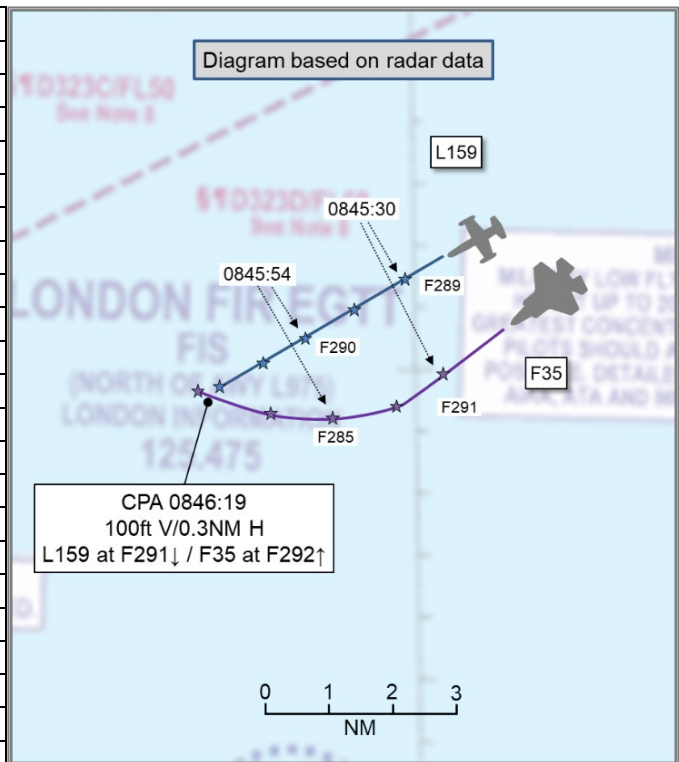


**AIRPROX REPORT No 2023058**

Date: 12 Apr 2023 Time: 0846Z Position: 5411N 00037E Location: Danger Area EG-D323

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

| Recorded                 | Aircraft 1      | Aircraft 2   |
|--------------------------|-----------------|--------------|
| Aircraft                 | L159            | F35          |
| Operator                 | Foreign Mil     | HQ Air (Ops) |
| Airspace                 | D323            | D323         |
| Class                    | Danger Area     | Danger Area  |
| Rules                    | VFR             | VFR          |
| Service                  | Traffic         | Traffic      |
| Provider                 | CRC Hotspur     | CRC Hotspur  |
| Altitude/FL              | FL291           | FL292        |
| Transponder              | A, C, S         | A, C, S      |
| <b>Reported</b>          |                 |              |
| Colours                  | Grey            | Dark Grey    |
| Lighting                 | Fitted          | Fitted       |
| Conditions               | VMC             | VMC          |
| Visibility               | >10km           | >10km        |
| Altitude/FL              | 28,000ft        | 28,000ft     |
| Altimeter                | RPS             | NK           |
| Heading                  | 270°            | NR           |
| Speed                    | M0.65           | NR           |
| ACAS/TAS                 | Not fitted      | Not fitted   |
| Alert                    | None            | N/A          |
| <b>Separation at CPA</b> |                 |              |
| Reported                 | 0ft V/0.5NM H   | NK V/ NK H   |
| Recorded                 | 100ft V/0.3NM H |              |



**THE L159 PILOT** reports that [formation 1 callsign] had been part of an ORT sortie in D323 against [formation 2 callsign]. Formation 1 had been simulating dead and were returning to the start point in its allocated sanctuary at 28,000ft. The [lead] pilot became visual with a single F35 crossing their nose at approximately 0.25-0.5NM in a shallow climb. It had been deemed too late to take any avoiding action and assessed that a collision would not take place.

The pilot assessed the risk of collision as ‘High’.

