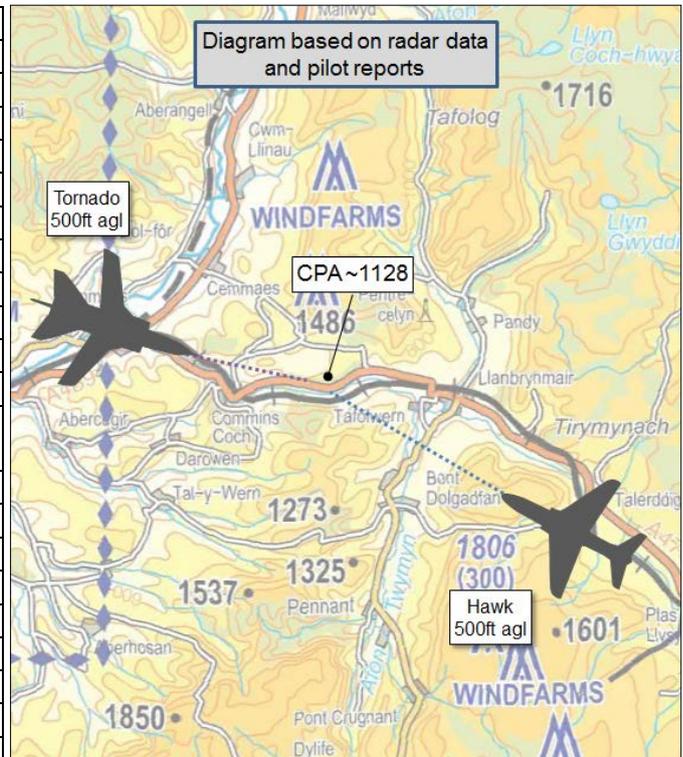


**AIRPROX REPORT No 2017144**

Date: 05 Jul 2017 Time: 1128Z Position: 5236N 00340W Location: Machynlleth Loop

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

| Recorded          | Aircraft 1                | Aircraft 2                |
|-------------------|---------------------------|---------------------------|
| Aircraft          | Hawk                      | Tornado                   |
| Operator          | HQ Air (Ops)              | HQ Air (Ops)              |
| Airspace          | LFA7                      | LFA7                      |
| Class             | G                         | G                         |
| Rules             | VFR                       | VFR                       |
| Service           | None                      | None                      |
| Provider          |                           |                           |
| Altitude/FL       |                           |                           |
| Transponder       | A, C, S                   | A, C, S                   |
| <b>Reported</b>   |                           |                           |
| Colours           | Black                     | Grey                      |
| Lighting          | Conspicuity, Strobes, Nav | Conspicuity, Strobes, Nav |
| Conditions        | VMC                       | VMC                       |
| Visibility        | 10km                      | 10km                      |
| Altitude/FL       | 500ft                     | 500ft                     |
| Altimeter         | RPS (1014hPa)             | Rad Alt                   |
| Heading           | 270°                      | 119°                      |
| Speed             |                           | 425kt                     |
| ACAS/TAS          | TCAS II                   | TCAS II                   |
| Alert             | None                      | None                      |
| <b>Separation</b> |                           |                           |
| Reported          | 0ft V/0.5nm H             | Not seen                  |
| Recorded          | NK                        |                           |



**THE HAWK PILOT** reports that he was the QFI in the back seat of a low-level navigational sortie. The final part of the sortie was to practice valley flying in the ‘Mach Loop’ [UKAB Note: this refers to the Machynlleth Loop which is a one-directional flow system for military aircraft that incorporates the Machynlleth Valley in West Wales]. The plan was to enter at the southern tip, follow the flow arrow to the north-east and exit at the northern tip. During the transit to the entry point the student transmitted their planned entry and exit points on the low-level common frequency. A Tornado formation on frequency responded with their intentions to exit the loop south-east heading towards Shobdon. The Hawk QFI perceived that the Tornado crew’s situational awareness at this point was that the Hawk was north, heading south, which gave the instructor cause for concern and he told the student to head north, a right turn from their current heading. The TCAS was clear at this point. The student entered a left-hand turn and, during the turn, became visual with a single Tornado. On rolling wings level, the instructor became visual with a Tornado ‘belly-up’ on a collision course with their flight path. The instructor took control and initiated a 4.5g climb to break the collision. There had been a ridge between the two aircraft which had appeared to mask the TCAS in both aircraft.

He assessed the risk of collision as ‘Medium’.

**THE TORNADO PILOT** reports that he was conducting a low-level sortie as a two-aircraft formation. On exiting the ‘Mach Loop’ a Valley callsign made a transmission on the low-level frequency that was largely unreadable but included the phrases ‘Mach Loop’ and ‘north’. He replied by transmitting the Tornado formation’s position and intentions to route south-east after the Mach loop towards Shobdon, to which the Valley callsign acknowledged but didn’t state a potential confliction. No TCAS indications were received and neither of the Tornado crews saw the Hawk at any point.

