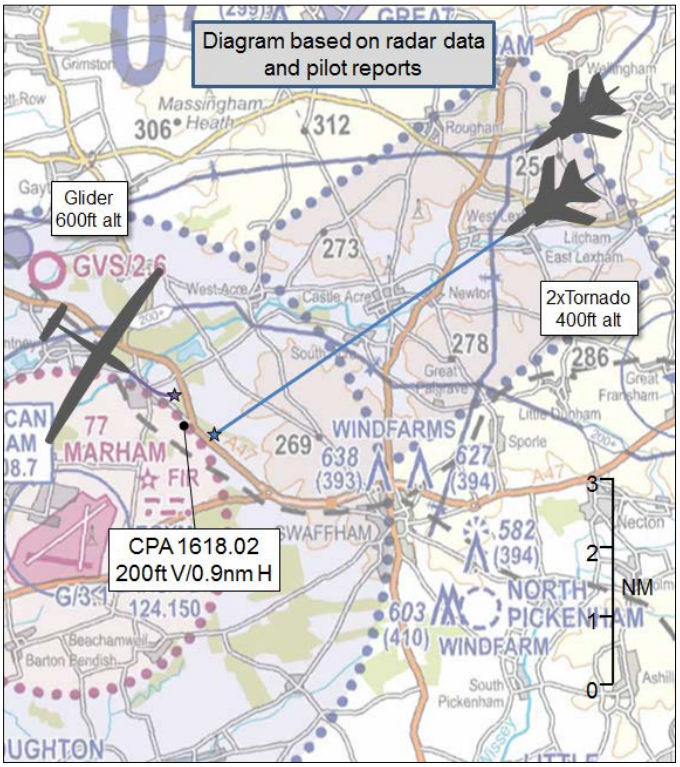
AIRPROX REPORT No 2016186

Date: 23 Aug 2016 Time: 1615Z Position: 5240N 00036E Location: 2.5nm NE Marham

PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

Recorded	Aircraft 1	Aircraft 2
Aircraft	Tornado	Ventus glider
Operator	HQ Air (Ops)	Civ Club
Airspace	Marham MATZ	Marham MATZ
Class	G	G
Rules	VFR	VFR
Service	Traffic	None
Provider	Marham	
Altitude/FL	400ft	600ft
Transponder	A, C, S	A, C
Reported		
Colours	Grey	White, Blue
Lighting	NK	Nil
Conditions	VMC	VMC
Visibility	>40km	>20km
Altitude/FL	500ft	300ft
Altimeter	QFE	NK
Heading	240°	NK
Speed	420kt	60kt
ACAS/TAS	TCAS II	FLARM
Alert	Unknown	None
Separation		
Reported	200ft V/<1nm H	NK V/2nm H
Recorded	200ft V/0.9nm H	



THE MARHAM APPROACH CONTROLLER reports that at around 1605 he was informed that there were a number of gliders crossing through the Marham MATZ from NW to SE passing between 2-3nm NE, through the approach lane to RW24. He had a pair of Tornados and a Jetstream on frequency waiting to recover and had advised them to hold until the intentions of the gliders were known. Attempts were made to contact the gliders on the VHF Marham Zone frequency. The controllers in the VCR could see about 6 gliders that appeared to be from low-level to around 2000ft, and all appeared to be within the ATZ. At around 1615, the lead pilot in the Tornado formation told him that they would have to make an approach, or divert because they were approaching fuel minima. Traffic Information was passed to the Tornados on all of the gliders that were showing on the radar and then they were transferred to the ADC at around 10nm. They received a joining clearance and were passed more Traffic Information on the gliders that were visible from the VCR; a low break into the circuit was requested, and approved. As they approached 7nm, one of the gliders began to squawk 7000, with Mode C indicating that it was at 600ft as it crossed the approach lane. The ADC called the traffic indicating 600ft and the pilot reported visual with the glider. The Tornados then broke into the circuit and landed. The App controller noted that the glider was tracking ESE to cross the extended centreline and, as the Tornados approached the initials point,[1] it turned onto a ENE heading, belly-up to them; at its closest point it indicated 0.5nm and 100ft away from the Tornados. In his opinion, by transiting through the Marham MATZ and (he believed) the ATZ without speaking to Marham ATC, the gliders had posed a risk to life and the safety of the all of the aircraft involved.

He perceived the severity of the incident as 'Medium'.

[1] The initial Point at military airfields is 1-2nm on the extended centreline, deadside.

THE TORNADO PILOT reports that he contacted Marham App to request a pairs instrument recovery and was informed about a large number of gliders in the vicinity of the airfield. The formation was advised to hold off until the activity reduced sufficiently to allow the instrument approach to commence. He assessed that they did not have enough fuel to hold off, so elected to recover visually, descending to a height below where the gliding activity was reported to have been taking place. At approximately 2nm from the runway threshold, at 500ft, the formation leader had a late TCAS contact indicating an aircraft approximately 200ft above the formation. A glider was subsequently observed above the formation and within 1nm laterally. The formation completed the visual circuit with no further incident.

He assessed the risk of collision as 'Medium'.

THE VENTUS PILOT reports that he did not consider the event to be an Airprox. Although he had a hazy recollection of the event, he was fairly certain he saw the Tornados on the run and break and definitely had them in sight whilst they conducted a left-hand circuit and approach to land on the south-westerly runway at Marham. At this time he had successfully started his engine and was heading in a NNE direction away from the runway centreline.

He assessed the risk of collision as 'None'.

THE MARHAM SUPERVISOR reports that during the build-up to the incident she was out of the ACR. As she entered, she was informed that there were gliders crossing the ATZ and MATZ who were not speaking to Marham ATC. The zone and Approach controllers were in place and an extra, fully-endorsed controller was listening out and helping with liaison and assisting as required. The controllers were working to capacity, so she went to retrieve a gliding NOTAM from the briefing folder to get the gliding frequency on it. She then instructed the Zone controller to transmit on 130x1 (the promulgated frequency) to ask the gliders to call on the Marham frequency. The Tornado formation were then transferred to the ADC so she went upstairs to the VCR. All of the controllers involved were shaken by the incident. Following the event, she called the telephone number on the NOTAM and spoke to one of the organisers from the gliding club. She explained the situation and was told that all pilots had been briefed before the event that if they were going to pass close to Marham they were to call on the Marham Zone frequency (which hadn't happened). They also discussed the fact that the NOTAM had led the Marham controllers to believe that the gliders would be operating within a 5nm radius of Tibenham; unfortunately, although the NOTAM mentioned a website to get further information, they were unable to gain access to that website through their Dii (military) network. The following day the competition organisers telephoned Marham ATC to inform them that the route taken that day would not affect them.