**THE F35 PILOT** reports that they had been the pilot of [formation 2 callsign] operating as part of a 4-ship of F35 in an OCA (Offensive Counter Air) role in D323. After killing out [formation 1] at 0840, and another contact in the same group at 18,000ft, they had SA that [formation 1] had been at 28,000ft kill-removing to the west. As the F35 pilot continued west to a follow-on group in block one, their last SA had been that [formation 1 callsign] had been 10 miles in their stern and had therefore not been a factor (the low contact in the same group had also not been a factor as they had been on the edge of the airspace heading west). The F35 pilot reports that the last indication in cockpit of [formation 1 callsign] had been received at 0841:40. At 0843 they merged with the follow-on group in block three [formation 3 callsign]. The merge with the following group required them to reverse direction and climb to block three. After killing this follow-on group, they positioned themselves into blue block (29-34,000ft) and turned hot again to the west. At this point, the F35 pilot had an insidious descent from 30,000ft down to 27,500ft with about a 1-2° nose down attitude. They had no indication in cockpit that [formation 1] had been beneath them. Once they realised that they were in a red block, they climbed and turned cold to set up a CAP with their formation leader. At this point, [formation callsign 1] reported an Airprox at 0846:12. On reviewing the tapes, it can be seen that the kill-removing contact at 28,000ft does not beam, but instead drags immediately west. This positions [formation 1] directly underneath the follow-on group and therefore the next merge. Ultimately the F35 pilot reported having lost SA on this kill-removing group because they thought it to be a contact behind them and no further factor but, because of the

follow-on merge, they [acknowledged] that they needed to be aware of all aircraft kill-removing as they may later have become a factor.

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

**THE BOULMER (HOTSPUR) CONTROLLER** reports that they were acting as WC2 (Weapons Controller 2) and were unaware of the Airprox at the time of occurrence, as their focus had been on updating the status of red alive or dead and the chat on [the] red tactical [frequency] had been focused on [the] game plan for [the] next push/alive. No indications of [an] unsafe situation were communicated.

Timeline of events:

0840:25 L159 called dead on RED TAC freq. WC2 (Weapons Controller) shifted focus to the south of the fight.

0840:50 L159 pilot manoeuvred in a left-hand turn from heading 060° to heading 260°.

0843:40 L159 pilot heading 260° at FL286 and the F35 had been in a left turn descending through FL300 3NM away from the L159. The F35 continued tracking parallel 2NM south of the L159 for 14NM.

0844:10 [An uninvolved aircraft] requested elevator in the south on RED freq.

0844:40 WC2 requested the status of [3 different aircraft] on RED freq. The conversation within the weapons team had been focused on kill removal.

0845:00 The F35 pilot further descended to FL285, now co-level with the L159 at a distance of 2NM.

0845:50 The F35 pilot initiated a right-hand turn into the path of the L159.

0846:00 Game plan for next alive comms on RED frequency.

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

## **Factual Background**

The weather at Humberside was recorded as follows:

METAR EGNJ 120850Z 21021KT 9999 SCT023 08/03 Q0990=

## **Analysis and Investigation**

### **Military ATM**

Utilising occurrence reports and information from the local investigation, outlined below are the key events that preceded the Airprox. Where available, they are supported by screenshots to indicate the positions of the relevant aircraft at each stage. The screenshots are taken from solely NATS radars as Unit radar recording cannot be presented due to security classification restrictions. As NATS radars are not available to the controllers, they may not be entirely representative of what the controller was presented.

Operational Training Sorties are conducted in accordance with Air Training Orders with aircraft assigned operating blocks and sanctuary levels in accordance with their Red/Blue group allocation. The F35 had been a Blue participant under the control of Weapons Controller 1, operating primarily in the assigned block of 29,000ft to 34,000ft, but with approval to transit between block altitudes in accordance with Air Training Order policy. The L159 had been a Red participant under the control of Weapons Controller 2, recovering to their sanctuary level of 28,000ft following a simulated kill.

In addition to the two Weapons Controllers, the Boulmer Weapons Control Team had also consisted of a Fighter Allocator, who had been responsible for supervision throughout the Operational Training

Sortie. Each Weapons Controller and the Fighter Allocator had then been supported by a Weapons Controller Assistant.

