

AIRPROX REPORT No 2022050

Date: 14 Apr 2022 Time: 1328Z Position: 5247N 00044E Location: IVO West Raynham

PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

Recorded	Aircraft 1	Aircraft 2
Aircraft	4 x F35	C42
Operator	HQ Air (Ops)	Civ FW
Airspace	London FIR	London FIR
Class	G	G
Rules	VFR	VFR
Service	Traffic	Basic
Provider	Marham App	Marham App
Altitude/FL	FL013	FL011
Transponder	A, C	A, C, S
Reported		
Colours	Grey	White, Red
Lighting	Strobe, Positioning	Nil
Conditions	VMC	VMC
Visibility	>10km	>10km
Altitude/FL	1300ft	1150ft
Altimeter	QFE (1019hPa)	QFE (1018hPa)
Heading	200°	SW
Speed	NK	84kt
ACAS/TAS	Not fitted	FLARM
Alert	N/A	None
Separation at CPA		
Reported	200ft V/0.5NM H	'a few hundred ft' V/0m H
Recorded	200ft V/0.2NM H	



THE F35 PILOT reports that during a 4-ship recovery, in arrow heavy-side right, a light aircraft was seen by No3 and No4 to pass slightly below and to the left of the formation. The traffic had been called once prior to the Airprox as "SE, 4NM, track west, 1200ft" which was acknowledged by the flight lead. There was no sensor situational awareness in any of the formation aircraft about the called aircraft that was soon to become a conflict. ATC began talking about another potential conflict that was "south, 8NM, track north, 800ft" but the Airprox aircraft was not mentioned again. No3 and No4 pilots both became 'tally' when passing slightly above and ahead of the conflict aircraft, visually estimated to be within 0.5NM laterally and 200ft vertically.

The pilot assessed the risk of collision as 'High'.

THE C42 PILOT reports that they called Marham LARS and requested a Basic Service and MATZ penetration as their direct route was through the MATZ circle north of the stub. The controller declined the request due to recovering fast jets. So the C42 pilot agreed to keep clear to the north routing just south of Kings Lynn. Soon after the lakes / railway line south of Kings Lynn a four-ship of F35s appeared directly above them, from directly behind, heading away so no avoiding action was necessary. Immediately after the close encounter they called the controller and thanked them for the flyby of the 4-ship - they replied 'you're welcome'. Which made the C42 pilot believe that the controller had made the F35 pilots aware of their position. Subsequently discovering that the F35 pilots weren't aware made the incident more concerning. At the time they would have liked to have reminded the controller that they said the fast jets would be inside the MATZ which is why the C42 had been kept outside, but they couldn't think of a short phrase at the time to say it.

The pilot assessed the risk of collision as 'Medium'.

THE MARHAM APP CONTROLLER reports that they were the Approach controller at the time of the Airprox. It was a relatively busy session and they had been in the seat for over 2hrs. They had two station-based Traffic Service aircraft that they were handing over to Swanwick, and 4 LARS tracks (3 Basic Service and 1 Traffic Service), all geographically spread at opposing ends of radar coverage. At approximately 1315 they received a late notice prenote for [F35 C/S] to recover from Swanwick. At this point, they requested a LARS controller via the Supervisor due to workload. The LARS controller quickly arrived and assumed the position. They pointed out the zone tracks and relinquished the frequency to them. This was a fairly speedy handover, but the controller appeared to have a grasp of the situation and was happy to accept control of that position. They then turned their attention to the Approach task. They were handed [the F35s] from Swanwick, as 'descending below FL70' at approx. 20NM to the NE of Marham, which caught them off guard as this was a nonstandard piece of handover phraseology. [The F35 C/S] requested a visual recovery from the north; following which, the controller identified them, gave them the QFE and told them to descend as required. By this point the formation were already through 3500ft. They called traffic 4-5NM to the SE and provided the indicated height information which the [F35 C/S] formation acknowledged. They subsequently called additional traffic transiting under the MATZ stub, which they perceived to be a significant factor once [the] formation were to be clear of the first conflictor. This was due to the indicated height being approx. 200ft below circuit joining height. By turning their attention to this conflictor, it prevented them from updating Traffic Information on the previous, which having called, they assumed that [the] formation would either be visual with it or would have stopped their descent to acquire it. By issuing the instruction to "descend as required" and providing Traffic Information on the conflicting track, it was their expectation that were the formation not content, they would not have continued to descend. In hindsight, if this were to happen again, they would have repeated the Traffic Information, checked that the crew were visual with that particular track or issued a descent to 1000ft above the indicated altitude in the first instance to build in some kind of vertical separation.

