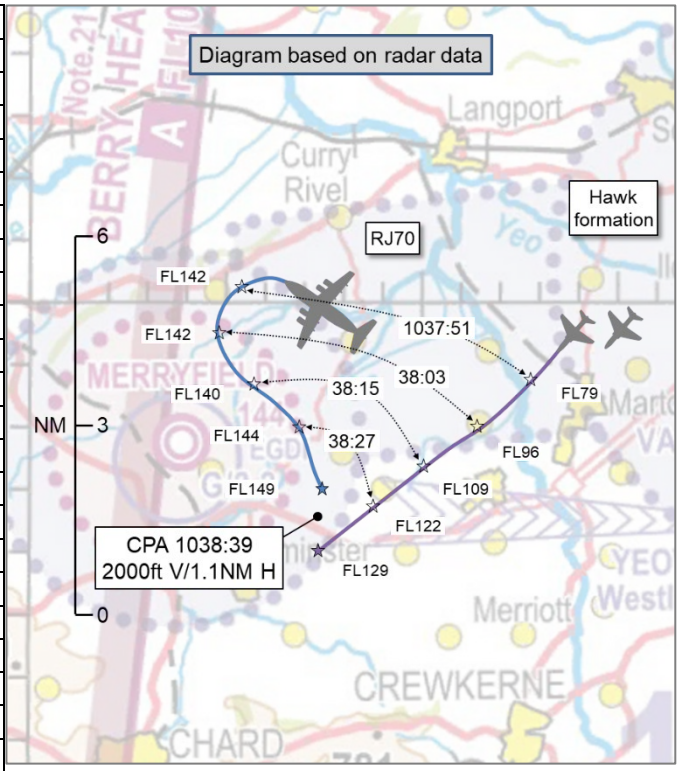
AIRPROX REPORT No 2021242

Date: 10 Dec 2021 Time: 1039Z Position: 5056N 00253W Location: Whitelackington

PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

Recorded	Aircraft 1	Aircraft 2
Aircraft	RJ70	Hawk formation
Operator	MoD ATEC	RN
Airspace	Boscombe ARA	Boscombe ARA
Class	G	G
Rules	VFR	VFR
Service	Traffic	Traffic
Provider	Boscombe	Yeovilton
Altitude/FL	FL149	FL129
Transponder	A, C, S	A, C, S
Reported		
Colours	Red, white, blue	Black
Lighting	HISL, nav	HISL, nose, nav
Conditions	VMC	VMC
Visibility	>10km	>10km
Altitude/FL	FL150	FL120
Altimeter	SPS	SPS
Heading	180°	240°
Speed	220kt	300kt
ACAS/TAS	TCAS II	Not fitted
Alert	RA	N/A
Separation at CPA		
Reported	0ft V/1NM H[1]	0ft V/1NM H
Recorded	2000ft V/1.1NM H	



THE RJ70 PILOT reports conducting a familiarisation flight profile for an inexperienced member of staff. The aircraft was being manually flown by the staff pilot (autopilot and autothrottle OFF, flight director OFF) in a gentle descent through FL150 at approximately 400fpm in a left-hand 30° AoB turn. Speed was sufficient for manoeuvre at 220 KIAS, vice the minimum of 177 KIAS. The TCAS was selected 'BELOW', such that threats could be visible on the TCAS display up to 9900ft below the aircraft and 2700ft above. Passing heading 180° for an intended roll-out on a heading of 075°, a TCAS contact appeared on the display in the 9 o'clock position, climbing extremely rapidly. They saw the relative altitude close from 4500ft below to 1500ft below in approximately 30sec. They asked the staff pilot to roll the wings level to allow the traffic to pass behind. At that point, a TCAS 'Level Off, Level Off' Resolution Advisory (RA) was generated. They took control of the aircraft and initiated a climb, as they could see the situation developing and the contact continuing to climb rapidly towards them. A 'CLIMB, CLIMB' RA was generated in the seconds that followed. The situation was very uncomfortable, as the threat aircraft were now somewhere behind and climbing quickly through their level. They estimated the minimum horizontal separation at about 1NM. Once the 'Clear of Conflict' alert was generated, an attempt to become visual was made by rolling left. The threat aircraft were not seen, but ATC informed them that a pair of Hawks had departed from Yeovilton on a transit to Culdrose and that they were working a different frequency, with Swanwick Mil. The RJ70 pilot asked whether the Hawks had been visual with the RJ70 and the answer was 'yes'. In completing the Airprox report narrative, the RJ70 pilot questioned why the Hawk pilots did not reduce their rate of climb and turn away from the RJ, rather than continue at the same rate on an apparent track towards them? The Hawk crews demonstrated a lack of awareness with regards to the relatively poor manoeuvrability of a larger aircraft, TCAS in general and the implications of their high energy state. The event unfolded so quickly that the RJ crew did not have time to visually acquire the Hawks or speak to ATC for potential deconfliction information.