Factual Background

The weather at Marham was recorded as follows:

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METAR EGYM 231550Z 14011KT CAVOK 29/14 Q1020 BLU NOSIG=
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Portions of the tape transcripts between the Marham Zone controller and Voodoo 31 Flt are below:

To	From	Speech Transcription	Time
All Stations	Zone VHF	Aircraft in the vicinity of East Winch come up this frequency if you're on this frequency come up this frequency aircraft in the vicinity of East Winch please	16:11:30
Zone UHF	Voodoo	Zone Voodoo we're complete general handling now we're er gonna freecall stud 4	16:12:03
Voodoo	Zone UHF	Voodoo 31 Flt er roger, what type of recovery?	16:12:11
Zone UHF	Voodoo	Looking for an instrument recovery, vectors PAR as a pair and eh it'll be to low approach and join the visual	16:12:14
Voodoo	Zone UHF	Voodoo 31 Flt roger maintain this frequency have you Papa copied?	16:12:20

Voodoo	Zone UHF	Voodoo 31 Flt if you're are happy to own navigate with basically a left hand orbit we've got multiple gliders in the approach lane at this time with the Jetstream struggling to get in so we're just gonna hold you off for a little while	16:13:10
Zone UHF	Voodoo	That's copied we've got fuel for approximately ten minutes, and we're still descending Voodoo	16:13:28
Voodoo	Zone UHF	Voodoo 31 Flt affirm descend to height six thousand feet initially	16:13:36
Zone UHF	Voodoo	Copied six thousand Voodoo	16:13:39
Voodoo	Zone UHF	Voodoo 31 Flt vectoring PAR	16:14:22
Zone UHF	Voodoo	Zone, Voodoo what's the position of the gliders we're looking at perhaps changing to visual recovery	16:14:23
Voodoo	Zone UHF	Voodoo 31 Flt there's multiple gliders in the approach lane last reported between one thousand and one thousand five hundred feet erm, we can see lots on the radar screen and we can see them out from the tower but they're just constantly coming in northwest to southeast	16:14:28
Zone UHF	Voodoo	That's copied northwest to southeast through the approach lane, er we'll come back for a visual recovery then and fly at five hundred feet, we're getting a bit low on gas	16:14:41
Voodoo	Zone UHF	Voodoo 31 Flt that's all acknowledged, your er fuel priority is acknowledged we've got Jetstream currently north of us by two miles trying to get him in downwind if you could position behind?	16:14:54
Zone UHF	Voodoo	Er copied we'll just join through initials if your happy	16:15:07
Zone UHF	Voodoo	Voodoo 31 we're descending VMC one thousand feet erm	16:15:30
Zone UHF	Voodoo	and we'll be doing a visual recovery to initials	16:15:38
Voodoo	Zone UHF	Voodoo 31 Flt roger the Jetstream's is currently northwest of Marham by two miles tracking west at four thousand five hundred feet descending now to two thousand feet	16:15:41
Zone UHF	Voodoo	Er Voodoo copies	16:15:51
Voodoo	Zone UHF	Voodoo 31 Flt my radar can see a contact north northeast by two miles and one at three miles	16:16:09
Zone UHF	Voodoo	Voodoo	16:16:18
Zone UHF	Voodoo	Voodoo can take an early descent to one thousand feet now	16:16:35
Voodoo	Zone UHF	Voodoo 31 Flt roger taking your own terrain clearance descent approved	16:16:40
Voodoo	Zone UHF	Voodoo 31 Flt that previously reported contact on the zero three zero at eh two point eight miles	16:16:50
Zone UHF	Voodoo	Voodoo	16:16:56
Zone UHF	Voodoo	If there's no further traffic we'll continue with Tower	16:16:59
Voodoo	Zone UHF	Voodoo 31 Flt if you're happy continue with Tower there's no radar traffic to affect continue with them stud two	16:17:04
Zone UHF	Voodoo	Copied many thanks	16:17:09
Zone VHF	Glider	Marham {Glider c/s}	16:18:55
Glider	Zone VHF	{Glider c/s} Marham Zone	16:18:58
Zone VHF	Glider	Be advised I'm currently circling er three miles to the southeast of you visual with two fast jets in circuit to the south I'm at fourteen hundred feet drifting downwind towards you	16:19:00
Glider	Zone VHF	{Glider c/s} roger are you maintaining one thousand four hundred feet	16:19:13
Zone VHF	Glider	Say again	16:19:17
Glider	Zone VHF	{Glider c/s}, roger we have further traffic inbound if you could er maintain well clear	16:19:21
Zone VHF	Glider	We shall stay outside the ATZ I'm just informing you of where I am	16:19:27
Glider	Zone VHF	{Glider c/s} er many thanks for the call if you could er let the other gliders know	16:19:31

		if you've got them on your frequency that would be most useful	
Zone VHF	Glider	Erm Marham {Glider c/s} I'm unaware of any other gliders in the vicinity there were some but they've left gone towards *??*	16:19:45
Glider	Zone VHF	{Glider c/s} roger we've had multiple gliders going through our approach lane today I just wondered if they were on your frequency but no worries thanks	16:19:52
Zone VHF	Glider	We were advised to contact you if we we're gonna do that that's why I'm doing it	16:20:01
Glider	Zone VHF	Many thanks for your call	16:20:05

Portions of the tape transcripts between the Marham Tower controller and Voodoo 31 Flt are below:

To	From	Speech Transcription	Time
Approach	Twr	Tower	16:17:08
Twr	Approach	Approach, Voodoo are coming to you now	16:17:08
Approach	Twr	Right	16:17:09
Twr	Approach	I'm gonna turn East flight downwind behind them and once he's visual I'll descend him to circuit height and come to you downwind	16:17:10
Approach	Twr	OK	16:17:16
All callsigns	Twr	Any callsign any callsign this is Marham Tower	16:17:18
Voodoo 32	Voodoo 31	Voodoo	16:17:20
Voodoo 31	Voodoo 32	32	16:17:21
Twr	Voodoo	Marham Tower Voodoo join	16:17:23
Voodoo	Twr	Voodoo, Marham Tower join runway 24, QFE 1017, circuit clear	16:17:25
Twr	Voodoo	24, 1017, Voodoo, request low break	16:17:33
Voodoo	Twr	The low break is approved be advised there are a number of gliders circling around er the er approach lane	16:17:37
Sup	Twr	Tower	16:17:47
Twr	Sup	Have you, can you see the two gliders circling mate	16:17:48
Voodoo	Twr	Voodoo 31 Flt that traffic is er right one o'clock half a mile crossing right to left indicating 500ft SSR	16:17:50
Twr	Sup	Can you see em mate?	16:17:58
Sup	Twr	Yep mate I'll??	16:18:00
Twr	Voodoo	We're visual we're through initials now	16:18:01
Voodoo	Twr	Roger	16:18:04
Twr	Voodoo	We're visual with a couple of gliders to the south as well	16:18:05
Voodoo	Twr	Roger	16:18:07
Voodoo	Twr	Voodoo with those gliders in sight are you able to make an approach?	16:18:12
Twr	Voodoo	I believe so	16:18:16
Voodoo	Twr	Roger	16:18:17
Twr	Voodoo	And Voodoo two aircraft on the break land	16:18:23
Voodoo	Twr	Voodoo 31 Flt roger, surface wind 150/14 max crosswind 16 from the left	16:18:26
Twr	Voodoo 31	Voodoo 31 finals gear down	16:19:31
Voodoo 31	Twr	Voodoo 31 cleared to land	16:19:32