The controller perceived the severity of the incident as 'High'.

THE MARHAM ZONE CONTROLLER reports they were instructed to take the position by the Supervisor after being told the Approach seat, which was doing both positions at this point, was getting busier with a further inbound handover from Swanwick to come. As of late the local GA community has been getting busier and busier with the improved weather. They arrived with haste and took over the LARS position from the Approach controller. They were well rested and confident with the hand over, firmly identifying where the tracks were and had awareness how the situation in the airspace was unfolding. They were given the three Basic Service and one Traffic Service, which were spread geographically across the radar screen. At this time they had a Basic Service track which was approaching the Approach lane for RW24, however was going to go under the MATZ stub. This was the same time that the Approach controller received a handover from Swanwick for the [F35] 4-ship. They heard the Approach controller call out Traffic Information to [the formation], which was given after they had taken the hand over from Swanwick and the formation was now on their frequency. The Zone controller did not feel the need to call out Traffic Information to the Basic Service aircraft because they did not believe, even with duty of care, there was an immediate risk of collision. The traffic had been called by the Approach controller to the formation. While the Basic Service track under their control did not declare an Airprox themselves, they did state on frequency how close the 4-ship formation had flown past them. In hindsight, given the situation, they would have asked the Approach controller if the traffic both had been called and if the pilots were visual, given how close the Mode C became.

THE MARHAM SUPERVISOR reports that Approach was manned by an experienced controller and breaks were offered throughout, particularly during quieter periods with LARS relief readily available. Following a prenote from Swanwick of [F35 formation] inbound, a LARS controller was placed into position to allow Approach to focus on their primary frequency. [F35 formation] were handed over from Swanwick approx. 25NM NE of Marham and made contact with App around 20NM NE. Own navigation and descent were given to the 4-ship before calling Traffic Information on a LARS Basic Service track but the Supervisor was content that the traffic had been called by 4NM with an acknowledgement from the lead pilot. Further traffic was then called 8 miles further south at 800ft underneath Marham's eastern stub whilst the 1st track called was now within 300ft and 1/2NM. The Supervisor thought the Approach controller was going into a further Traffic Information call on the 1st track to ask 'if visual' as per

procedures but it was the track at 800ft beneath the stub that was called instead. Following an acknowledgement from the pilot on the second track the 1st track was no longer relevant. They first heard of an Airprox when the pilot rang switchboard after landing and explained they thought there was no traffic call given on the 1st LARS aircraft but after listening to the [RT] tapes the Supervisor confirmed with the pilot that there was Traffic Information passed and that it was acknowledged by the lead pilot.

Factual Background

The weather at Marham was recorded as follows:

METAR EGYM 141321Z 14002KT 9999 SCT032 18/10 Q1022 NOSIG RMK BLU BLU=

Analysis and Investigation

Summary of Marham Occurrence Investigation

The Airprox occurred on 14 Apr 22 at 1328:03Z in Class G airspace adjacent to the north of RAF Marham with both callsigns under an ATS by RAF Marham ATC. [F35 Formation] was visually assessed by [F35 No3 and No4] pilots from their arrow heavy-side-right position as being laterally ahead of an Icarus C42 [C/S redacted] by 0.5NM¹ and with 200ft of vertical separation at the Closest Point of Approach.

