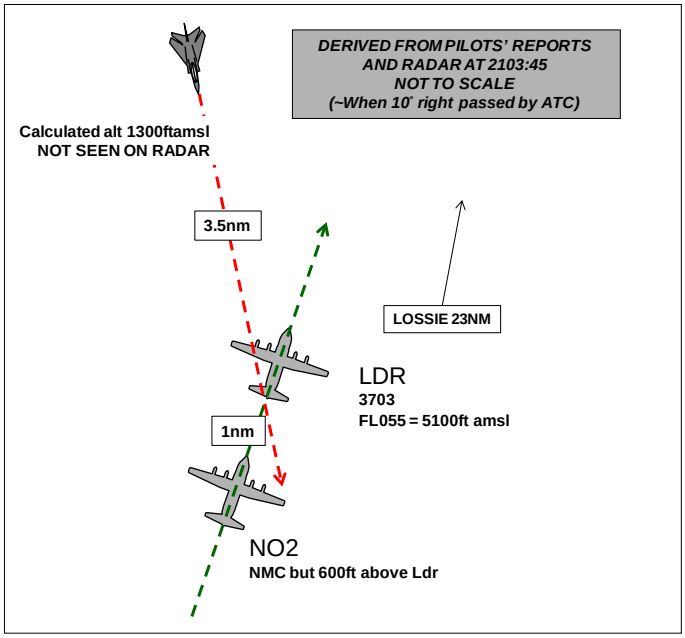
AIRPROX REPORT No 2012057

Date/Time:	24 Apr 2012 2103Z (Night)	
Position:	5731N 00349W (23nm SW Lossiemouth)	
Airspace:	Scot FIR	(*Class: G*)
	Reporting Ac	*Reporting Ac*
Type:	MC130P	Tornado GR4
Operator:	Foreign Mil	HQ Air (Ops)
Alt/FL:	5800ft↓ SPS (29.92in)	>2680ft↑ RPS (994hPa)
Weather:	IMC BL	VMC CLBC
Visibility:	1nm	8km
Reported Separation:	25ft V/70m H	NK
Recorded Separation:	NK	



BOTH PILOTS FILED

PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

THE MC130P PILOT reports flying as No2 of a flight of 2, on a night formation, exercise support mission; TCAS was fitted but was set to TA only in accordance with their (formation) SOPs. They were heading of 057° on an en-route descent at 230kt while in receipt of a TS from Lossie APP on VHF when they experienced an Airprox with a single Tornado, seen ¼nm away, displaying nav lights, and climbing through their level from L to R. The incident occurred while they were descending through 5600ft amsl to 4000ft amsl, in 1nm radar trail and 600ft above their leader while on a vector from Lossie APP for a visual low-approach at Lossiemouth to depart at low level.

They were given TI by Lossie on a Tornado and when reporting visual, Lossie gave them a heading of "10 degrees right" for traffic deconfliction. The Tornado passed from L to R from No2's 10 o'clock position to their 4 o'clock, about 25-50ft above and about 100-300ft away. No RA was given because of wing TA-only TCAS configuration.

Both the Tornado and their formation were under TS from Lossie and were in IMC.

They [No2] pushed forward on the flight controls when the Tornado was first observed in their 10 o'clock position about ½-⅓nm away to increase the RoD and therefore, increase the separation between the two ac. An Airprox notification was passed to their leader, who in turn passed it to Lossie APP.

They assessed the risk as being high.

THE TORNADO GR4 NAVIGATOR reports departed Lossiemouth at 2057 on a training flight and were climbing to FL50 following a SID 05 West under a TS [see BM SM report] while squawking as directed with Mode C. When they were 15nm NW of the airfield, they informed ATC that they were coming left onto S and requested a descent to 3000ft on the Lossiemouth QFE of 999. They were in a high workload situation while engaging and monitoring the TFR heading 177° at 378kt, (they were not using NVGs at the time).

They were aware of a C130 C/S XXX to the west on recovery, via a Radar-to-Visual approach. Upon coasting in at the 'Nairn Gap', they reported that they were good VMC and going en-route and at that time ATC informed them of the 2xC130s on recovery in their right one o'clock, 15nm going right to left and descending to 4000ft. They then heard ATC report their position to the C130s as being "North, 10nm crossing left to right". Believing that there was sufficient vertical separation between ac, their current heading would put them behind the recovering ac and the fact the C130s were under a radar service, they went en-route, set the RPS of 994hPa, levelling at 3000ft and transferred to the low-level common frequency.

They were VMC, in sight of the surface but were not visual with the C130s due to a thin layer of cloud at about 4000ft.

After completing the TFR checks, they proceeded to engage the TFR system from the leg MEA of 3000ft. They descended to a BARO alt of 2680ft at 2103:45 (verified by RAIDS) at position N5726 W00346 when the system reacted to what was assumed to be weather returns and started to climb the ac. The ac went almost immediately through the leg MEA of 3000ft and the climb was continued to 5740ft BARO alt at 2104:10 (verified by RAIDS) at position N5723 W00345 while the crew assessed what had happened before then descending back to 4600ft for the next leg's MEA.