A copy of the glider NOTAM is reproduced below:

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Group: M_MARHAM / User: M_MARHAM_FPL 17293        UTC Time: 2016.06.22-14:32:00

MRM FLT PLG / 2016-06-22-86 / 22 Jun 2016 14:31:09

AFP5739 221431
GG EGXYZGZX EGYDYWYF EGYDZXAO EGYEZXAO EGYMYWYF EGYMZGZX EGYMZXCO
EGYMZXDF EGYPZGZX LXGBZGZX
221430 EUECYIYN
(H3373/16 NOTAMN
Q) EGTT/QWGLW/IV/M  /W /000/050/5227N00109E005
A) EGTT B) 1608200800 C) 1608281900
D) 0800-1900
E) GLIDING. MAJOR GLIDING COMPETITION. INTENSE ACT WI 5NM RADIUS
522724N 0010915E (TIBENHAM AD, NORFOLK). UP TO 100 GLIDERS AND 10 TUG
ACFT MAY PARTICIPATE. FOR DAILY ROUTE INFO:
WWW.BGALADDER.CO.UK/SHOWTASK.ASP OR 01379 677207 AND 130.1 MHZ.
16-08-0017/AS4
F) SFC G) 5000FT AMSL)
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At Figure 1 is map showing the position of Tibenham.

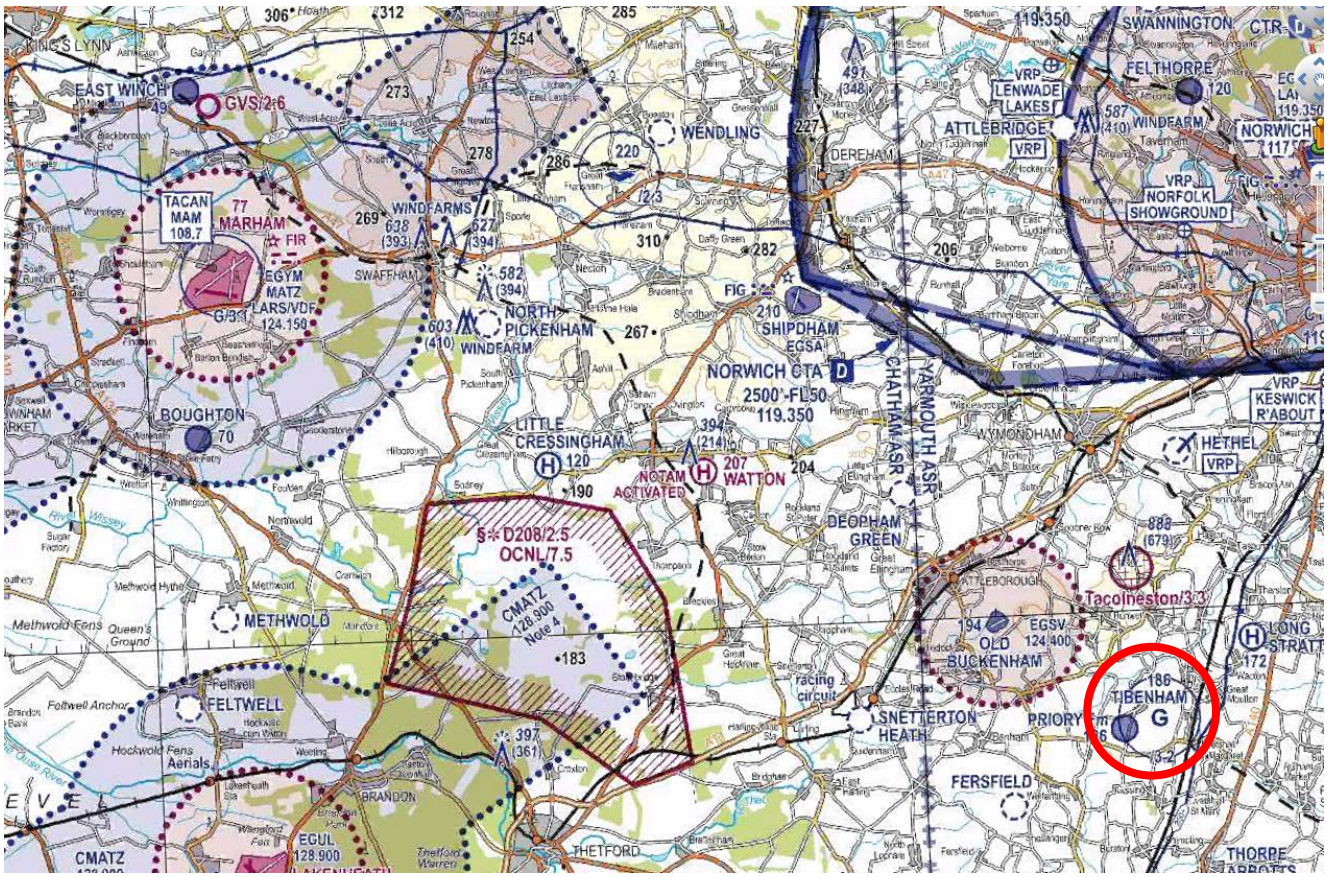


Figure 1

At Figure 2 is a copy of SeeYou provided by the BGA showing the position of the gliders in the competition at 1615.

