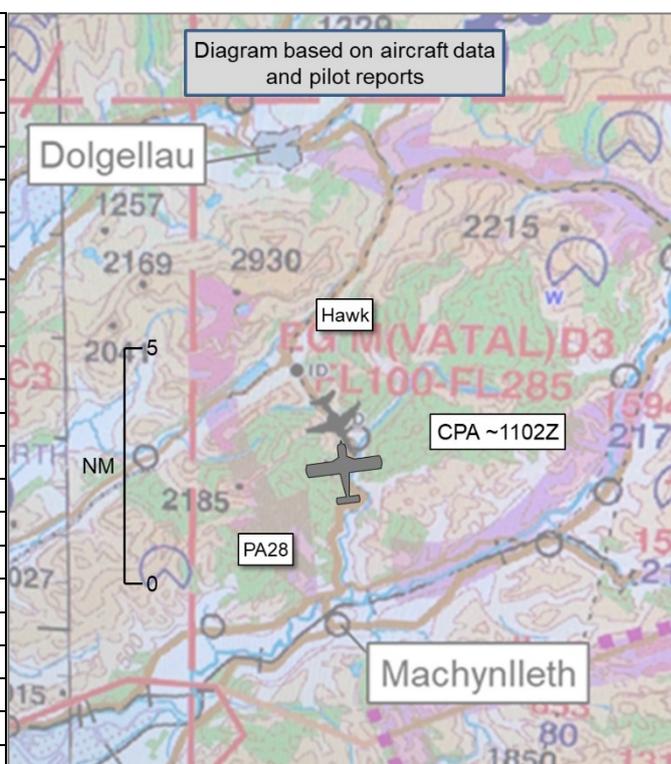


AIRPROX REPORT No 2021193

Date: 21 Sep 2021 Time: 1102Z Position: 5240N 00352W Location: Corris Uchaf

PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

Recorded	Aircraft 1	Aircraft 2
Aircraft	Hawk T2	PA28
Operator	HQ Air (Trg)	Civ FW
Airspace	London FIR	London FIR
Class	G	G
Rules	VFR	VFR
Service	Listening Out	Listening Out
Provider	LL Common	LL Common
Altitude/FL	NK	NK
Transponder	A, C, S	A, C
Reported		
Colours	Black	Blue, white
Lighting	HISL, nav, nose	Strobe, landing
Conditions	VMC	VMC
Visibility	>10km	>10km
Altitude/FL	450ft agl	1800ft
Altimeter	RPS (1024hPa)	RPS (1024hPa)
Heading	130°	Westerly
Speed	430kt	106kt
ACAS/TAS	TCAS I	SkyEcho
Alert	TA	None
Separation at CPA		
Reported	300ft V/0m H	500ft V/0m H
Recorded	NK	



THE HAWK PILOT reports that whilst at low level, adhering to a flow arrow, they noticed a civilian PA28 pass approximately 300ft above and in the opposite direction. The pilot noted that the civilian aircraft was around the corner of a valley and therefore they had no way of seeing it any earlier than they did. A TCAS TA indicated at the 'point of Airprox', with nothing before due to terrain; nothing appeared on TCAS until they had rolled out at which time the PA28 had already passed. There was no time to take avoiding action because the PA28 was overhead at the point of visual acquisition. Of significant note, they were giving positional calls on the VHF Low-Level Common frequency but nothing was heard in reply.

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

THE PA28 PILOT reports on a land-away with a friend. They knew exactly where they passed the Hawk and had it visual as it passed below, although not on ADS-B, despite seeing other Hawks and a C-130 on ADS-B. The Hawk passed below as they were at 1800ft and slightly on the left side of the valley floor, to allow them to see up the northerly valley, looking for traffic, before committing to a turn. The pilot remarked that they should have been more visible than the Hawk as they would have been against the sky and horizon. As they looked they saw a Hawk in the 2 o'clock position at a range of 2NM, coming southbound in a left turn that was going to pass below with an estimated altitude difference of 500-800ft. There was minimal lateral separation although the Hawk was perhaps slightly to the right. They had the Hawk in sight as it started its turn and would have been able to move laterally should there have been any conflict, which there was not so no action was taken.