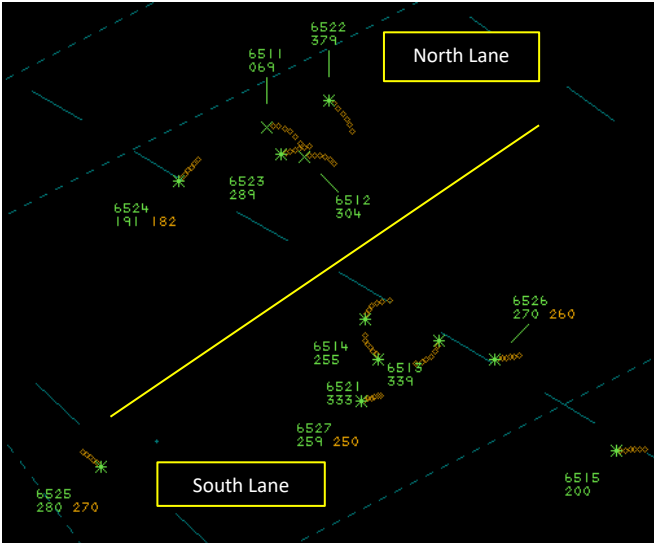


Figure 1: Scale of the Operational Training Sortie. (Approximately 35NM from the northern to southern aircraft, split across a North and South Lane).

**Sequence of Events**

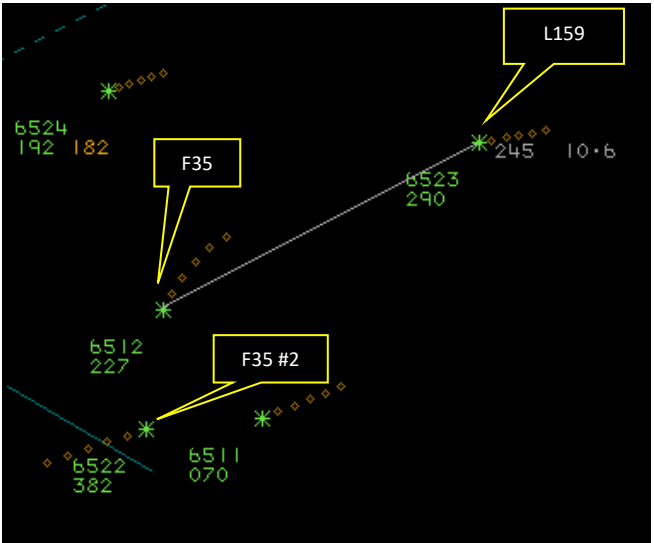


Figure 2 (0842:26): F35 commenced climb and turn, whilst L159 regenerated.

At 0842:26, the L159 pilot had been regenerating from a simulated kill and transiting southwest at their sanctuary level of 28,000ft. The F35 pilot commenced a climb looking to intercept with F35 #2 who had been simulating a hostile aircraft to the southeast.

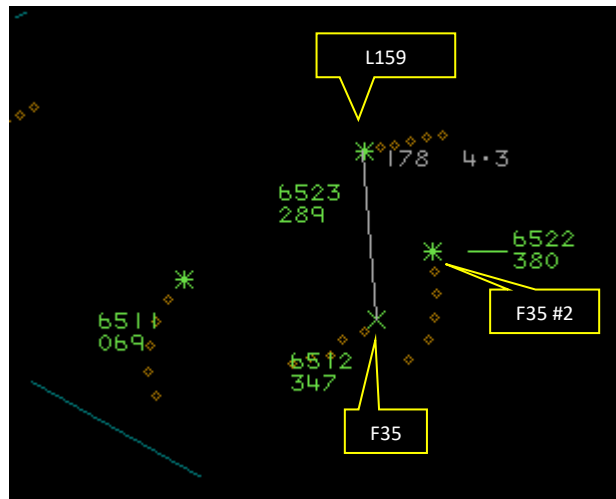


Figure 3 (0843:22): F35 conducted the intercept of the Hostile, whilst L159 regenerated.

At 0843:22, the L159 pilot continued to regenerate, maintaining a southwest heading at their sanctuary level of 28,000ft. The F35 pilot had conducted a rapid climbing turn and positioned to simulate a kill of F35 #2.

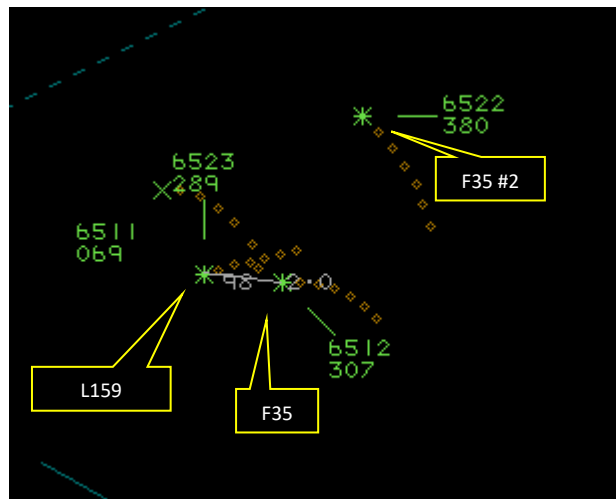


Figure 4 (0844:05): F35 re-established in the assigned block tracking parallel to the L159.