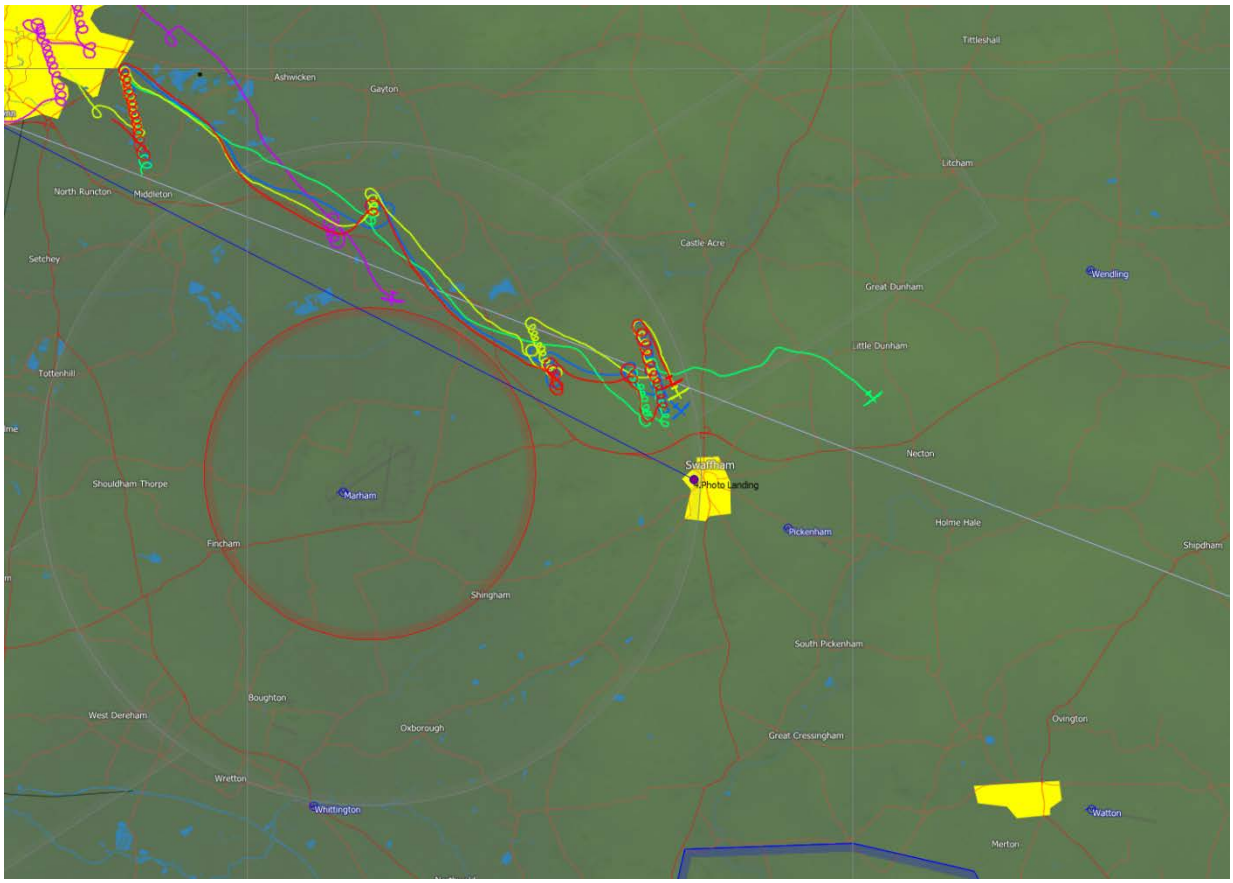


Figure 2

Analysis and Investigation

Military ATM

At 16:16:09 (Figure 3), the Marham Approach controller passed Traffic Information to Voodoo 31 Flt on a contact north-northeast of Marham 2nm and another at 3nm.

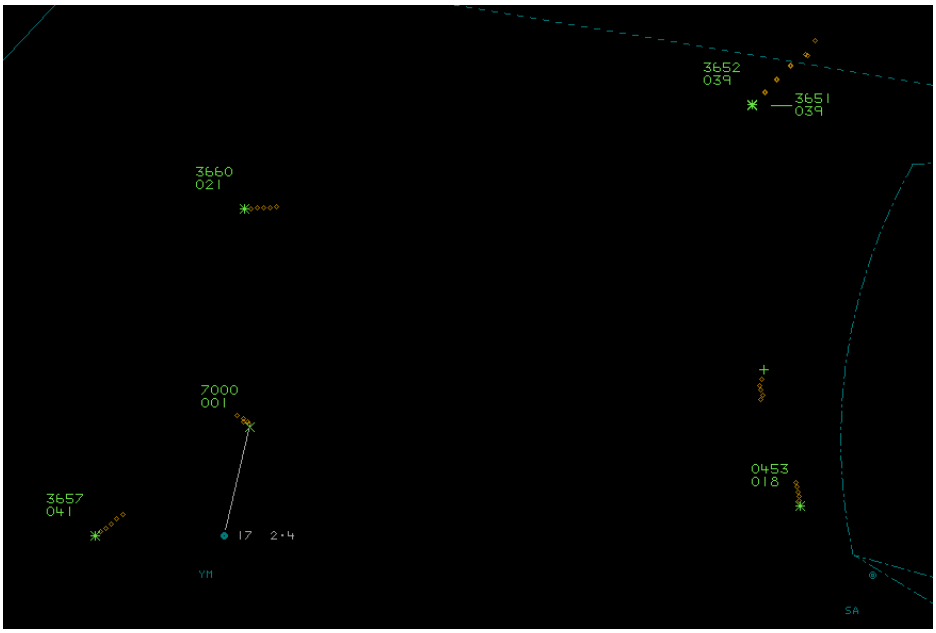


Figure 3: Geometry at 16:16:09 (Voodoo 31 Flt SSR 3651/2; unknown ac SSR 7000)

At 16:16:50, the Marham Approach controller passed traffic information to Voodoo 31 Flt on traffic on the MRM 030 radial at 2.8nm.

At 16:17:04 (Figure 4), the Marham Approach controller advised Voodoo 31 Flt that there was no traffic on radar to affect and instructed them to continue with Marham Tower.

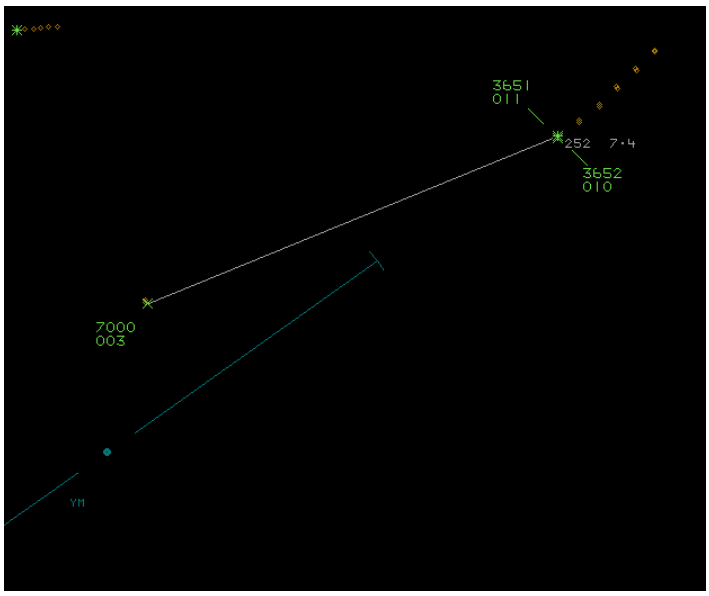


Figure 4: Geometry at 16:17:04 (Voodoo 31Flt SSR 3651/2; unknown ac SSR 7000)

At 16:17:50 (Figure 5), the Marham Tower controller passed Traffic Information to Voodoo 31 Flt on traffic in their right 1 o'clock, half a mile, crossing right to left, indicating 500ft.