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

Factual Background

The weather at Caernarfon and Shawbury was recorded as follows:

METAR EGCK 211120Z 25007KT 9999 FEW019 18/13 Q1031=
 METAR EGCK 211050Z VRB02KT 9999 FEW023 17/12 Q1031=

METAR EGOS 211150Z 29003KT 9999 FEW024 BKN250 18/11 Q1031 NOSIG RMK BLU BLU=
 METAR EGOS 211050Z 29005KT 9999 FEW023 BKN250 17/12 Q1031 NOSIG RMK BLU BLU=

Analysis and Investigation

UKAB Secretariat

The Hawk and PA28 pilots shared an equal responsibility for collision avoidance and not to operate in such proximity to other aircraft as to create a collision hazard.¹ If the incident geometry is considered as head-on or nearly so then both pilots were required to turn to the right.² The PA28 pilot provided a picture of their planned route (pink) and track (blue), see Figure 1 below.

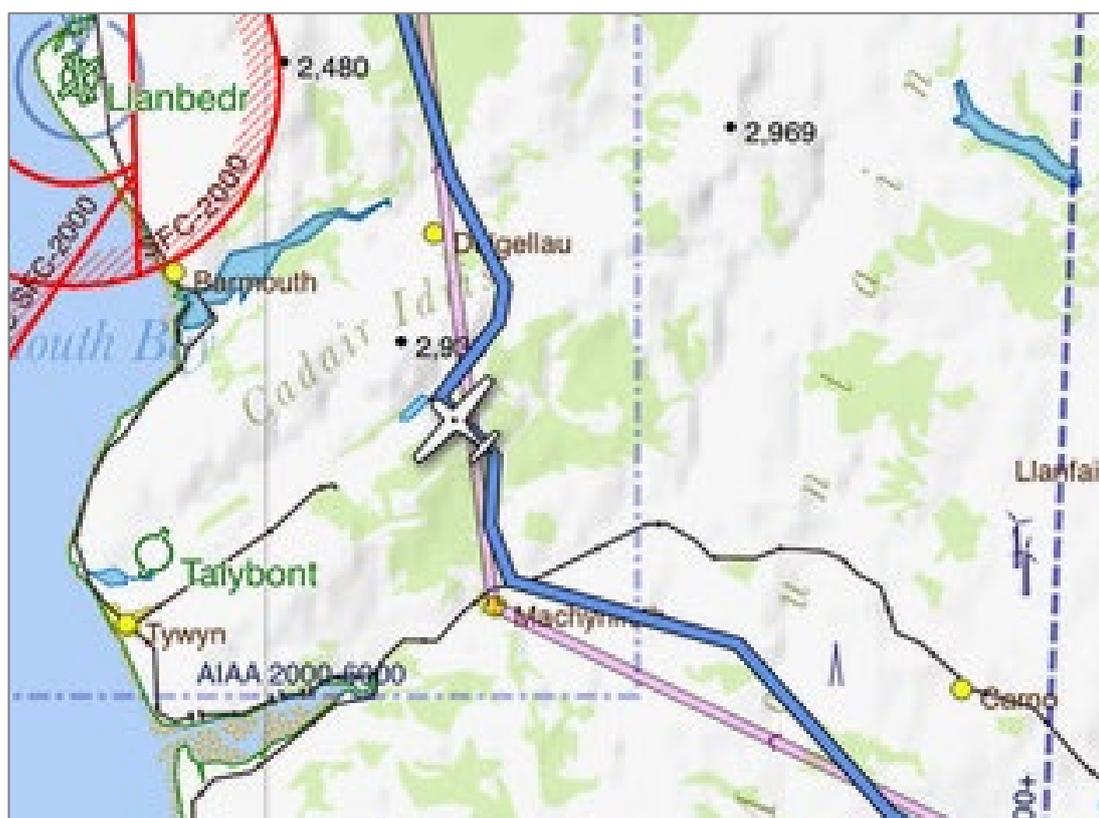
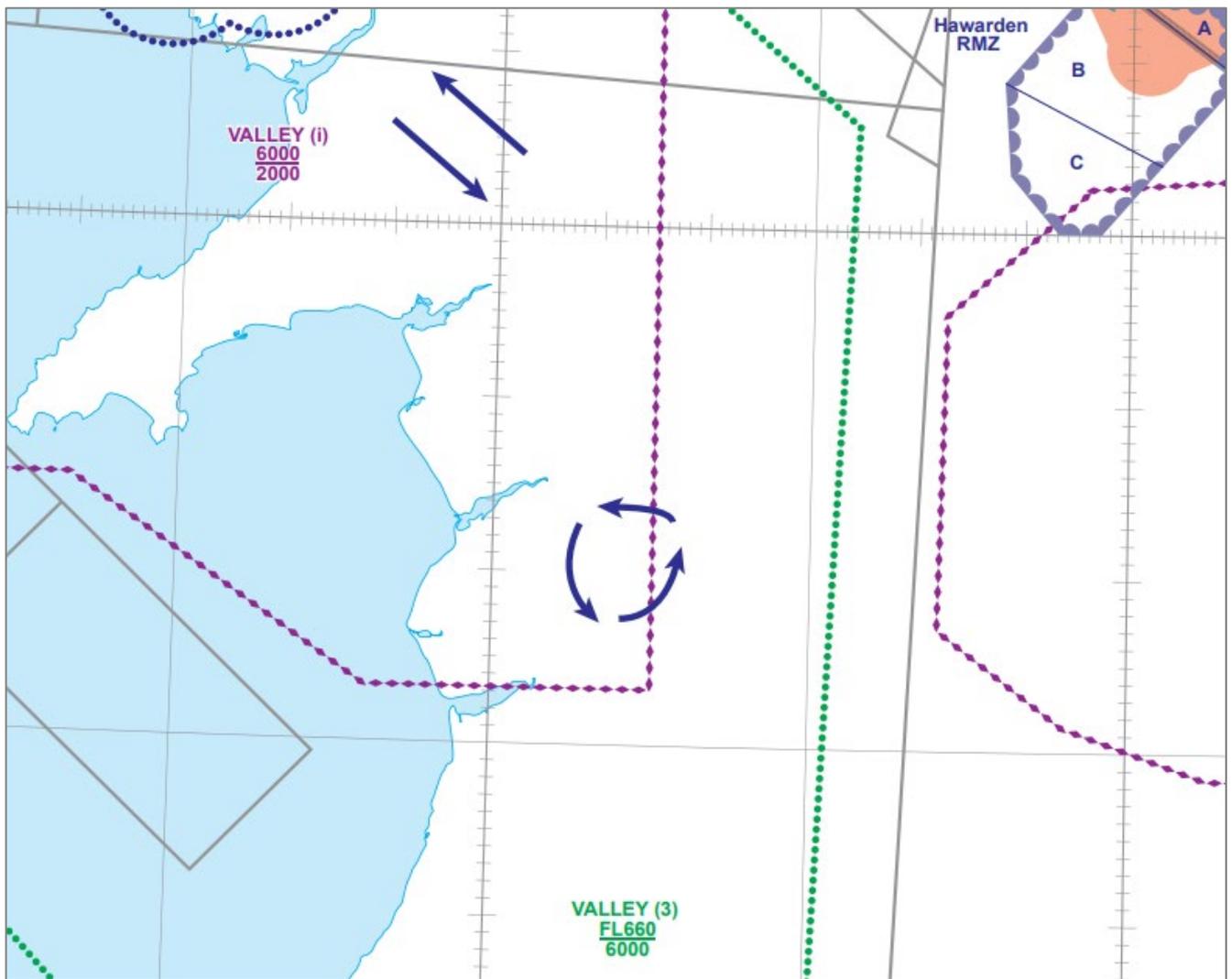