[1] The Hawk formation was not seen; CPA was estimated from the TCAS display.

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

THE HAWK PILOT reports leading a flight of 2 Hawk T1 aircraft conducting a minimum fuel recovery from Yeovilton to Culdrose heading 240°, climbing FL240 at 300 KIAS. Rate of climb approximately 6000fpm. No weather to affect in the area. The formation was receiving a Traffic Service from Yeovilton and about to be transferred to Swanwick. As they passed approx. FL120, traffic was called in the right 1 o'clock around 5-7 miles at around 16000ft. Both pilots saw the traffic and it was possible to make out it was a four engine high tail aircraft; the lead recognised it as the RJ. When the aircraft was visually acquired it was heading west-southwest with approx. 45° of bank but generally level. The RJ was then seen conducting significant and impressive rapid rolling up to around 60° angle of bank and according heading changes. The RJ then bank hard left to an approximately reciprocal heading. As the RJ turned left to the reciprocal heading (reducing the lateral separation to the Hawk formation, on a steady heading) the lead pilot reduced the rate of climb, transmitting to Yeovilton that they were levelling against the traffic to prevent any confliction as it was unknown what the RJ's final heading would be. As the RJ rolled out on the reciprocal, around 3 miles displaced in the Hawk formation's 2.30 (right 70°) they continued the climb. The RJ was then seen to conduct a hard right turn, by around 90°. The RJ nose was basically on the formation, or slightly ahead, approx. 500ft above with the formation climbing. The RJ turned to the right and reduced the lateral separation. The formation was about to initiate a hard climb following the RJ's turn however the RJ was then seen to turn hard left and tracked behind around 1 mile north as they passed through the same level. This all occurred in Class G airspace with no risk of a collision. The Hawk pilot noted that it was impressive to see such manoeuvring by a large aircraft. The formation members were visual with the RJ following the traffic call and maintained heading but reduced the rate of climb to aid deconfliction. It was a surprise when the RJ tipped-in on the pair of Hawks, showing impressive manoeuvrability for a large aircraft.

The pilot assessed the risk of collision as 'None'.

THE BOSCOMBE U/T CONTROLLER reports they were in the TC (Zone) position, controlling [a BE200] and [the RJ70] on frequency. [RJ70 C/S] was showing level at 150 on Mode C, transiting west of Yeovilton. Initially the [Hawk] contact was observed on talkdown to Yeovilton before climbing out low level, then the Mode C disappeared. When it returned it was [at] 105 climbing. As such, the controller called the traffic with 3 miles and the contact at 115 climbing. [RJ70 C/S] informed them that there was a TCAS RA, which was acknowledged and therefore Traffic Information was not updated. In response, Swanwick were contacted and they received Traffic Information that the contact was a pair of Hawks that were visual with the RJ, which was passed on to [RJ70 C/S].

THE BOSCOMBE OJTI CONTROLLER reports they were instructing a low/medium experience U/T controller in Radar. [BE200 C/S] and [RJ70 C/S] on frequency. [RJ70 C/S] was displaying a Mode C of 150 when a contact climbed out of Yeovilton towards the southwest, initially without Mode C, which appeared as 115 climbing. Traffic Information was given, southeast, 3 miles, tracking southwest, indicating FL115, climbing. After Traffic Information was passed, it was not updated due to [RJ70 C/S] informing them of a TCAS RA, which was acknowledged. [RJ70 C/S] updated them on their course of action as they observed the contact pass behind them, still climbing. [RJ70 C/S] then requested they find out the details of the aircraft. Swanwick Mil were contacted, and they were informed it was a pair of Hawks transiting to Culdrose and that Traffic Information was given on the RJ and they were visual. This information was passed to [RJ70 C/S].