At 0844:05, having completed the simulated kill of F35 #2, the F35 pilot re-established in the assigned block of 29,000ft to 34,000ft. The south-westerly heading meant that the F35 and L159 paralleled each other, however neither pilot had been aware of the other's position.



Figure 5 (0844:50): F35 descended out of the assigned block.

At 0844:50, the F35 pilot descended out of the assigned block (29,000ft to 34,000ft) and into the L159 pilot's sanctuary level (28,000ft). The F35 pilot had been unaware of their slow descent and the Weapons Controller did not notice it had occurred.

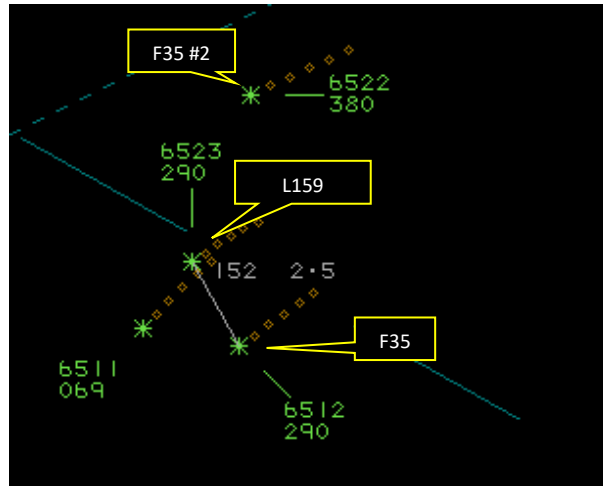


Figure 6 (0845:34): The F35 and L159 were co-level.

At 0845:34, the F35 pilot's unobserved descent had continued to a point that the F35 and L159 were co-level. Both aircraft remained unaware of each other's position.

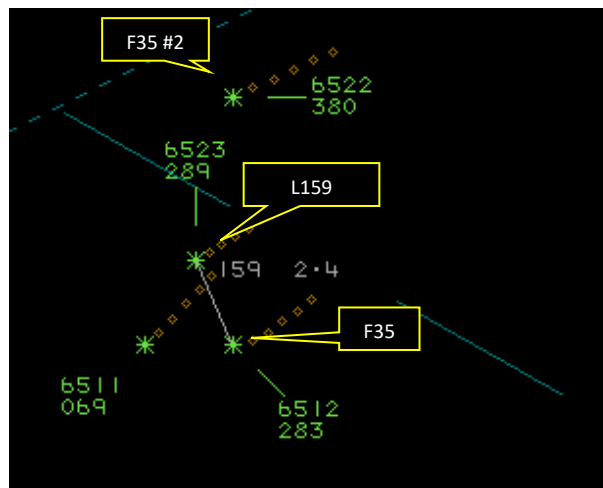


Figure 7 (0845:46): The F35 commenced a climbing right hand turn.

At 0845:46, the F35 pilot, who had continued below the L159's level, recognised that they were below the assigned block and instigated a climbing right-hand turn to reposition. Both aircraft pilots remained unaware of each other's position.

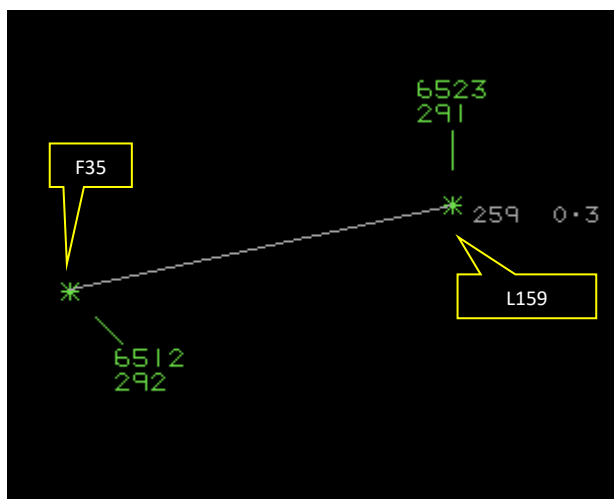


Figure 8 (0846:19): CPA. (Separation 0.3NM, 100ft)

At 0846:19, CPA occurred as the F35 pilot continued their climbing right hand turn through the nose of the L159.