Three of the pilots were considered to be amongst the most experienced members of the RAF Marham Lightning Force and the fourth was an Instructor Pilot with extensive fast-jet aviation experience; the formation did not include any pilots 'Under Training'.

There is a routine of conducting 4-ship recoveries to RAF Marham, through student qualification flights and continued Ops Trg and this is the second F35 Airprox where a 4-ship has been recovering to RAF Marham and situational awareness on a conflictor has been developed late or dropped with a resulting merge to a close-aboard event.

Subsequent to this investigation ATC have recognised some potential procedural improvements with regard to multiple AV recoveries with conflicting local transitory traffic.

No formation pilot (Lead plus 3 others) acted upon the supplied Traffic Service information on the conflictor and the formation continued to merge to it without situational awareness whilst receiving a second conflictor update on traffic on the centre-line for recovery to Initials.

The ATC controller correctly passed Traffic Information on the Airprox conflictor but did not consider imposing a limit to the descent well above the conflictor's height as opposed to "descend as required".

Mitigations focus on:

ATC imposing a limit to descent (+500ft minimum) where there is known traffic ahead of the formation, as opposed to descend as required; and

Reminding ALL pilots that when in formation they should be actively processing the ATC info, be thinking wingmen and supporting the Flight Lead with timely internal calls to ensure formation Situational Awareness for safe separation ie "check height" or "confirm tally with traffic" or suchlike.

Military ATM

The Marham Approach controller had been bandboxing with the LARS task however, after receiving a prenote on the F35, which was part of a formation, a LARS controller was brought in and the task was split out. The Marham Approach controller took the handover of the F35 with the pilot requesting

¹ Radar replay recorded the lateral separation as 0.2NM

a visual recovery. The Approach controller provided the F35 pilot with the QFE pressure and approved their descent as required. Traffic Information was passed to the F35 pilot on the conflicting C42 which was acknowledged before further Traffic Information on conflicting traffic operating under the MATZ stub was passed. The Approach controller did not restrict the descent of the F35s on their recovery and the Traffic Information on the C42 was not updated after it was initially passed.

The Marham LARS controller had taken the handover of the LARS task from the Approach controller and was providing a Basic Service to three aircraft including the C42 and a Traffic Service to another over a large geographical split. The LARS controller did not pass Traffic Information to the C42 pilot as they did not perceive there to be an immediate risk of collision and had heard the Approach controller pass Traffic Information to the F35 formation.

Figures 1 – 5 show the positions of the F35 and the C42 at relevant times during the Airprox. The screen shots are taken from a replay using the NATS Radars which are not utilised by the Marham controllers, therefore, may not be entirely representative of the picture available.

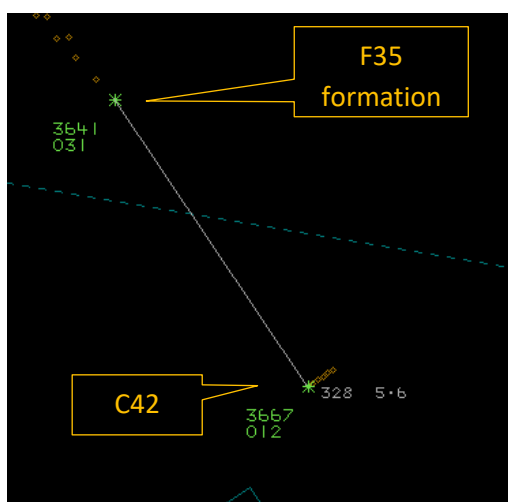


Figure 1:
The F35 pilot was given descent as required.

Shortly after handover from Swanwick Mil, the F35 pilot was given the QFE and descent as required for their visual recovery. Separation was measured at 5.6NM and 1900ft.