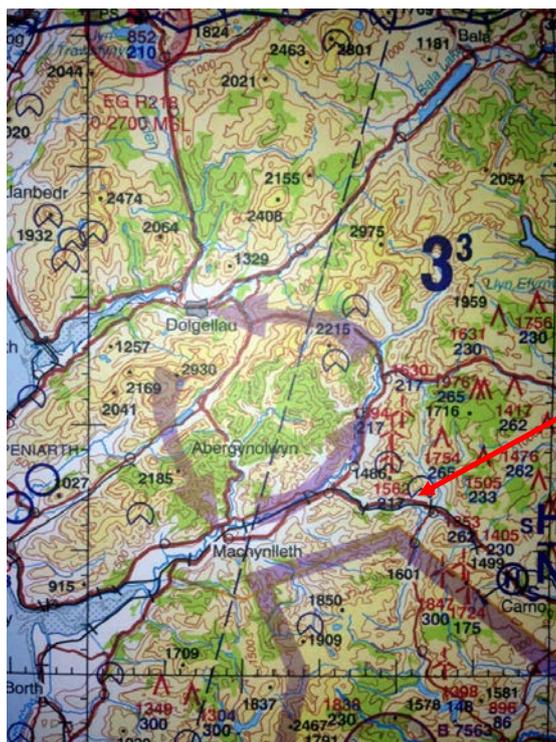
He assessed the risk of collision as ‘Medium’.

## Factual Background

The weather at Valley was recorded as follows:

METAR EGOV 051121Z 28003KT 9999 FEW012 BKN030 18/14 Q1019 BLU NOSIG=

Ac flying in the valleys that constitute the Machynlleth Loop (see ½ mil LFC) should fly in an anti-clockwise direction only. Increased vigilance is advised when joining or leaving the Loop for other ac or formations which may be entering or exiting the Loop; positional calls are to be made on the LL Common frequency immediately prior to joining or leaving the Loop<sup>1</sup>.



Machynlleth Loop as depicted on the UK LFC

## Analysis and Investigation

### UKAB Secretariat

The incident did not show on the NATS radars, therefore the exact radar separation is not known.

The Hawk and Tornado 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>2</sup>. If the incident geometry is considered as head-on or nearly so then both pilots were required to turn to the right<sup>3</sup>.

## Comments

### HQ Air Command

The MAC barriers available to the crews involved in this incident were pre-flight planning (through CADS), electronic conspicuity (through TCAS), procedures (through use of the radio) and lookout. Both crews submitted their routes to CADS and no conflict was highlighted. However, this barrier was weakened due to both crews being off their pre-planned timeline and an

<sup>1</sup> UKMLFHB

<sup>2</sup> SERA.3205 Proximity.

<sup>3</sup> SERA.3210 Right-of-way (c)(1) Approaching head-on.

unplanned confliction was therefore generated. Additionally, when operating at low-level in hilly terrain then it is highly likely that the line-of-sight requirement for radio and TCAS to operate efficiently will be compromised. This appears to be the case here where the positional call made by the Hawk crew – in accordance with extant orders and procedures – was not received in its entirety and the TCAS contacts only became apparent at short range. However, the positional information provided on the common frequency by the Tornado crew cued the lookout of the Hawk crew and they became visual with the Tornado as they manoeuvred to increase separation from the perceived position of the formation.

This incident highlights the need for a layered defence to MAC and that each barrier employed can never be perfect. Crews should maintain a constant awareness of the risk and be vigilant and rigorous to maximise the benefit of each barrier.

## Summary

An Airprox was reported when a Hawk and a Tornado flew into proximity at 1128 on Wednesday 5<sup>th</sup> July 2017. Both pilots were operating under VFR in VMC, and were operating low-level in LFA7.

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

Information available consisted of reports from the pilots of both aircraft radar photographs/video recordings and reports from the appropriate operating authorities.

The Board first looked at the actions of the Hawk pilot. As the Hawk was approaching their LL Mach Loop entry point he gave a call on the low-level frequency. He heard the Tornado pilot reply, but could not understand all of the message, most likely because of terrain blanking; however, he heard enough to cause him concern that the Tornado was in a similar position. Unfortunately, it was only once the instructor had told the student to turn away that they saw the Tornado. One of the RAF members told the Board that since the last Airprox in this area, new RT procedures had been implemented so that pilots now call prior to entering the loop. It was this call that the Hawk pilot made, and although they only heard half of the Tornado pilot's reply, it was enough to alert them rather than continue into conflict. Some members commented that, on hearing the Tornados in the area and becoming concerned about their perception of his flight path, the Hawk pilot may have been better placed by easing out of low-level immediately rather than staying low and simply turning away. However, it was recognised that this was a finely balanced decision between maintaining in the valley and therefore focusing lookout ahead and pulling out from the valley and potentially into conflict with an aircraft that might be crossing the valley above the ridge-lines.