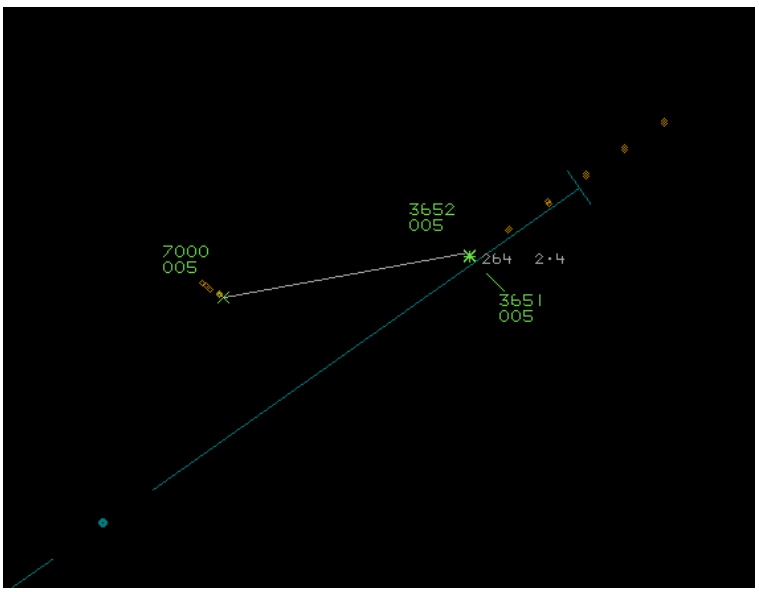


Figure 5: Geometry at 16:17:50 (Voodoo 31 Flt SSR 3651/2; unknown ac SSR 7000)

At 16:18:02 (Figure 6), Voodoo 31 Flt passed the unknown aircraft with 0.9nm lateral separation, the closest point of approach.

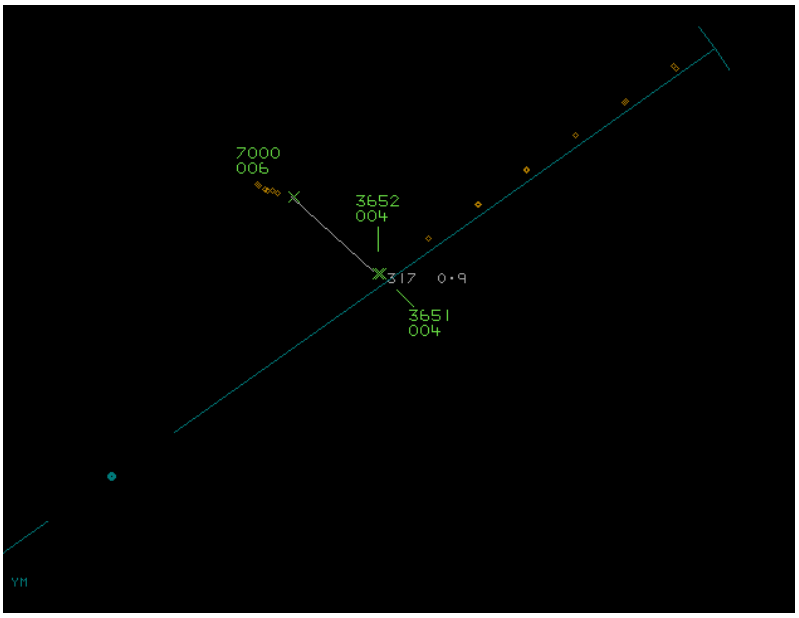


Figure 6: Geometry at 16:18:02 (Voodoo 31 Flt SSR 3651/2; unknown aircraft SSR 7000)

At 16:18:55 (Figure 7), a glider pilot called the Marham Zone frequency and proceeded to describe his position as 3nm South East, 1400ft and visual with two fast-jets in the circuit. The pilot added that he intended to remain outside of the ATZ. This position report did not correlate with the previous traffic SSR 7000.

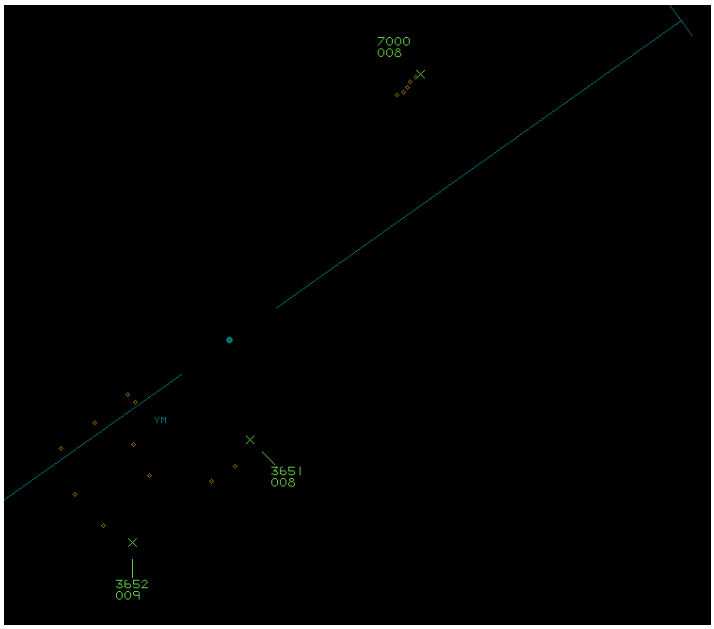


Figure 7: Geometry at 16:18:55 (Voodoo 31 Flt SSR 3651/2; unknown aircraft SSR 7000; glider 63C not visible)

The Marham Zone controller received a call from Voodoo 31 Flt advising that they were complete general handling and ready for instrument recovery for training. The controller requested that they remain on Zone rather than changing to Approach, who was working hard to vector an inbound Jetstream around gliders. Voodoo 31 Flt were asked to hold due to multiple gliders in the approach lane between 1000ft and 1500ft agl but, due to fuel constraints, elected to descend to low-level and attempt to recover visually beneath the gliders. The Marham Zone controller passed Traffic Information on the recovering Jetstream and multiple unknown contacts. When Voodoo 31 Flt were transferred to Marham Tower, there was an aircraft in their 1 o'clock, 7.4nm,

slowly crossing the approach lane right to left. While the Tornados were downwind and final, a glider pilot called on Zone VHF and gave a position report to the south east, 3nm, 1400ft and visual with the recovering traffic. Marham Zone attempted to contact all of the gliders, with a request that they remain to the north of the extended centreline with fast jets recovering.