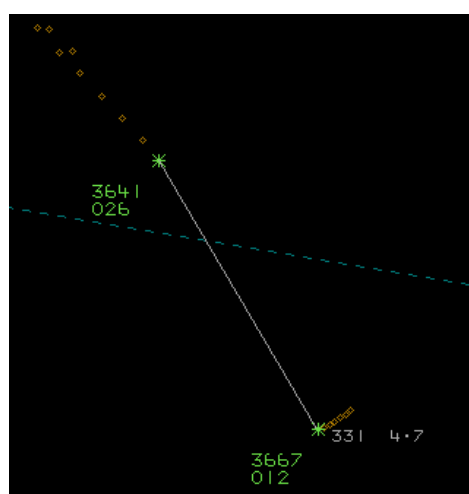


Figure 2:
Traffic Information was passed to the F35 pilot regarding the C42.

Six seconds after the descent approval was given, the Marham Approach controller passed Traffic Information to the F35 pilot regarding the C42. Separation decreased to 4.7NM and 1400ft. The F35 lead pilot acknowledged the Traffic Information but did not report visual.

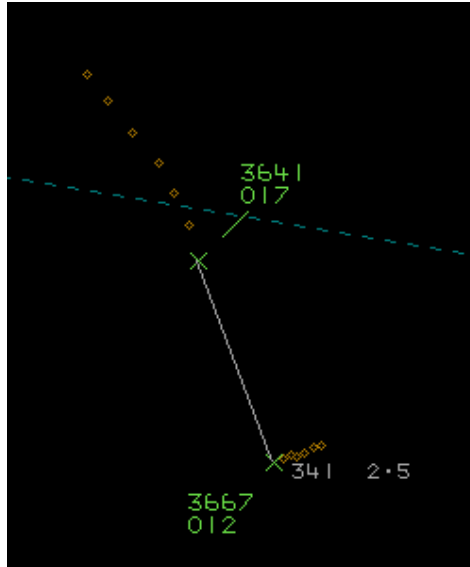


Figure 3:

Traffic Information is passed to the F35 regarding other conflicting traffic.

Twenty seconds later the Approach controller provided further Traffic Information relating to another conflicting track that was transiting beneath the MATZ stub, approximately 8NM south of the F35 formation position. Separation decreased to 2.5NM and 500ft.

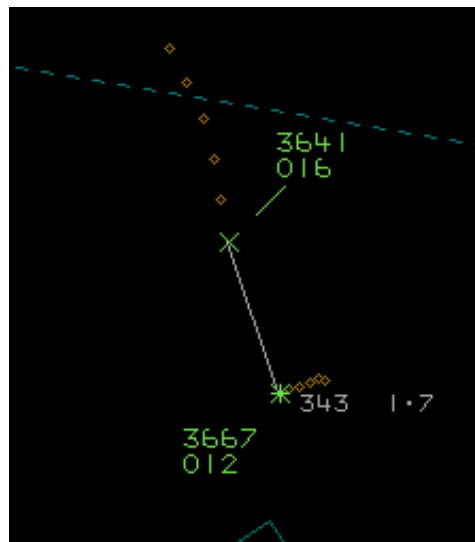


Figure 4:

Traffic Information on the other conflicting traffic is updated.

Nine seconds after the Traffic Information had been passed the Approach controller updated the height which was missed from the initial Traffic Information report. Separation decreased to 1.7NM and 400ft (Figure 4). CPA was measured at 0.2NM and 200ft.