THE BOSCOMBE SUPERVISOR reports they had been upstairs in the VCR at the time of the incident involving the RJ70 because it was perceived that the greater volume of traffic was in the visual circuit. They were informed very soon after the event with all details. They called Yeovilton Supervisor to ascertain their perspective of the occurrence. They were aware that the Hawks had been visual with the RJ70 on climb and that the occurrence took place in Class G airspace. The aim of the conversation with Yeovilton Supervisor was to expand their awareness of Boscombe operations within the TRA, highlighting sometimes the lack of manoeuvrability and types of operation of their traffic. The goal was to ensure an awareness, when performance aircraft depart and climb into the TRA from Yeovilton, to inform Boscombe by landline of subsequent departure profiles.

THE YEOVILTON CONTROLLER reports that [Hawk formation C/S] climbed out from Yeovilton RW26 under a Traffic Service, requesting FL240 for their transit to Culdrose. After identification at approximately 1 mile from the runway, the controller issued the climb to FL240 and passed Traffic Information on an aircraft wearing a Boscombe squawk in their 12 o'clock at 7 miles indicating FL 150. [Hawk formation C/S] called visual with that traffic and continued to climb. During the handover to Swanwick Mil, [Hawk formation C/S] called to say they were stopping their climb below the Boscombe traffic and then, once clear, resumed climbing. They were handed over to Swanwick Mil without further issue.

THE YEOVILTON SUPERVISOR reports that [Hawk formation C/S] were departing Yeovilton under their own navigation climbing FL240. The approach controller called Boscombe traffic to the [Hawk formation C/S] as soon as they came on frequency and this was acknowledged by [Hawk formation C/S] who reported visual. At this point the Boscombe traffic looked like it was general handling and was heading away from [Hawk formation C/S]. During the handover to Swanwick Mil, [Hawk formation C/S] reported stopping the climb (presumably because the Boscombe traffic had turned towards them), then moments later called continuing climb. The handover to Swanwick was completed and [Hawk formation C/S] went enroute.

Factual Background

The weather at Yeovilton was recorded as follows:

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METAR EGDY 101050Z 30018KT 9999 FEW028 07/02 Q1003 NOSIG RMK BLU BLU=
METAR EGDY 101020Z 29018KT 9999 FEW030 07/02 Q1002 NOSIG RMK BLU BLU=
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Analysis and Investigation

Military ATM

An Airprox occurred on 10 Dec 21 at approximately 1038 UTC, in the vicinity of RNAS Yeovilton between an RJ70 and a pair of Hawks. The RJ70 was in receipt of a Traffic Service from Boscombe Down Zone controller and the Hawks were in receipt of a Traffic Service from Yeovilton ATC.

The Boscombe Zone controller was under training with the Instructor reporting that the trainee had low to medium experience. They were providing a Traffic Service to the RJ70 pilot and had one other aircraft on frequency although it is not known what type of Air Traffic Service with which they were being provided. They observed the pair of Hawks departing Yeovilton although noted that the Mode C was not visible until they were passing FL105. Traffic Information was passed to the RJ70 and was not updated as the RJ was manoeuvring in accordance with instructions from their TCAS.

The Boscombe Supervisor had been in the VCR and did not witness the Airprox.

Figures 1 – 3 show the positions of the RJ70 and the Hawks at relevant times during the Airprox. The screenshots are taken from a replay using the NATS radars which are not utilised by the Boscombe controllers, therefore, may not be entirely representative of the picture available.