The Marham Tower controller advised Voodoo 31 Flt on join that there were a number of gliders circling around the approach lane. As the Tornados approached the airfield, Traffic Information was passed on a glider seen from the VCR and correlated on radar squawking 7000, which appeared to be crossing the approach lane. Voodoo 31 Flt called visual with the glider and proceeded through initials, where they also became visual with another two gliders operating to the south.

There was a period of over 30 minutes, during which controllers and assistants in the ACR and VCR attempting to identify, visually acquire and/or communicate with multiple gliders believed to be operating within the Marham MATZ and ATZ. The CAA guide to VFR in the UK states that, 'an aircraft shall not fly, take-off or land within the ATZ of an aerodrome unless the commander of that aircraft has obtained permission of the air traffic control unit at the aerodrome'. Although the recognition of a MATZ by civil pilots is not mandatory, it is encouraged.

Initially, none of the Marham controllers made the connection between the volume of glider traffic in the vicinity and a NOTAM of a gliding competition at Tibenham airfield, approximately 30nm SE. Although the NOTAM had been displayed in the briefing area, it stated that there would be intense gliding activity within 5nm of Tibenham, from surface to 5000ft agl and therefore had been plotted to depict these details. The NOTAM also provided a website address on which daily routes would be published, along with a contact phone number for the organiser and a frequency to contact participating gliders. All of the ATC personnel, as well as the Tornado crews, assumed that the gliding activity would not affect RAF Marham and did not check the website. The website was later found to be inaccessible using DII (military network). The competition director had not contacted the nominated ATC unit (Norwich) to discuss the daily activity that might affect the local area, a requirement of the ACN.

An OSI was convened at RAF Marham on 30 Aug 16 to investigate the incident. After thorough investigation, involving interviews with all military personnel involved and access to transcripts, radar replays, aircraft tapes and all relevant publications, the team concluded that the Airprox was caused by Voodoo 31 Flt being unable to take avoiding action on the glider due to late visual acquisition.

The OSI identified 7 Causal factors and made 10 recommendations to reduce the likelihood of recurrence. Recommendations included review of the process used to ensure all NOTAM information is promulgated and assimilated, brief of ATC personnel to ensure that both the Supervisor and Duty Commander Flying are notified swiftly in any scenario where safety may be compromised, increased efforts to secure BGA attendance at EAAUWG meetings and the introduction of FLARM to Marham ATC.

UKAB Secretariat

The Tornado and Ventus 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]. The incident geometry was converging so the Tornado pilot was required to give way to the glider[3].

[2] SERA.3205 Proximity.
[3] SERA.3210 Right-of-way (c)(2) Converging.

Comments

HQ Air Command

The recognised barriers to MAC in the Class G airspace environment are: provision of an appropriate Air Traffic Service; electronic conspicuity (on-board traffic alerting systems), and; see-and-avoid. Whilst the Tornados were in receipt of a Traffic Service (appropriate for the prevailing weather conditions), the ability of the controllers to pass timely and accurate Traffic Information was hampered by the low radar cross-section of the gliders and the absence of on-board transponding equipment that could interact with the radar equipment at RAF Marham. Additionally, this lack of interoperable transponder equipment on the majority of gliders also removes the ability of systems such as TCAS (as fitted to the Tornado aircraft) to warn the Tornado crew of a glider's presence. It is commendable that at least one of the gliders carried and operated its transponder whilst in the vicinity of RAF Marham, but there were many other gliders involved in the competition that either were not similarly equipped or chose not to turn the equipment on. This leads to the only remaining barrier being see-and-avoid, which is also notoriously difficult to achieve as gliders are widely acknowledged to be difficult to detect visually.

This incident led to a far-reaching investigation on the Tornado unit concerned and a number of recommendations have been made. Many of these recommendations address issues surrounding the promulgation and management of the information provided by the competition organisers, such as NOTAM information and the Airspace Coordination Notice, whilst others concern the highlighting of incidents such as these to other airspace users such that the lessons are promulgated as widely as possible. Certainly the controllers involved were working very hard at maintaining separation of the fast-jet traffic from the gliders, and it is no doubt down to the additional awareness provided by the TCAS interacting with the glider's transponder that the Tornado crew were able to visually acquire the other aircraft, albeit too late to materially affect CPA.

BGA

There was a failure in the competition organization that resulted in neither Marham nor Norwich being informed of the task for that day. It's disappointing that Marham ATC were not able to access the web site specifically set up to help controllers in this situation. It's good to see that they will in future have access to FLARM information.

As a result of this incident, the BGA will modify the guidance to Competition Organisers to make specific reference to advising Military airfields of competition tasks passing through their vicinity, using contact details provided by the RAF Safety Cell. We will continue to emphasize the safety benefits of calling ATS when transiting close to busy airfields.

Summary

An Airprox was reported when a Tornado and a Ventus glider flew into proximity at 1615 on Tuesday 23rd August 2016. Both pilots were operating under VFR in VMC, the Tornado pilot in receipt of a Traffic Service from Marham; the Ventus pilot was not in receipt of an ATS.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

Information available consisted of reports from the pilots of both aircraft, transcripts of the relevant RT frequencies, radar photographs/video recordings, reports from the air traffic controllers involved and reports from the appropriate ATC and operating authorities.

The Board first discussed the actions of the glider competition planners. The gliding member noted that they had set a route only half a mile from the Marham ATZ on a difficult gliding day, and had forgotten to tell Norwich ATC (the notified ATC agency on the ACN) or thought to tell Marham. He noted that new BGA advice had now been issued which should address these problems in the future.