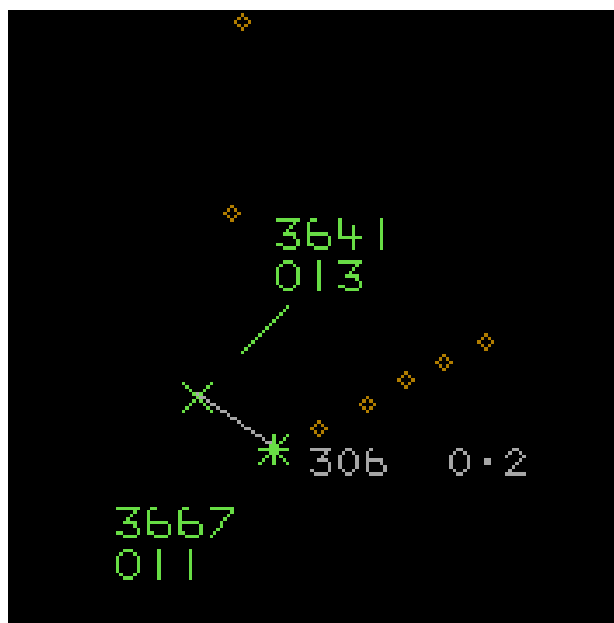


Figure 5: CPA.

ANALYSIS

Traffic Information was passed to the F35 pilot regarding the C42 however, this was not updated, with the controller opting to pass Traffic Information on other conflicting traffic. The controller did not request that the F35 pilot report visual with the C42 and assumed that the pilot would stop their descent if they were not visual with the C42. Under CAP 774 the controller was expected to update the Traffic Information if the confliction continued to constitute a definite hazard, this was not completed on this occasion. The controller had sufficient time to update the Traffic Information on the C42, or stop the descent until the F35 pilot reported visual or was clear of the conflict.

The unit level investigation also identified that the F35 pilot did not act upon the Traffic Information that was passed by the Approach controller as they had become more focused on the other conflicting traffic. Had the Approach controller updated the Traffic Information on the C42, this may have prompted the F35 pilot to act.

The unit investigation identified some actions in an attempt to reduce the likelihood of a similar occurrence including changing the way in which an 'as required' descent is issued and a reminder to pilots about the importance of shared situation awareness throughout a formation. The Approach controller in this situation could have done more to manage the developing scenario however, the F35 pilots should have assimilated the general situation to enable them to act accordingly.

UKAB Secretariat

The F35 formation and C42 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 converging then the C42 pilot was required to give way to the F35s.³ If the incident geometry is considered as overtaking then the C42 pilot had right of way and the F35 formation was required to keep out of the way of the other aircraft by altering course to the right.⁴

² (UK) SERA.3205 Proximity. MAA RA 2307 paragraphs 1 and 2.

³ (UK) SERA.3210 Right-of-way (c)(2) Converging. MAA RA 2307 paragraph 12.

⁴ (UK) SERA.3210 Right-of-way (c)(3) Overtaking. MAA RA 2307 paragraph 14.

Comments

HQ Air Command

This occurrence was subject to a Local Investigation; although no formal recommendations, there were some very important lessons identified with actions taken to avoid this situation from developing again. As the DDH states: *This investigation has uncovered the contributory human factors, which very nearly led to a Mid-Air Collision. The situation was wholly avoidable.* It is identified that pilots just responding with callsign rather than visual/not sighted leaves ATC assuming that the pilot's will take deconfliction action. Pilots have been reminded about phraseology and to share situational awareness and to confirm whether visual with traffic or not, and not just to use callsign as an acknowledgement. This will aid everyone's Situational Awareness/Mental Model and hopefully prompt further traffic calls or a stop descent. Subordinate pilots have also been reminded to follow developing situational awareness and support Lead pilot.

For RAF Marham ATC, following the investigation it has been agreed that "descend as required" will only be passed to aircraft if there is no conflicting traffic in the flight path. A stepped descent will be issued if there is conflicting traffic with visible Mode C height information, to ensure some form of height separation is imposed. No standard deconfliction minima exists under a Traffic Service IAW CAP 774; therefore, this height separation will differ depending on the situation. The controller will however ensure that no risk of collision is introduced. Even though the C42 was a Basic Service, the LARS controller could have passed Traffic Information to the C42 pilot as a significant conflict was developing and would have helped build the situational awareness of the C42 pilot.