Figure 1

The UK AIP, ENR 6-76, CHART OF UNITED KINGDOM AREAS OF INTENSE AIR ACTIVITY (AIAA) AND AERIAL TACTICS AREAS (ATA) depicts the military low-level system flow arrows at the 'Mach Loop'. An extract is reproduced below:

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

² (UK) SERA.3210 Right-of-way (c)(1) Approaching head-on. MAA RA 2307 paragraph 13.



Occurrence Investigation

Outcome: Whilst at low level, adhering to the flow arrow in the [Machynlleth Loop] 'Mach Loop' (see Figure 2) the Hawk got a late visual sighting of a PA28, opposite direction and approx. 500-800ft above and no lateral separation. Nothing was observed on Hawk TCAS or the PA28 ADS-B until aircraft were passing each other. The PA28 had the Hawk visual earlier and assessed there was no conflict due to the vertical separation.



Figure 2: 'Mach Loop'

Cause: The Hawk was listening out and transmitting position reports on the Low-Level Common frequency. The PA28 was also listening out on the Low-Level Common frequency and heard other aircraft transmitting including a C-130J however no transmissions were heard from the Hawk. TCAS in the Hawk and ADS- B in the PA28 did not show traffic until the aircraft were co-located.

Recommendations(Mitigation): The Low level common frequency is a relatively new procedure with positive safety benefits however it cannot be relied upon to give a full picture especially in areas of high terrain. TCAS may also give late warnings in areas of high terrain. This DASOR and the findings of the Airprox report will be publicised to all crews to increase awareness.

Contributory factor: The aircraft were operating in an area of very high terrain which can block VHF, TCAS / ADS transmissions and visual sightings for aircraft operating at Low Level.

Recommendations(Mitigation): The Low level common frequency is a relatively new procedure with positive safety benefits however it cannot be relied upon to give a full picture especially in areas of high terrain. TCAS may also give late warnings in areas of high terrain. This DASOR and the findings of the Airprox report will be publicised to all crews to increase awareness.

Contributory factor: The Hawk was showing some TCAS traffic at approx. 20NM but did not show the PA28 until already on top. There were no transmissions heard to suggest another aircraft was in the same vicinity at low level. The PA28 had no indication of the Hawk on ADS-B and had not received the Hawk transmissions on Low level common VHF. This gave incomplete SA to the crews of both aircraft and the final barriers were height separation and visual contact by the PA-28. A further startle factor for the Hawk pilot was the fact that the PA-28 was flying in the opposite direction of the flow arrow.

Recommendations(Mitigation): The Low level common frequency is a relatively new procedure with positive safety benefits however it cannot be relied upon to give a full picture especially in areas of high terrain. TCAS may also give late warnings in areas of high terrain. This DASOR and the findings of the Airprox report will be publicised to all crews to increase awareness.

Observations: This report will be investigated³ further by the Airprox board. The Hawk Pilot may have been surprised further by an aircraft flying at low level against the Flow Arrow. It is worth noting that civilian traffic is not part of the Military Low Flying system and do not have the flow arrows marked on charts. Civil traffic may be flying in any direction. In this case the PA28 had the Hawk visual and ensured separation only because it was flying in a opposite direction. All aids such as ADS B, TCAS, VHF LL common transmissions can aid situational awareness. The final barrier remains visual lookout. ADS-B IN would add to the SA within Hawk as was used in the PA28.

Accountable Manager Comments: The PA28 pilot was an experienced former RAF pilot and current airline pilot. He had full awareness of the 'Mach Loop' and the likelihood of Hawk T2 activity. He chose to fly opposite direction to improve his lookout and [at more than] 500ft above the MSD that he expected military LL system users to be flying at in order to build separation with military traffic. He was unaware, and surprised, that Hawk T2 is not equipped with ADS-B out (Hawk T2 SO reports ambition to equip by 31 Mar 24); he was monitoring ADS-B and had confirmed the serviceability of his own transponder as part of his EC suite. In this instance the Low-Level Common frequency proved unreliable due to terrain blocking despite both parties using it. The area concerned is Class G airspace and as such GA traffic is clear to operate in this manner. Of note, flow arrows do not appear on civilian charts. Flying within the 'Mach Loop' was discussed at the recent Regional Airspace User Working Group to raise awareness to the GA fraternity. We will wait out for the outcome of the Airprox board.

Comments

HQ Air Command

This Airprox was subject to a Local Investigation which made an action to publicise the findings to all crews, educating them on the limitations of electronic conspicuity (EC) and comms when flying in valleys. It is encouraging to hear that both pilots were using some form of EC and both using the

³ The UKAB function is to evaluate Airprox, rather than investigate. www.airproxboard.org.uk

VHF Low-Level Common frequency. Unfortunately, these barriers were hampered by the terrain of the “Mach Loop” (shown in Figure 2) and therefore did not perform as hoped. This Airprox once again raises the importance of sound lookout, as this proved to be the last remaining and most reliable barrier. Past military investigations and Airprox reports have highlighted that ‘flow arrows’ do not appear on civilian flying charts and therefore, that civilian pilots may be unaware of the defined direction of military low-level aircraft. It is heartening to hear that the flow arrows were discussed at the Regional Airspace User Working Group to try and help raise awareness of their existence. Of note, the “Mach Loop” is a busy route for military aircraft and it is quite reasonable to expect to encounter fast-jet traffic in it.