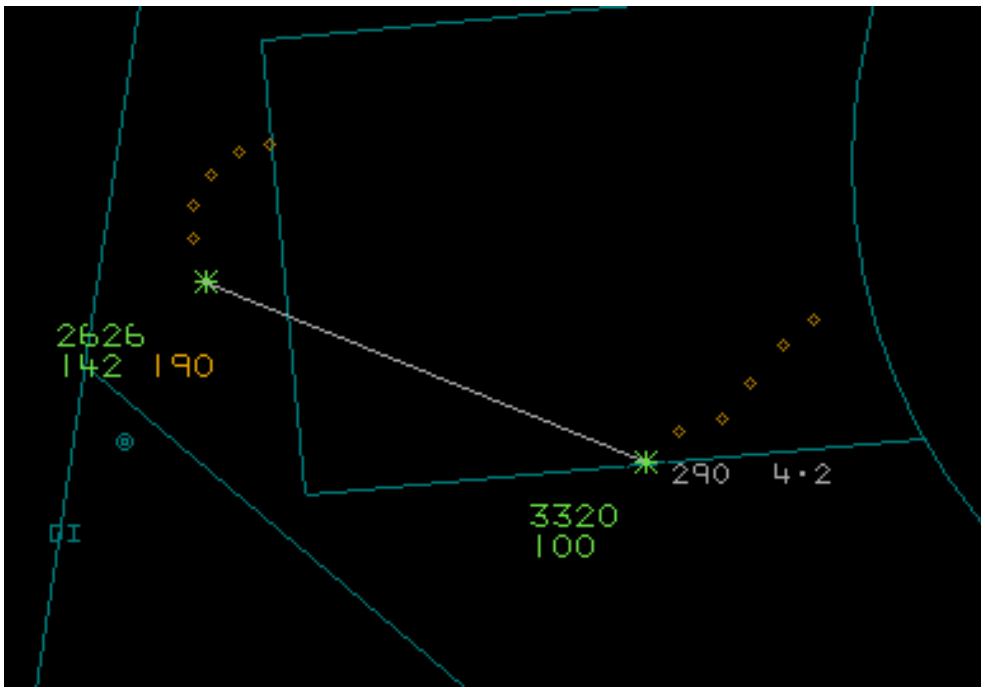

Figure 1: Traffic Information passed to the RJ70.

Following the observed departure of the Hawks from Yeovilton, the Boscombe Zone controller passed Traffic Information to the RJ70 pilot, stating *"traffic south east three miles tracking south west indicating one one five climbing"*. Separation was measuresd as 4.2NM and 4200ft. The Boscombe Zone controller was unaware that the return was in fact a pair and not a singleton.

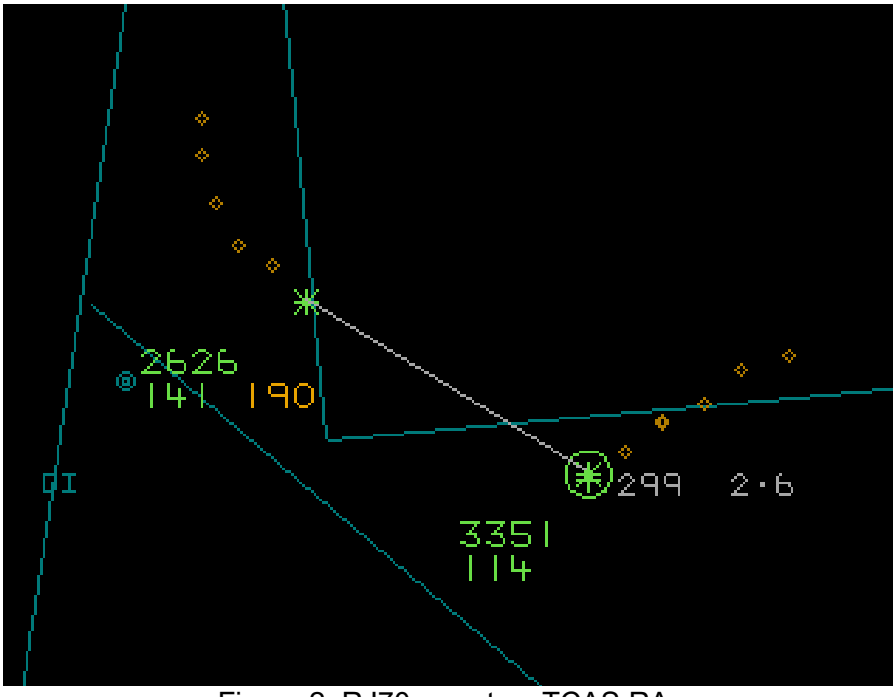

Figure 2: RJ70 reports a TCAS RA.