Overall, this incident has highlighted that there were too many assumptions made, leading to a very close aboard; as OC Operations at RAF Marham stated: Although D/SATCO has implemented stepped descents to avoid a repeat of this Airprox, I believe that this incident highlights the more fundamental requirement for aircrew and controllers to prioritise actions, avoid assumptions, use effective comms and to take positive, timely action to avoid hazards.

AOPA

No Traffic Information was required to be passed to the C42, however, duty of care, initially denying entry to the MATZ, and knowing the routing of the C42 and the formation, it would have been advantageous to the C42 pilot for the controller to pass Traffic Information on the overtaking 4-ship formation.

Summary

An Airprox was reported when a formation of 4 F35s and a C42 flew into proximity in the vicinity of West Raynham at 1328Z on Thursday 14th April 2022. Both pilots were operating under VFR in VMC, the F35 formation in receipt of a Traffic Service from Marham App and the C42 pilot in receipt of a Basic Service from Marham LARS.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

Information available consisted of reports from both pilots, radar photographs/video recordings, reports from the air traffic controllers involved and reports from the appropriate operating authorities. Relevant contributory factors mentioned during the Board's discussions are highlighted within the text in bold, with the numbers referring to the Contributory Factors table displayed in Part C.

The Board first considered the actions of the F35 pilots. They were recovering to Marham for a visual recovery and receiving a Traffic Service. The controller had given Traffic Information on the C42, which was acknowledged by the lead with just the formation callsign, leading the controller to believe the pilots were either visual, or would ask if they required more information. However, the pilots did not assimilate this Traffic Information (**CF8**), possibly because the controller had given further Traffic Information on another track which the pilots then considered to be more of a threat. Although the RT was conducted

by the lead pilot in the formation, members commented that there were 4 pilots in total in the formation, and none of them appeared to have assimilated the information about the C42, they thought that the wingmen in the formation could have been looking-out to assist the lead pilot. They noted that Marham has since changed their procedures in that pilots were no longer to just use callsign as an acknowledgement, but were now required to acknowledge with a positive 'visual' or 'not visual' to ensure the controller was left in no doubt as to the situation. Without being visual, and having been cleared by ATC to descend as required, the formation flew past the C42, at which point the No3 and No4 pilots saw the other aircraft, making it a non-sighting by two of the pilots and, as it was too late to take any action, effectively a non-sighting by the other two (**CF10**).

Turning to the C42 pilot, members felt that there was little more the pilot could have done to affect the outcome of the Airprox. They had called Marham for a Basic Service and, even though they were not required to, had asked for permission to cross the MATZ, which had been denied, and so the pilot took a re-route to the north of the MATZ. Some members suggested that had the pilot asked for a Traffic Service, the controller would almost certainly have provided Traffic Information. The C42 was equipped with an EWS that was not compatible with the SSR transponder equipped F35s, and as the F35s were not equipped with the same EWS, it did not detect them (**CF9**). The C42 pilot did not receive any Traffic Information from ATC either, and consequently had no knowledge that the F35s were approaching until becoming visual (**CF7**), by which point it was too late to take any avoiding action (**CF10**).

The Board then looked at the actions of Marham ATC. A military member noted that Marham was suffering from a 'feast or famine' traffic situation at the moment with either no traffic, or very high traffic loads and there was some concern that there was a lack of currency for the high traffic levels during busy periods. In this case, the App controller had correctly split the combined task early enough to handover the LARS task to another controller prior to the F35s coming onto their frequency, and therefore were not overloaded. The F35s were recovering for a visual recovery and as such were not receiving vectors, however, the controller had given them a clearance to descend as required without a stop above the conflicting traffic, and members thought this continuous descent contributed to the Airprox (**CF5**). They were therefore heartened to hear that Marham intended to update their procedures to ensure continuous descents will no longer be given to visual recoveries if there is traffic to affect. The App controller saw the potential for the C42 to be a factor to the F35s and gave Traffic Information, however, when the F35 pilot acknowledged the Traffic Information with their callsign, the controller erroneously took this to mean the pilot was visual with the C42 and would take action accordingly (**CF4**). The controller therefore did not update the Traffic Information, but went on to call other conflicting traffic instead (**CF3**). Whilst members understood the human factors behind why the controller would assume this, still some members opined that the terms of a Traffic Service stated that a controller shall update Traffic Information if it continues to constitute a definite hazard, and they thought the controller should have updated it on this occasion (**CF1**).