This advice asked, amongst others things, that organiser didn't set tasks routing through a MATZ without speaking to the controlling authority, and, noting the difficulty the Marham controllers had getting onto the BGA website on the day, generally advised better communication with Military controllers prior to the event. The Board were heartened to hear that this action had been taken by the BGA but also noted that the competition NOTAM information was misleading and members could understand why Marham had thought the competition would not affect them. A discussion followed on what could and could not be put in a NOTAM, which often had to be issued well before the competition routes of the day were agreed upon. Board Members thought that a change in the wording would have encouraged 'curious' readers to investigate further. For example, simply using the phrase 'cross-country', and stating that the competition started at Tibenham and could route all over East Anglia may have made it clearer that it wasn't remaining in the 5nm area around Tibenham. Finally, although the glider pilots had reportedly been briefed to call on the Marham frequency if transiting close to the MATZ, in fact only one pilot did; this led some members to wonder how well this requirement had been emphasised during their task briefing. Overall, the Board concluded that whilst the glider pilots were entitled to route where they did (outside the Marham ATZ), as a whole they had demonstrated something of a lack of airmanship in the execution of their task which had been exacerbated by the competition organisers not doing their part to notify local airfields of the activity.

In looking at the actions of the particular glider pilot involved in the Airprox, the Board noted that he had turned on his transponder just in time to alert ATC to his exact position and allow the Tornado's TCAS to issue a proximity warning. Noting that he also probably had a high cockpit workload at this time (switching on his engine and turning to the NE to avoid the ATZ), the Board thought that he had probably seen the Tornados after they had passed him and were established on their break into the visual circuit; hence his differing perspective of the severity of the incident.

Turning to the actions of the Tornados, members noted that they had been asked to hold off by ATC but had subsequently stated that they were short of fuel. Some members with military experience wondered whether the crew had left themselves with too few options when they eventually decided to make an approach to land. Accepting that military fast-jet crews would normally join the visual circuit via initials or straight-in to land, members offered that the crew could have given themselves more options by joining down-wind or through the overhead to avoid the gliders in the approach lane. As it was, whether through lack of fuel or otherwise, they gave themselves little option but to join through initials and hope that, by flying lower than the reported height of the gliders, they would go beneath them. Ultimately, even within the MATZ, the gliders were in Class G airspace, and it was for the Tornados to give way to them in a converging situation.

Finally, the Board looked at the actions of the Marham controllers. Noting that it was a controller that reported the Airprox, the Board could understand that the situation was a worrying one for the controllers on the day. The controllers in the VCR could see the gliders visually, but the radar controllers could not see them on the radar. The controllers went to great effort to try and contact the gliders on the published Marham VHF frequency; however, the glider pilots were not listening on it and so their intentions were unknown. The Board could understand why the controllers had not assimilated that the gliders corresponded to those on the competition NOTAM but, even if they had realised this, without speaking to the glider pilots themselves the controllers could not know the exact heights of the traffic flowing through the approach lane. The Board noted that the Marham OSI had recommended that Marham installs a FLARM receiver for use by its operators but military members were quick to note that this had not yet been approved; FLARM use is still on trial in other military ATC towers and a decision has yet to be made about its viability. In supporting the case for its installation, the Board recognised that it could not be used for controlling purposes but noted that had FLARM been installed, ATC would have at least had some general indications about the height and tracks of the gliders.

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

- **Airspace Design and Procedures** had been an **ineffective** barrier because the glider competition planners had not taken into consideration the effect the competition routing would have on other airspace users.

- **Ground-based Safety Nets** was assessed as **absent** because RAF Marham did not have a FLARM receiver, which would have offered at least some generic information to the controllers.

- **Flight Crew Pre-Flight Planning** was assessed as **partially effective** because the Tornado pilots (and the Marham controllers), had not realised that the competition NOTAM would affect them.

- **Flight Crew Situational Awareness** was assessed as **partially effective** because the glider pilots had no information about the Tornados, and the Tornado pilot only had generic information about the gliders from ATC.

- **Onboard Warning/Collision Avoidance Equipment** was assessed as **partially effective** because although the two aircraft had incompatible systems, it was only once the glider's transponder was switched on that the TCAS warned the Tornado pilots of the glider's proximity.

- **See-and-Avoid** was considered **partially effective** because the Board considered that the glider pilot had probably only seen the Tornados just before or after CPA.

In determining the cause of the Airprox, members quickly agreed that this had been a late sighting by the Tornado crew and a probable non-sighting by the Ventus pilot. However, the Board thought there were also a number of contributory factors: first, the glider pilots had not called on Marham Zone frequency as briefed by competition organisers; second, the glider competition organisers had not notified local ATSUs; and third, the competition NOTAM had not sufficiently described the extent of the glider activity. This led the Board to resolve to recommend that the BGA provides guidance on NOTAM content sufficient to describe the extent of planned activity. Finally, in assessing the risk, the Board noted that radar separation indicated 0.9nm and that the Tornado pilot had assessed the risk only as medium. As a result, they therefore decided the risk to be Category C, safety had been degraded, but there was no risk of collision.

PART C: ASSESSMENT OF CAUSE AND RISK

Cause: A late sighting by the Tornado crew and a probable non-sighting by the Ventus pilot.

Contributory Factors: 1. The glider pilot did not call Marham Zone as briefed.

2. The glider competition organisers did not notify local ATSUs.

3. The glider NOTAM did not sufficiently describe the extent of the activity.

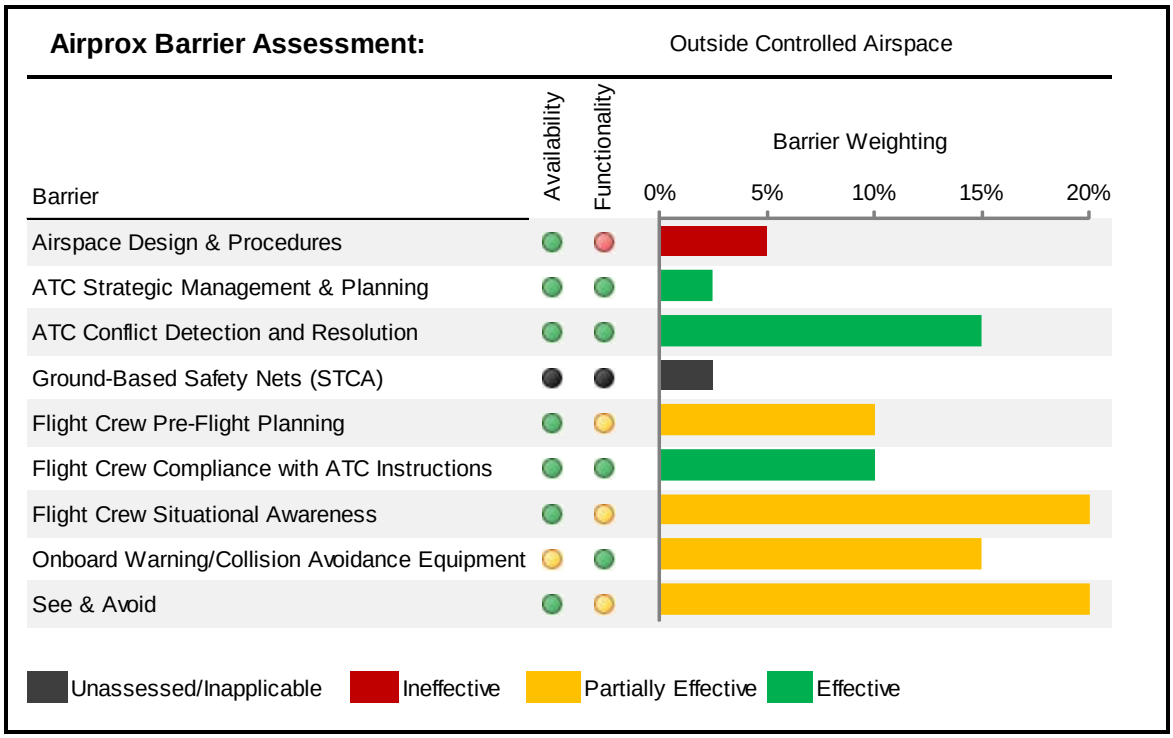
Degree of Risk: C.