Eleven seconds later the RJ70 pilot reports that they have received a TCAS RA due to the rapid climb rate of the Hawks. Separation decreased to 2.6NM and 2700ft. The Boscombe Zone controller did not pass any further updates on the Hawks due to the RJ70 manouvering under a TCAS RA.

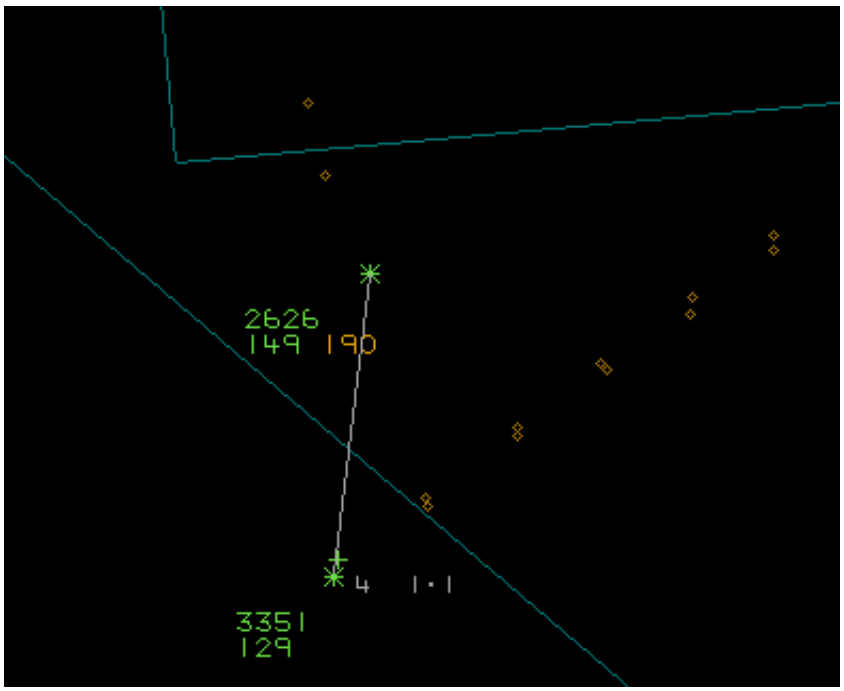

Figure 3: CPA.

CPA occurred 19 seconds after the reported TCAS RA. The separation was measured as 1.1NM and 2000ft. The Boscombe Zone controller, although under training, passed Traffic Information as required, based on the information that was presented to them in the lead-up to the Airprox. The operating area of the RJ70 was potentially not optimal being in the extended climb out lane [of Yeovilton] although it is not known if Traffic Information had been passed to or requested by Yeovilton ATC.

UKAB Secretariat

The RJ70 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]. Formations of aircraft are normally less manoeuvrable than single aircraft and are unable to take sudden avoiding action. The handling pilots of single aircraft should therefore give way to, and keep clear of, formations of aircraft.[3]

To prevent incorrect pilot responses, in [TCAS] version 7.0 the "Adjust vertical speed, adjust" RAs [sic] has been replaced [in the TCAS version 7.1] by a new "Level off, level off" RA which requires a reduction of vertical rate to 0 ft/min. The level off is to be achieved promptly, not at the next standard flight level (e.g. FL200, FL210, etc.). The "Level off, level off" RA may be issued as an initial RA or as a weakening RA when the vertical distance between the aircraft increases [4].

In some instances, TCAS may not have a reliable bearing for an intruder causing a TA or RA. Since bearing information is used for display purposes only, the lack of bearing information does not affect the ability of TCAS to issue TAs and RAs [5].

TCAS II is designed to provide collision avoidance protection in the case of any two aircraft that are closing horizontally at any rate up to 1200 knots and vertically up to 10,000 feet per minute (fpm) [6].

Comments

[2] (UK) SERA.3205 Proximity. AMC to MAA RA 2307 paragraphs 1 and 2.
[3] AMC to MAA RA 2307 paragraph 9.
[4] TCAS II version 7.1 | SKYbrary Aviation Safety
[5] US Department of Transportation, FAA, Introduction to TCAS II Version 7.1, page 14
[6] US Department of Transportation, FAA, Introduction to TCAS II Version 7.1, page 26.