The Zone controller reported taking over the LARS frequency shortly before the Airprox, but being comfortable with the traffic situation. They saw the F35s approaching, but because they heard the App controller giving Traffic Information to the F35s, did not provide Traffic Information to the C42 pilot who was receiving a Basic Service. Members were bemused by this approach, whilst they recognised that Traffic Information would not be routinely passed under a Basic Service, they noted that the terms of a Basic Service state that if a definite risk of collision exists a warning shall be issued and they thought that it should have been passed on this occasion (**CF1**, **CF3**). Members also discussed the actions of the Supervisor, although they were on hand to assist the App controller with the splitting of the task and were monitoring the situation closely, they stated in their report that they expected that the App controller was going to update the Traffic Information to the F35s. Members thought that the Supervisor could have been more proactive in making sure Traffic information was passed by the Zone controller, rather than standing back and watching the situation unfold (**CF2**).

Finally, members were told that Marham ATC was now working on the new equipment currently being rolled out into RAF ATSU's. This new equipment is fitted with an STCA function, but because the new equipment had a tendency to alert spuriously when used with old sensors (radar), the decision had been taken not to use it at the present time (**CF5**).

When determining the risk; members considered the reports by all the pilots and controllers, and the radar replay data. They noted that the radar replay only presented one primary return for the formation of 4 F35s, and were told that the formation were flying in arrow, heavy side right, meaning that two aircraft were behind the lead on the right-hand side, No3 and No4, and it was these two pilots that had seen the C42. Although the radar separation between the F35s and the C42 indicated 0.2NM, members thought that given radar tolerances and the spread of the formation, it had probably been closer than that. They noted that the F35 pilots had not taken any avoiding action, and the C42 pilot had not seen the F35s until they appeared in front of the aircraft, going away. Members therefore agreed that providence had had a part to play and there had been a serious risk of collision; Risk Category A (CF11).

PART C: ASSESSMENT OF CONTRIBUTORY FACTORS AND RISK

Contributory Factors:

	2022050			
CF	Factor	Description	ECCAIRS Amplification	UKAB Amplification
Ground Elements				
• Regulations, Processes, Procedures and Compliance				
1	Human Factors	• ATM Regulatory Deviation	An event involving a deviation from an Air Traffic Management Regulation.	Regulations and/or procedures not fully complied with
• Manning and Equipment				
2	Human Factors	• ATM Leadership and Supervision	An event related to the leadership and supervision of ATM activities.	
• Situational Awareness and Action				
3	Human Factors	• ANS Traffic Information Provision	Provision of ANS traffic information	TI not provided, inaccurate, inadequate, or late
4	Human Factors	• Expectation/Assumption	Events involving an individual or a crew/ team acting on the basis of expectation or assumptions of a situation that is different from the reality	
5	Human Factors	• Traffic Management Information Provision	An event involving traffic management information provision	The ANS instructions contributed to the Airprox
• Electronic Warning System Operation and Compliance				
6	Technical	• Conflict Alert System Failure	Conflict Alert System did not function as expected	The Conflict Alert system did not function or was not utilised in this situation
Flight Elements				
• Situational Awareness of the Conflicting Aircraft and Action				
7	Contextual	• Situational Awareness and Sensory Events	Events involving a flight crew's awareness and perception of situations	Pilot had no, late, inaccurate or only generic, Situational Awareness
8	Human Factors	• Understanding/Comprehension	Events involving flight crew that did not understand or comprehend a situation or instruction	Pilot did not assimilate conflict information
• Electronic Warning System Operation and Compliance				
9	Technical	• ACAS/TCAS System Failure	An event involving the system which provides information to determine aircraft position and is primarily independent of ground installations	Incompatible CWS equipment
• See and Avoid				
10	Human Factors	• Monitoring of Other Aircraft	Events involving flight crew not fully monitoring another aircraft	Non-sighting or effectively a non-sighting by one or both pilots
• Outcome Events				
11	Contextual	• Near Airborne Collision with Aircraft	An event involving a near collision by an aircraft with an aircraft, balloon, dirigible or other piloted air vehicles	

