 (to remain below Airway Y70 whose base was FL175) and changed the pre-note into a handover. During this handover she passed Traffic Information to the Hawk pilot about an aircraft in his 1 o'clock, crossing right to left descending through FL195. This was believed to be the E135 although, from the military report, there appeared to be some confusion about the timing of the Traffic Information being passed and the Marham controller observing the E135. Swanwick requested her to stop the Hawk's climb at FL160, which she complied with. Further Traffic Information about the E135 was passed to the Hawk pilot, who subsequently reported visual; the radar recordings show that this was at a range of 3nm. Although recognising that the Hawk pilot was in receipt of only a Traffic Service which did not require the controller to provide avoiding action, ATC members opined that good 'controllership' would have been to offer the Hawk pilot a suggested heading to avoid the E135 rather than allowing him to climb towards the E135 and into potential conflict.

The Board then discussed the piloting aspects of the Airprox. The Civil ATC member commented that the E135's company was a regular user of the airport and its pilot would be well aware that he would be approaching the airport outside CAS. He was of the opinion that the pilot would also have been aware of the Norwich Deconfliction Service procedures. The Board noted that he had reported to ATC that he had received a TCAS RA and had complied with its climb instruction. Some members wondered why, having reported the RA, he had not queried the controller's actions in continuing avoiding-action manoeuvring; however, other members noted that in his report he had stated that by the time the instructions were passed he had received a TCAS 'clear of conflict' message whilst they were climbing through FL190. Although there was no record that the pilot made a transmission stating that he was clear of conflict, the RT recording shows that there was an unintelligible call made by the E135 pilot just after he had been given the avoiding action right turn. All-in-all, the Board were sympathetic to the E135 pilot's predicament; he had received a number of avoiding action instructions (with reversal of turns) and a TCAS RA against an aircraft that he was never visual with whilst he was transiting in Class G airspace, it was unsurprising that he was concerned by the situation. That being said, members commented that the receipt of a Deconfliction Service in Class G does not provide any guarantee that separation will be achieved, especially against highly-manoeuvring traffic; controllers will endeavour to do all that they can to achieve 5nm and 3000ft separation but this is not always possible against other aircraft not under positive control.

For the Hawk pilot's part, the HQ Air member explained that the Hawk's task can be fuel critical and, although pilots would normally give a 1 minute to completion call, this could vary between 20 seconds and 2 minutes depending on the task. Because of fuel issues, the pilot would expect to initiate his climb and set course direct to base after completion of the task, with ATC coordinating his climb and routing through CAS as required. Although an earlier call pre-noting his completion of task would have helped in this specific situation given the propinquity of airway Y70, members with military experience commented that he would probably not know an exact time for his climb given that there may be unknown factors involved in his coordination with the tactical ground unit he was supporting. Members debated whether the Hawk pilot should have requested a climb only to FL170 until he received positive clearance to enter CAS, but the general opinion was that he would have believed that ATC would be able to coordinate his climb before entering airway Y70.

A lengthy debate then took place as to how this Airprox could have been prevented. During the discussion the Board were unanimous in agreeing that all personnel involved had complied with the letter of their appropriate operational requirements; however, it was considered that additional actions could have been taken to prevent the Airprox occurring. If the Norwich controller had monitored the Hawk on radar (such Hawk operations were relatively common in that area) then the controller would probably have observed the potential confliction prior to the activation of the STCA and it might have been possible to coordinate a plan of action to separate the E135 and the Hawk before avoiding-action was required and the TCAS RA occurred. If the E135 pilot had ensured that he received a response from ATC to his RA it would have stopped the controller passing conflicting instructions to his aircraft. If the Hawk pilot had been able to provide a proposed completion call of more than one minute the additional time would have assisted the Marham controller to coordinate with Swanwick. If the Marham controller had offered the Hawk pilot a suggested heading to avoid the E135 as he climbed, then the Hawk and E135 would have been unlikely to have come into proximity. In this latter respect, further discussion took place concerning the apparent reluctance of the Marham controller to stop the Hawk's climb at FL160. Members agreed that under a Traffic Service there was no requirement for her to provide separation between the aircraft; however, several members considered that the controller could have more pro-actively ensured a greater margin of vertical separation.

The Board noted that the E135 pilot commented that he thought that his airline should consider staying on Airway Y70 until further east of the Wash area before turning for Norwich. The ATC member explained that it is not unusual for them to take traffic further east if there is the likelihood of a confliction in the Wash area; on this occasion, it was just unfortunate timing of the Hawk pilot leaving his operating area and climbing just as the E135 came off the airway.

Looking at the safety barriers associated with this incident, the Board considered that the following were key factors:

- **ATC Strategic Management and Planning** was assessed as **partially effective** because the Marham controller was bandboxing 4 frequencies and had to deal with the Helimed aircraft rather than being able to pre-note the Hawk's climb in a more timely manner.

- **ATC Conflict Detection and Resolution** was also assessed as **partially effective** because the Norwich controller had not noticed the Hawk's climb towards the E135 until STCA had alerted, and the Marham controller had not offered the Hawk pilot a heading suggestion or climb limit on detecting the likely conflict.