For their part, the Tornado crews were already in the Mach loop when they heard the Hawk pilot's call, but couldn't fully understand his intentions; they sensibly responded to the call by just broadcasting their own position and intentions. Unfortunately none of them saw the Hawk as it flew past in the opposite direction; their perception was that the Hawk was following behind them from the North.

The RAF member pointed out that the encounter could have occurred in any valley in the low-level system but, because it was the Mach Loop, the one-way system and the need to make positional calls had prevented this incident from being more serious. The Board agreed that it was the nature of low-flying in hilly terrain that unseen conflicts could occur, and that was presumably part of the risk calculation that DHs made. The Board questioned why CADS had not highlighted the confliction to the crews in the planning phase prior to them getting airborne, but were informed that because both crews were slightly off their planned time-line, (i.e. one was early and one slightly late) CADS would not have shown a conflict. Members commented that it had been unfortunate that these changes to the Hawk and Tornado timings had negated CADS, which was designed to provide some mitigation for low-level operations; however, it was recognised that CADS could only provide generic situational awareness and was subject to the vagaries of actual flight routing and timing.

In assessing the cause of the Airprox, the Board had a short debate as to whether this was a late sighting or a conflict in the low-flying system. In the end, it was agreed that neither pilot could have seen the other aircraft before they did, and so the latter view prevailed. However, because of the nature of the avoiding action taken by the Hawk crew, the risk was assessed as Category B, safety margins had been much reduced below the norm.

### **PART C: ASSESSMENT OF CAUSE AND RISK**

Cause: A conflict in the Low-Flying System.

Degree of Risk: B.

#### **Safety Barrier Assessment<sup>4</sup>**

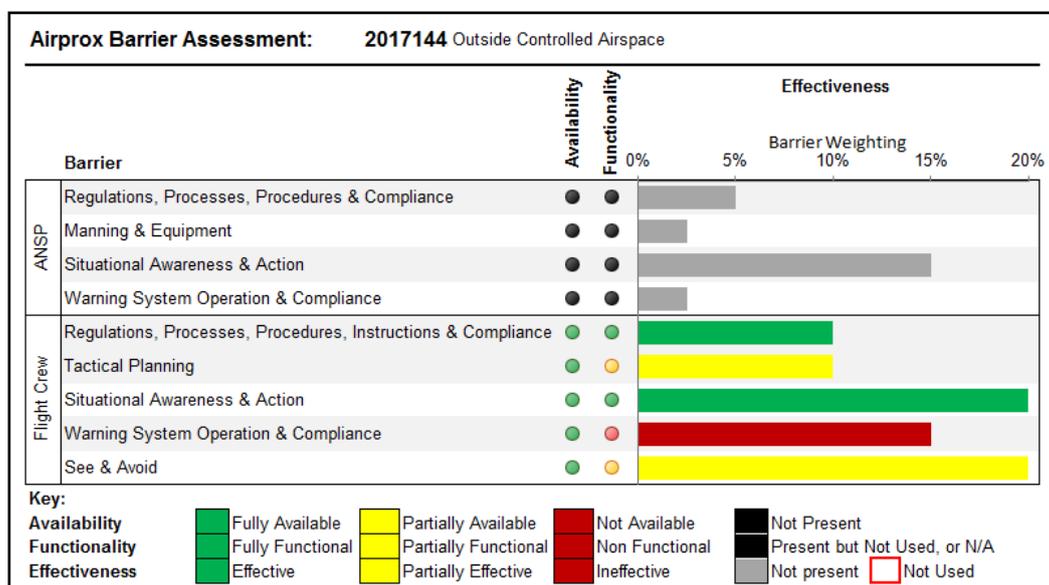
In assessing the effectiveness of the safety barriers associated with this incident, the Board concluded that the key factors had been that:

#### **Flight Crew**

**Tactical Planning** was assessed as **partially effective** because the Hawks had arrived at the LL entry point early, and the Tornados were late, thereby negating the value of CADS.

**Warning System Operation and Compliance** was assessed as **ineffective** because neither TCAS had alerted due to terrain masking.

**See and Avoid** was assessed as **partially effective** because although the Hawk pilot had taken avoiding action, it was later than ideal due to the fact that the Tornado was not seen until they were in proximity.



<sup>4</sup> The UK Airprox Board scheme for assessing the Availability, Functionality and Effectiveness of safety barriers can be found on the [UKAB Website](#).