### Local BM (Battlespace Management) Investigation(s)

The local investigation conducted by 19 Sqn (Boulmer) identified the cause of the Airprox as a loss of safe separation between co-operating aircraft following a loss of situational awareness. As part of the investigation, the following BM related causal/aggravating factors were identified that were believed to have contributed to the Airprox:

- a. Both Weapons Controllers presumed that all pilots had maintained situational awareness and therefore did not provide further information. This presumption had been due to there having been no request for additional situational awareness information from the F35 pilot(s) as per Air Training Orders.
- b. A conversation regarding simulated kill removal distracted both Weapons Controllers sufficiently to prevent them from observing the F35 descend into the L159's sanctuary level. This distraction had been further exacerbated by non-operational discussions occurring within the Operations Room.

As a result of the causal factors identified, the following mitigations for local action were proposed by 19 Sqn (Boulmer):

- a. Aircraft commanders are to be reminded of their responsibility to request an update in the event of a loss of situational awareness.
- b. A Signage and a Safety Bulletin to be produced to educate Weapons Control teams regarding distraction and all personnel regarding non-operational discussions within the Operations Room.

## 2 Gp BM Analysis

The local investigation identified how the Weapons Controllers could have provided additional situational awareness information to potentially prevent the Airprox. The mitigations suggested are considered suitable and no further BM related causal/aggravating factors were identified by 2 Gp BM.

### RAF Marham Investigation

The F35 had been in EG-D323 as part of a multi-ship Offensive Counter Air sortie operating as Blue Air and had been flowing west having killed-out the L159. The F35 pilot had then expected it to Kill-Remove with a significant tangential flow to the beam and separate away from the fight volume and, only when clear of the fight, then begin to regenerate back to the west. The debrief highlighted that the L159 pilot had not done this, instead they had dragged directly west, staying in the airspace volume of the next likely merge with a following group. The F35 pilot then reversed the fight to the east to prosecute a second group and had then climbed into the allocated Blue Air Sanctuary before once again turning hot to the west. Whilst obtaining pre-merge situational awareness on the remaining fight, the F35 pilot had an insidious shallow descent of 1-2° nose down and entered the Red Block by approximately 2500ft unnoticed.

At this stage the F35 pilot had had no updated mental situational awareness picture or additional sensor indication that the L159 had still been a threat as it egressed from the initial fight. Finally aware of the height loss and consequential inadvertent entry into the Red Block, the F35 pilot quickly egressed with a positive vector back to their own sanctuary. However, the F35 pilot had still not gained situational awareness of the previously killed-out L159 before initiating the climb back to the Blue Air Sanctuary Block which then brought the F35 pilot into unsighted proximity with it. The L159 pilot then reported that the F35 had crossed their nose at 300-400 yards co-altitude and, at the time of the event, believed it had been with full situational awareness by the F35 pilot who they believe must have been in sight of them to be that close and so would have assessed it as operating within the rules of the engagement of a visual merge. During debrief, both pilots managed to miss talking directly with each other (the F35 pilot had still not in-briefed from that sortie) which left them unaware that the event had been flown without situational awareness.

A number of days then passed before it subsequently emerged that the F35 pilot had no situational awareness on the L159 during the climb back to the Blue Block and so this event turned from a perceived close pass with situational awareness, within the rules of engagement, to an Airprox where aircraft bubbles were infringed without direct situational awareness by either pilot of their merging flightpaths. The F35 pilot stated that the flight path selected to return to Blue Sanctuary had been to quickly re-establish in the correct height block and that the L159 had not been seen at that time. Having missed the debrief with the L159 pilot at the mission wash-up, the F35 pilot had been unaware of the Airprox (TCAS is not fitted to F35) and had only become aware days later when the L159 DASOR had been submitted. The F35 pilot accepted that situational awareness on the L159 had been dropped and never regained and this had directly contributed to the event, noting that the kill-removing aircraft did not beam away and sufficiently separate from the fight when killed out. The cause, however, had been that the F35 pilot did not clear their flightpath prior to changing height block. The primary causal factor to this had been the unexpected presence of the L159 which had not fully cleared the fight volume as it should have done.