Recommendation: The BGA provides guidance on NOTAM content sufficient to describe the extent of planned activity.

Barrier assessment:

Modern safety management processes employ the concept of safety barriers that prevent contributory factors or human errors from developing into accidents. Based on work by EASA, CAA, MAA and UKAB, the following table depicts the barriers associated with preventing mid-air-collisions. The length of each bar represents the barrier's weighting or importance (out of a total of 100%) for the

type of airspace in which the Airprox occurred (i.e. Controlled Airspace or Uncontrolled Airspace).[4] The colour of each bar represents the Board's assessment of the effectiveness of the associated barrier in this incident (either Fully Effective, Partially Effective, Ineffective, or Unassessed/Inapplicable). The chart thus illustrates which barriers were effective and how important they were in contributing to collision avoidance in this incident.



Barrier Effectiveness		Consequence		
		Non-functional	Partially Functional	Functional
Availability		**1**	**2**	**3**
Completely Unavailable	**1**	1	2	3
Partially Available	**2**	2	4	6
Available	**3**	3	6	9

Key:

Effective

Partially Effective (If the system was partially available but fully functional score availability as 2.5)

Ineffective

Unassessed/Inapplicable

[4] Barrier weighting is subjective and is based on the judgement of a subject matter expert panel of aviators and air traffic controllers who conducted a workshop for the UKAB and CAA on barrier weighting in each designation of airspace.

Barrier	Availability			Functionality			Unassessable / Absent
	Fully (3)	Partially (2)	Not Available (1)	Fully (3)	Partially (2)	Non Functional (1)	
Airspace Design and Procedures	Appropriate airspace design and/or procedures were available	Airspace design and/or procedures were lacking in some respects	Airspace design and/or procedures were not appropriate	Airspace design and procedures functioned as intended	Airspace design and/or procedures did not function as intended in some respects	Airspace design and/or procedures did not function as intended	The Board either did not have sufficient information to assess the barrier or the barrier did not apply; e.g. TCAS not fitted to either aircraft or ATC Service not utilised. Note: The Board may comment on the benefits of this barrier if it had been available
ATC Strategic Management and Planning	ATM were able to man and forward plan to fully anticipate the specific scenario	ATM were only able to man or forward plan on a generic basis	ATM were not realistically able to man for or anticipate the scenario	ATM planning and manning functioned as intended	ATM planning and manning resulted in a reduction in overall capacity (e.g. bandboxed sectors during peak times)	ATM planning and manning were not effective	
ATC Conflict Detection and Resolution	ATS had fully serviceable equipment to provide full capability	ATS had a reduction in serviceable equipment that resulted in a minor loss of capability	ATS had a reduction in serviceable equipment that resulted in a major loss of capability	The controller recognised and dealt with the confliction in a timely and effective manner	The controller recognised the conflict but only partially resolved the situation	The controller was not aware of the conflict or his actions did not resolve the situation	
Ground-Based Safety Nets (STCA)	Appropriate electronic warning systems were available	Electronic warning systems is not optimally configured (e.g. too few/many alerts)	No electronic warning systems were available	Electronic warning systems functioned as intended, including outside alerting parameters, and actions were appropriate	Electronic warning systems functioned as intended but actions were not optimal	Electronic warning systems did not function as intended or information was not acted upon	
Flight Crew Pre-Flight Planning	Appropriate pre-flight operational management and planning facilities were deemed available	Limited or rudimentary pre-flight operational management and planning facilities were deemed available	Pre-flight operational management and planning facilities were not deemed available	Pre-flight preparation and planning were deemed comprehensive and appropriate	Pre-flight preparation and/or planning were deemed lacking in some respects	Pre-flight preparation and/or planning were deemed either absent or inadequate	
Flight Crew Compliance with Instructions	Specific instructions and/or procedures pertinent to the scenario were fully available	Instructions and/or procedures pertinent to the scenario were only partially available or were generic only	Instructions and/or procedures pertinent to the scenario were not available	Flight crew complied fully with ATC instructions and procedures in a timely and effective manner	Flight crew complied later than desirable or partially with ATC instructions and/or procedures	Flight crew did not comply with ATC instructions and/or procedures	
Flight Crew Situational Awareness	Specific situational awareness from either external or onboard systems was available	Only generic situational awareness was available to the Flight Crew	No systems were present to provide the Flight Crew with situational awareness relevant to the scenario	Flight Crew had appropriate awareness of specific aircraft and/or airspace in their vicinity	Flight Crew had awareness of general aircraft and/or airspace in their vicinity	Flight Crew were unaware of aircraft and/or airspace in their vicinity	
Onboard Warning/Collision Avoidance Equipment	Both aircraft were equipped with ACAS/TAS systems that were selected and serviceable	One aircraft was equipped with ACAS/TAS that was selected and serviceable and able to detect the other aircraft	One aircraft was equipped with ACAS/TAS that was selected and serviceable but unable to detect the other aircraft (e.g. other aircraft not transponding)	Equipment functioned correctly and at least one Flight Crew acted appropriately in a timely and effective manner	ACAS/TAS alerted late/ambiguously or Flight Crew delayed acting until closer than desirable	ACAS/TAS did not alert as expected, or Flight Crew did not act appropriately or at all	
See and Avoid	Both pilots were able to see the other aircraft (e.g. both clear of cloud)	One pilots visibility was uninhibited, one pilots visibility was impaired (e.g. one in cloud one clear of cloud)	Both aircraft were unable to see the other aircraft (e.g. both in cloud)	At least one pilot takes timely action/inaction	Both pilots or one pilot sees the other late and one or both are only able to take emergency avoiding action	Neither pilot sees each other in time to take action that materially affects the outcome (i.e. the non-sighting scenario)	