The Board then turned their attention to the cause and risk of the Airprox. Members noted that the E135 pilot was obviously concerned about the presence of the Hawk, having received a TCAS RA (requiring a good rate of climb) and a number of avoiding action turns (given by the controller in, he reported, a not very relaxed manner). A prolonged debate then ensued in which the Board discussed numerous potential causal aspects including: whether the Hawk pilot should have done more to pre-notify and clear his flight path before and as he climbed; whether the Norwich controller should have been more alert to the Hawk's presence and have expected it to climb at any time; whether the Marham controller was overtasked or could have been more pro-active in suggesting routing and climb limits to the Hawk pilot; or whether the E135 pilot was simply oversensitive to the TCAS RA and avoiding action turns that he had received in Class G mixed IFR/VFR airspace. In the end, members decided that the situation was probably best described simply as a Conflict in Class G airspace in recognition that each participant had done what was required of them, even if more could have been done by all. Turning to the risk, members noted that at CPA the two aircraft had in fact been vertically separated by 2900ft, and that a minimum of 1000ft vertical separation had already been built in by the Marham controller who had initially limited the Hawk's climb to FL170 (albeit not knowing that the E135 would remain at FL180). Notwithstanding the confusion that had been generated in the E135 pilot's mind by the TCAS RA and the multiple conflicting avoiding action turns from the Norwich controller, the Board considered that 2900ft could be judged as being within normal standards of separation in Class G airspace and they therefore concluded that there had been no risk of a collision and the Airprox was assessed as risk Category E.

PART C: ASSESSMENT OF CAUSE AND RISK

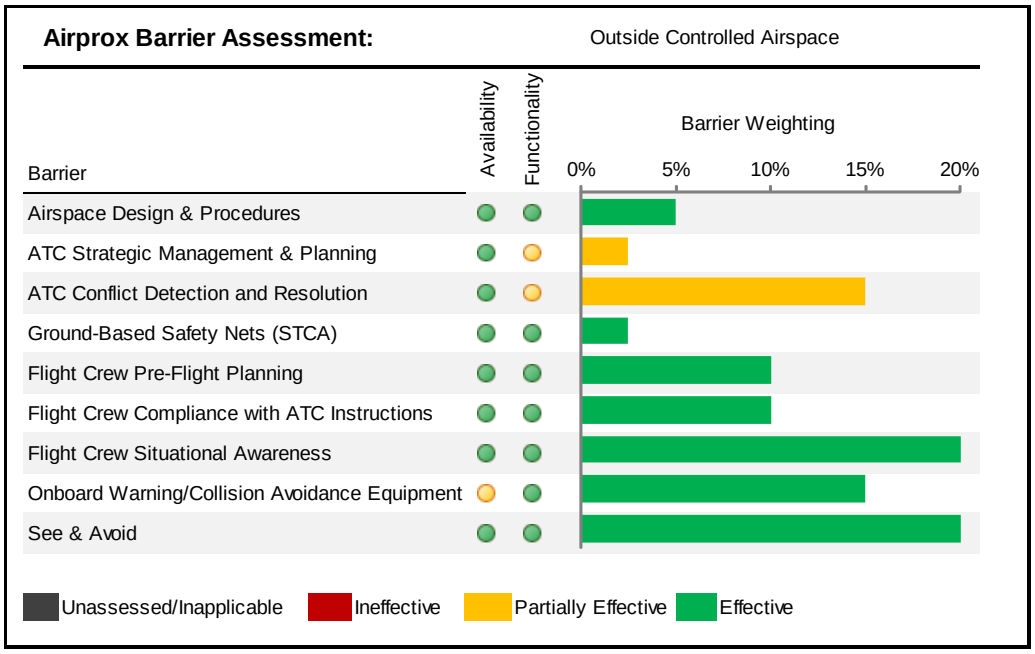
Cause: A conflict in Class G airspace.

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).[4] 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.

[4] 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 Effectiveness		Consequence		
		Non-functional	Partially Functional	Functional
Availability		**1**	**2**	**3**
Completely Unavailable	**1**	1	2	3
Partially Available	**2**	2	4	6
Available	**3**	3	6	9

Key:

Effective

Partially Effective (If the system was partially available but fully functional score availability as 2.5)

Ineffective

Unassessed/Inapplicable

Barrier	Availability			Functionality			Unassessable / Absent
	Fully (3)	Partially (2)	Not Available (1)	Fully (3)	Partially (2)	Non Functional (1)	
Airspace Design and Procedures	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. TCAS not fitted to either aircraft or ATC Service not utilised. Note: The Board may comment on the benefits of this barrier if it had been available
ATC Strategic Management and Planning	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	
ATC Conflict Detection and Resolution	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 confliction 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	
Ground-Based Safety Nets (STCA)	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	
Flight Crew Pre-Flight Planning	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	
Flight Crew Compliance with Instructions	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	
Flight Crew Situational Awareness	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	
Onboard Warning/Collision Avoidance Equipment	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	One aircraft was equipped with ACAS/TAS that was selected and serviceable but unable to detect the other aircraft (e.g. other aircraft not transponding)	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	
See and Avoid	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)	