## UKAB Secretariat

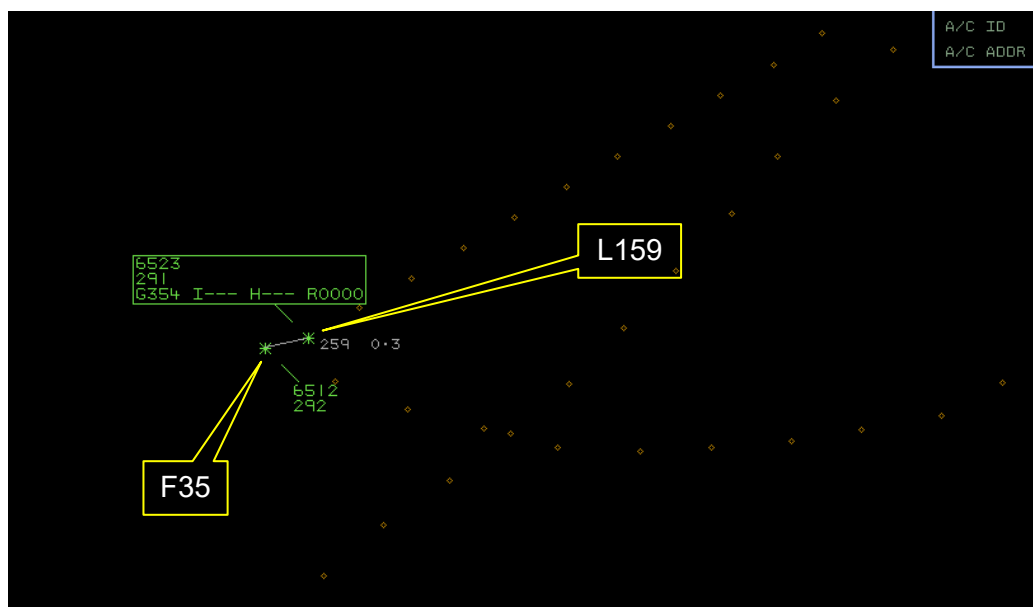


Figure 9: CPA 0846:19 100ft V/0.3NM H

The L159 and F35 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 F35 pilot was required to give way to the L159.<sup>2</sup>

## Comments

### HQ Air Command

Air-to-Air Training Rules (ATRs) is the military document which defines the procedures for deconfliction amongst aircraft conducting air-to-air training. These rules make it very clear that discrete altitude blocks should be maintained unless pilots have sufficient SA when within a prescribed range. They can only depart these altitude blocks with SA on all relevant exercise participants (visual contact being one means of SA). The F35 pilot had unknowingly drifted out of their assigned altitude block and inadvertently entered an occupied lower sanctuary assigned to Red Air (the L159). The F35 pilot lost SA on the L159 which brought them into conflict. The F35 pilot did not expect a potential confliction as the perceived SA to be that the L159 had been geographically offset further north. This had been due to a kill-removal procedure not being formally incorporated into ATRs; the L159 pilot had not been aware of any additional requirement to offset geographically. These rules should be reviewed to consider formally incorporating a lateral element to the kill-removal procedure to ensure more robust deconfliction. Local briefings have already been employed on both the Aircrew and Weapons Controllers to mitigate a similar occurrence.

## Summary

An Airprox was reported when an L159 and an F35 flew into proximity within EG-D323 at 0846Z on Wednesday 12<sup>th</sup> April 2023. Both pilots were operating under VFR in VMC, and in receipt of a Traffic Service from Boulmer.

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

Information available consisted of reports from both pilots, radar photographs/video recordings, reports from the fighter controllers involved and reports from the appropriate operating authorities. Relevant

<sup>1</sup> MAA RA 2307 paragraphs 1 and 2.

<sup>2</sup> (MAA RA 2307 paragraph 12.



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.