HQ Navy

The Yeovilton approach controller correctly discharged their duties under a Traffic Service resulting in the Hawk formation becoming visual with the RJ70 early in their departure, demonstrating the appropriate level of service given the meteorological conditions. This information was also passed to Swanwick Mil on handover, increasing Swanwick Mil's situational awareness. The Hawk formation took appropriate action to ensure no risk of collision was introduced, reinforced by the CPA shown in the NATS radar images. The effective barriers of accurate surveillance-based Traffic Information, aircrew lookout and TCAS alert ensured there was no threat of MAC.

Summary

An Airprox was reported when an RJ70 and a Hawk formation flew into proximity near Whitelackington at 1039Z on Friday 10th December 2021. The pilots were operating under VFR in VMC, the RJ70 pilot in receipt of a Traffic Service from Boscombe Down and the Hawk formation pilots in receipt of a Traffic Service from Yeovilton.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

Information available consisted of reports from both pilots, radar photographs/video recordings and reports from the air traffic controllers involved. 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 discussed this event and were satisfied that there had been no risk of collision. Members' focus then turned to whether or not there had been a degradation in safety and it was noted that both Hawk formation pilots had been visual with the RJ70 at a range of 5NM. Members also discussed that there was often a lag with the Mode C readout on the radar when aircraft are climbing or descending rapidly, which on this occasion meant that, although the Boscombe controller gave timely Traffic Information, this had been later than they might otherwise have done. They considered the separation at CPA, along with the TCAS RA which, although not desirable, is considered a normal system operation. Members were satisfied that normal safety standards and parameters had pertained and, as such, the Board assigned Risk Category E.

Members agreed on the following contributory factors:

CF1. The RJ70 pilot had had not followed the initial TCAS instruction correctly, climbing the aircraft when the TCAS commanded a "Level off".

CF2. The mental model that had been formed by the RJ70 pilot had been inaccurate because they believed that rolling the wings level would allow the Hawks to pass behind them.

CF3. The RJ70 pilot had received accurate Traffic Information regarding the Hawk formation, but the mental model that they had form had been incorrect due to incorrect TCAS bearing information.

CF4. The RJ70 pilot had been concerned by the proximity of the Hawk formation.

CF5. The TCAS equipment carried on the RJ70 had been effective and had issued a valid warning.

CF6. The warning and command issued by the TCAS had not initially been optimally actioned as the pilot of the RJ70 had climbed when instructed to "Level off".

CF7. The Hawk formation had not been seen by the RJ70 pilot.

PART C: ASSESSMENT OF CONTRIBUTORY FACTORS AND RISK

Contributory Factors:

	2021242			
CF	**Factor**	**Description**	**ECCAIRS Amplification**	**UKAB Amplification**
	Flight Elements			
	• Tactical Planning and Execution			
1	Human Factors	• Action Performed Incorrectly	Events involving flight crew performing the selected action incorrectly	Incorrect or ineffective execution
	• Situational Awareness of the Conflicting Aircraft and Action			
2	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
3	Human Factors	• Understanding/Comprehension	Events involving flight crew that did not understand or comprehend a situation or instruction	Pilot did not assimilate conflict information
4	Human Factors	• Unnecessary Action	Events involving flight crew performing an action that was not required	Pilot was concerned by the proximity of the other aircraft
	• Electronic Warning System Operation and Compliance			
5	Contextual	• ACAS/TCAS RA	An event involving a genuine airborne collision avoidance system/traffic alert and collision avoidance system resolution advisory warning triggered	
6	Human Factors	• Response to Warning System	An event involving the incorrect response of flight crew following the operation of an aircraft warning system	CWS misinterpreted, not optimally actioned or CWS alert expected but none reported
	• See and Avoid			
7	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

Degree of Risk: E.

Recommendation: Nil.

Safety Barrier Assessment[7]

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

Flight Elements:

Tactical Planning and Execution was assessed as **partially effective** because the RJ70 pilot did not conform to the TCAS RA 'Level off, level off'.

Situational Awareness of the Conflicting Aircraft and Action were assessed as **partially effective** because the RJ 70 pilot's situational awareness was incorrect, in that they assessed that the Hawk pair were rapidly closing to proximity and then manoeuvred the aircraft in an attempt to obtain visual contact when the TCAS RA was providing valid deconfliction information.

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

Airprox Barrier Assessment: 2021242 Outside Controlled Airspace