Degree of Risk: A

Safety Barrier Assessment⁵

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

Ground Elements:

Regulations, Processes, Procedures and Compliance were assessed as **ineffective** because ATC did not provide updated Traffic Information to the F35 pilots and did not provide any Traffic Information to the C42 pilot.

Manning and Equipment were assessed as **partially effective** because the ATC Supervisor could have stepped in to ensure both controllers had given the correct Traffic Information.

Situational Awareness of the Confliction and Action were assessed as **ineffective** because there was an expectation from ATC that the F35 pilots, in acknowledging the Traffic Information, were visual with the C42.

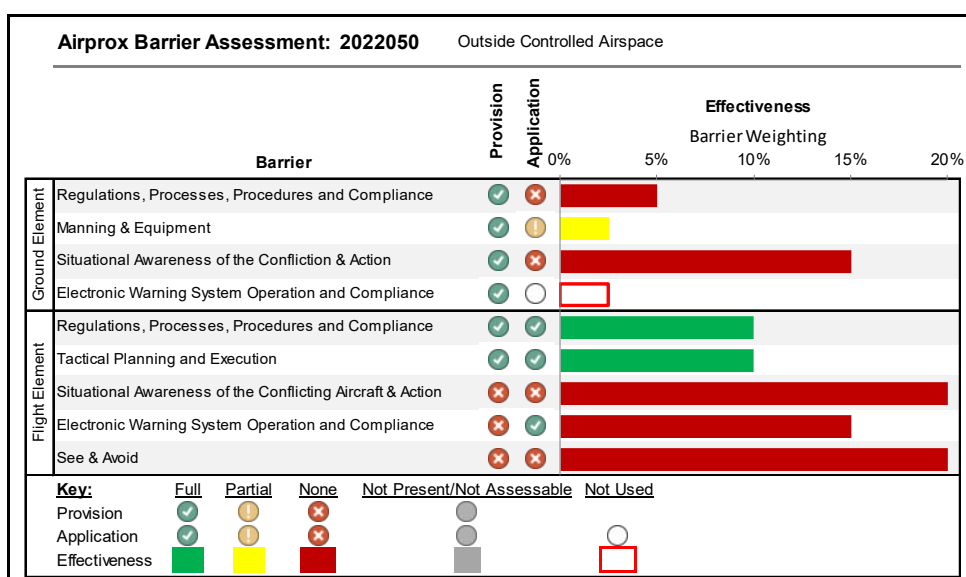
Electronic Warning System Operation and Compliance were assessed as **not used** because the new equipment at Marham had the capability to employ STCA, but due to the possibility of spurious readings with the legacy sensors, Marham had taken the option not to use them.

Flight Elements:

Situational Awareness of the Conflicting Aircraft and Action were assessed as **ineffective** because the F35 pilots had not assimilated the Traffic Information on the C42 and the C42 pilot was not given any Traffic Information, so was not aware of the presence on the F35s.

Electronic Warning System Operation and Compliance were assessed as **ineffective** because the EC on the C42 could not detect the F35s.

See and Avoid were assessed as **ineffective** because neither pilot saw the other aircraft in time to take any avoiding action.



⁵ The UK Airprox Board scheme for assessing the Availability, Functionality and Effectiveness of safety barriers can be found on the [UKAB Website](#).