Members first discussed the role that the controllers had to play. They noted that the Fighter Allocator (in the supervisory role) seemed to have been unaware of the situation as it unfolded (**CF1**) and therefore unable to interject. They also noted the lack of any Traffic Information pertinent to the situation from either of the Weapons Controllers (**CF2**), and heard from a military advisor familiar with the operation at Boulmer that it is normal practice to respond with Traffic Information when requested by pilots. The Board felt, however, that a pilot will not necessarily know when their situational awareness is degraded and that a reliance on the pilot requesting Traffic Information does not cater for the eventuality where the pilot has incorrect or degraded SA (as had been the case in this event).

Members opined that the Weapons Controllers had assumed that both pilots had acted in accordance with their understanding of the appropriate training rules (**CF4**) and agreed that they had not therefore noticed the developing conflict (**CF3**). Having been briefed by the military advisor familiar with the operation at Boulmer, members opined that, once the F35 had finished their fight, the Weapons Controller had diverted their attention to a further group of aircraft engaged in preparation for the second exercise in train approximately 30NM to the south of the area of the Airprox, and that this division of attention elsewhere had been contributory to the Airprox (**CF5**).

Board members went on to discuss the situation from the pilots' perspective, noting particularly the apparent difference of understanding relating to kill-removal and regeneration by those involved in the event. Both pilots had had a different understanding of the way the rules applied – the F35 pilot had assumed that the L159 pilot would 'beam out' to the north before heading west, whereas the L159 pilot had not been aware of that understanding and had been, in fact, heading directly west for a reset. This difference in understanding of procedures for kill-removal and regeneration led the Board to conclude that the Air-to-Air Training Rules were insufficiently descriptive of the procedures for kill-removal and regeneration (**CF6**) and therefore the Board resolved to make a Safety Recommendation that *HQ Air Command considers reviewing kill kill-removal procedures within Air-to-Air Training Rules*. Additionally, the Board agreed that, the F35 pilot's inadvertent descent into the sanctuary altitude of the L159 had been contributory to the Airprox (**CF7, CF8**).

The Board concluded that the combination of these air and ground issues had contributed to neither pilot having any situational awareness regarding the presence of the other aircraft (**CF9**) and that neither pilot had seen the other aircraft in time to have taken any action to increase the separation between the aircraft (a non-sighting on the part of the F35 pilot and effectively a non-sighting on the part of the L159 Pilot) (**CF10**).

The Board finally discussed the unit investigations provided by Boulmer and Marham, and noted that both had contained inaccuracies which had necessitated the Airprox being re-presented to the Board. Members wished to express their disappointment with the lack of rigour in the investigations which had hampered the Board's understanding of the event in the first instance and had subsequently resulted in extra work for all concerned.

When assessing the risk, members considered the reports from both pilots, the Weapons Controllers, the operating authorities and the radar replays available. They noted that the separation between the two aircraft had been minimal and that the F35 had passed ahead of the L159 by as little as 0.25NM with the L159 pilot deeming it too late to take any avoiding action. Members opined that safety had been much reduced and that a risk of collision had existed (**CF11**). Accordingly, the Board assigned a Risk Category B to this Airprox.

**PART C: ASSESSMENT OF CONTRIBUTORY FACTORS AND RISK****Contributory Factors:**

|   | 2023058        |  |   |   |
|---|----------------|--|---|---|
| CF  | Factor         | Description  | ECCAIRS Amplification   | UKAB Amplification  |
| <b>Ground Elements</b>  |                |  |   |   |
| <b>• Manning and Equipment</b>  |                |  |   |   |
| 1   | Human Factors  | • ATM Leadership and Supervision                   | An event related to the leadership and supervision of ATM activities.   |   |
| <b>• Situational Awareness and Action</b>                             |                |  |   |   |
| 2   | Human Factors  | • ANS Traffic Information Provision                | Provision of ANS traffic information  | TI not provided, inaccurate, inadequate, or late                      |
| 3   | Human Factors  | • Conflict Detection - Not Detected                | An event involving Air Navigation Services conflict not being detected.   |   |
| 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  | • Task Monitoring                                  | Events involving an individual or a crew/team not appropriately monitoring their performance of a task  | Controller engaged in other tasks                                     |
| <b>Flight Elements</b>  |                |  |   |   |
| <b>• Regulations, Processes, Procedures and Compliance</b>            |                |  |   |   |
| 6   | Organisational | • Flight Operations Documentation and Publications | Flight Operations Documentation and Publications  | Inadequate regulations or procedures                                  |
| 7   | Human Factors  | • Use of policy/Procedures                         | Events involving the use of the relevant policy or procedures by flight crew  | Regulations and/or procedures not complied with                       |
| <b>• Tactical Planning and Execution</b>                              |                |  |   |   |
| 8   | Human Factors  | • Action Performed Incorrectly                     | Events involving flight crew performing the selected action incorrectly   | Incorrect or ineffective execution                                    |
| <b>• Situational Awareness of the Conflicting Aircraft and Action</b> |                |  |   |   |
| 9   | 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 |
| <b>• See and Avoid</b>  |                |  |   |   |
| 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      |
| <b>• Outcome Events</b>   |                |  |   |   |
| 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:** B.**Recommendation:** HQ Air Command considers reviewing kill-removal procedures within Air-to-Air Training Rules.**Safety Barrier Assessment<sup>3</sup>**