As the pilot of the PA28 had previous knowledge of the area and activity associated with it, they positioned themselves accordingly so as not to pose a conflict for military aircraft. Even though the Hawk pilot saw the PA28 at a very late stage, and was no doubt startled by its presence, the risk of collision was low owing to the existing vertical separation.

Summary

An Airprox was reported when a Hawk T2 and a PA28 flew into proximity near Corris Uchaf at 1102Z on Tuesday 21st September 2021. Both pilots were operating under VFR in VMC, neither in receipt of a FIS but both listening out on the VHF Low-Level Common frequency.

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 discussed the available barriers to MAC and noted that with both aircraft being flown at a low level, both VHF R/T communication and effective EC operation had been compromised by the interposing high ground [CF1]. This resulted in neither pilot having situational awareness on the other aircraft [CF3] until visual sighting and a late TCAS warning for the Hawk pilot [CF4] at about CPA. However, the Board commented that the ex-military PA28 pilot did have situational awareness that the ‘Mach Loop’ was formed by a military flow arrow and that it was likely that southbound fast jets would be flying along the valley they had chosen to follow on a northbound heading. Members wondered whether the PA28 pilot had fully considered their plan. High ground prevented EC or voice warning, and with a reported closing speed in excess of 500kt and PA28 reported sighting at 2NM range, this gave a total time to take action of the order of 14 seconds. Members wondered what degree of avoiding action could be accomplished in that available time. Additionally, RAF fast jets were not the only users of the UK Low Flying System, with some other fast jet operators required to fly at a higher minimum level, typically 500ft MSD, and hence closer to a low-flying GA aircraft. Members reiterated that Class G airspace is available to all users but questioned the wisdom of choosing to fly a GA aircraft along a military flow arrow on a weekday, and at a low level, for leisure purposes [CF2]. The Board felt that had the PA28 pilot further considered their plan, they may have elected to remain clear of the flow arrow, either laterally or vertically.

Turning to risk, it was apparent that although the PA28 pilot had reported visual sighting at a range of 2NM, the Hawk pilot had only seen the PA28 at about CPA, effectively a non-sighting [CF5]. Some members felt that the closing speed was such that safety had been compromised but after further discussion it was decided that vertical separation at CPA, although far from desirable, was such that collision had been averted; the PA28 pilot was able to assess the closing vector and decided that no action was required.

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

	2021193			
CF	Factor	Description	ECCAIRS Amplification	UKAB Amplification
Flight Elements				
• Tactical Planning and Execution				
1	Human Factors	• Accuracy of Communication	Events involving flight crew using inaccurate communication - wrong or incomplete information provided	Ineffective communication of intentions
2	Human Factors	• Pre-flight briefing and flight preparation	An event involving incorrect, poor or insufficient pre-flight briefing	
• Situational Awareness of the Conflicting Aircraft and Action				
3	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
• Electronic Warning System Operation and Compliance				
4	Contextual	• ACAS/TCAS TA	An event involving a genuine airborne collision avoidance system/traffic alert and collision avoidance system traffic advisory warning triggered	
• See and Avoid				
5	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: C.

Recommendation: Nil.

Safety Barrier Assessment⁴

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 PA28 pilot elected to transit along an area of known high intensity fast-jet traffic and at an altitude such that EC and communication were compromised by the high ground.

Situational Awareness of the Conflicting Aircraft and Action were assessed as **ineffective** because neither pilot was aware of the proximity of the other aircraft until sighted.

Electronic Warning System Operation and Compliance was assessed as **ineffective** because the Hawk TCAS warning only occurred at a late stage due to terrain masking.

⁴ 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: 2021193		Outside Controlled Airspace						
Barrier		Provision	Application	Effectiveness				
				Barrier Weighting				
				0%	5%	10%	15%	20%
Ground Element	Regulations, Processes, Procedures and Compliance	○	○					
	Manning & Equipment	○	○					
	Situational Awareness of the Conflicion & Action	○	○					
	Electronic Warning System Operation and Compliance	○	○					
Flight Element	Regulations, Processes, Procedures and Compliance	●	●					
	Tactical Planning and Execution	●	●					
	Situational Awareness of the Conflicting Aircraft & Action	✗	●					
	Electronic Warning System Operation and Compliance	●	✗					
	See & Avoid	●	●					
Key:		Full	Partial	None	Not Present/Not Assessable	Not Used		
Provision	●	●	✗	○				
Application	●	●	✗	○	○			
Effectiveness	■	■	■	■	□			