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

**Ground Elements:**

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

**Manning and Equipment** were assessed as **partially effective** because the Fighter Allocator had been apparently unaware of the unfolding situation and had therefore not reminded the Weapons Controller to pass Traffic Information to the F35 pilot.

**Situational Awareness of the Confliction and Action** were assessed as **ineffective** because the Weapons Controllers’ attention had been on the fight to the south and they had therefore not provided timely Traffic Information to the involved aircraft.

**Flight Elements:**

**Regulations, Processes, Procedures and Compliance** were assessed as **ineffective** because the rules and procedures for actions under kill-removal and regeneration are unclear.

**Tactical Planning and Execution** was assessed as **ineffective** because the F35 had descended to the sanctuary altitude of the regenerating L159.

**Situational Awareness of the Conflicting Aircraft and Action** were assessed as **ineffective** because neither pilot had maintained SA on the opposing aircraft.

**See and Avoid** were assessed as **ineffective** because, although the L159 pilot had a very late sighting of the other aircraft, which was too late for them to have taken action to materially increase the separation, and the F35 pilot had no sighting of the L159.

| Airprox Barrier Assessment: 2023058 |  | Outside Controlled Airspace |                   |                            |           |     |     |
|-------------------------------------|--|-----------------------------|-------------------|----------------------------|-----------|-----|-----|
| Barrier                             | Provision  | Application                 | Effectiveness     |                            |           |     |     |
|                                     |  |                             | Barrier Weighting |                            |           |     |     |
|                                     |  |                             | 0%                | 5%                         | 10%       | 15% | 20% |
| Ground Element                      | Regulations, Processes, Procedures and Compliance          | ✓                           | ✓                 | [Green bar to 5%]          |           |     |     |
|                                     | Manning & Equipment  | ✓                           | ⚠                 | [Yellow bar to 5%]         |           |     |     |
|                                     | Situational Awareness of the Confliction & Action          | ✓                           | ✗                 | [Red bar to 15%]           |           |     |     |
|                                     | Electronic Warning System Operation and Compliance         | ○                           | ○                 | [Grey bar to 5%]           |           |     |     |
| Flight Element                      | Regulations, Processes, Procedures and Compliance          | ✗                           | ✗                 | [Red bar to 10%]           |           |     |     |
|                                     | Tactical Planning and Execution                            | ✓                           | ✗                 | [Red bar to 10%]           |           |     |     |
|                                     | Situational Awareness of the Conflicting Aircraft & Action | ✗                           | ✓                 | [Red bar to 20%]           |           |     |     |
|                                     | Electronic Warning System Operation and Compliance         | ○                           | ○                 | [Grey bar to 15%]          |           |     |     |
|                                     | See & Avoid  | ✗                           | ✗                 | [Red bar to 20%]           |           |     |     |
| <b>Key:</b>                         |  |                             |                   |                            |           |     |     |
|                                     | Full   | Partial                     | None              | Not Present/Not Assessable | Not Used  |     |     |
| Provision                           | ✓  | ⚠                           | ✗                 | ○                          |           |     |     |
| Application                         | ✓  | ⚠                           | ✗                 | ○                          |           |     |     |
| Effectiveness                       | [Green]  | [Yellow]                    | [Red]             | [Grey]                     | [Red Box] |     |     |