The whole event had happened very quickly and they were good VMC again above the thin layer of cloud, 30nm SW of Lossiemouth heading S and they elected to continue the sortie rather than return to the Lossiemouth ATC frequency.

They were unaware of any Airprox incident until they were informed by the Duty Authoriser upon their return to the Ops desk after landing at 2200z.

They took no other avoiding action as they were unaware of the incident at the time and assessed the risk as being low.

Having analysed the incident post flight with hindsight, applying sound airmanship would have lead to the pilot changing three things to try and avoid a similar situation in the future:

1. If near an airfield with recovering traffic then it would be worth staying with ATC until it is absolutely certain that the traffic is well out of the way before going en-route.

2. Try to avoid routing at 3000ft through the extended centreline, albeit over 20nm out on the extended centreline, when on RW05 with ac potentially undertaking GCA recoveries.

3. If there is traffic close to or above the route, ideally wait until it is well away from track and heading away before engaging TFR that has the potential to pull up into their track.

BM SAFETY MANAGEMENT reports that this Airprox occurred at night, between a MC130P (C130), operating IFR in receipt of a TS from Lossiemouth APP, and a Tornado operating VFR; the Tornado went en-route from APP's freq at 2102:39, just before the CPA.

All heights/altitudes quoted are based upon SSR Mode C from the radar replay unless otherwise stated. The Airprox was not captured on the radar replay, the Tornado having descended below recorded radar coverage at 2102:22 and re-appearing shortly after the CPA at 2104:24.

The Tornado crew reported that they were VMC with 8kms visibility with a thin layer of BKN cloud at 4000ft and the C130 (2) crew reported IMC with 1nm visibility between layers of cloud.

The C130 was operating as the trail ac of a pair inbound to RAF Lossiemouth for a self-positioned visual approach. The Tornado had departed RAF Lossiemouth, in receipt of a TS from APP and was positioning to enter the UKLFS in the vicinity of the 'Nairn Gap'. The incident sequence commenced at 2100:56 as the Tornado turned onto SSE'ly track at FL50, not yet having commenced an

instructed descent to 3000ft QFE 999hPa; the C130 [No2] was 33.4nm SSW of the Tornado, tracking NE'ly and descending through FL81.

At 2102:17, the Tornado reported to APP that they were, "*victor mike below and going on route*"; this was acknowledged by APP and they then passed TI to the Tornado on the C130 flight stating, "*traffic right, one o'clock, one-five miles, crossing right left, two Charlie one thirties, descending to height four thousand feet*." The Tornado had just coasted in, indicating descent through 3500ft; the MC-130P (2) was 18.9nm SSW descending through FL67. There was approximately 140° angular difference between the ac's respective tracks. The TI passed by APP was co-incident with the Tornado descending beneath the base of NATS radar coverage and thus disappearing from the radar replay, not reappearing until after the CPA (squawking the Lossiemouth assigned SSR code). Based upon the Tornado's track after the CPA and the lack of a contradictory statement in the crew's report, it is reasonable to argue that the Tornado maintained its SSE'ly track throughout the incident sequence.

The Tornado acknowledged the TI and APP then passed them the RPS and instructed them to, "*squawk as required, change en-route*" which was acknowledged at 2102:39. The Tornado crew subsequently reported that they decided to 'go en-route' because they believed that "there was sufficient vertical separation between aircraft, a current heading that should put them behind the recovering aircraft and the fact that the [C130 (2)] were under a radar service."

At 2102:49, APP passed TI to the C130 flight on the Tornado as, "*traffic north, one-zero miles, crossing left-right, a Tornado at three thousand feet*" which was acknowledged. Based upon the Tornado crew's report, it is evident that they were still monitoring APP's freq as they report having heard this TI.

At 2103:24, APP updated the TI on the Tornado to the C130 flight as, "*previously reported traffic, left eleven o'clock, five miles, crossing left-right*". The C130 lead replied that the formation was, "*India Mike Charlie*" which APP acknowledged. At 2103:41 when prompted by the Supervisor, APP instructed the C130 flight to "*turn right ten degrees*" which was acknowledged. Although the turn was not formally phrased as deconfliction advice, it was meant as such by APP and interpreted as such by the C130 crews, as highlighted in their report. Although the turn was aimed to 'ensure that a gap was maintained between the contacts', this was not achieved. It is worthy of note that the C130 crew were operating in IMC, having received TI on a conflicting aircraft, when a DS would have been available.

Based upon the Tornado crew's report, at 2103:45 they descended to a BARO altitude of 2680ft, in a position approximately 2.6nm N of lead C130, which was descending through 5300ft, and 3.6nm NNE of C130 No2. Their TFR then reacted to what the crew believed was weather returns and initiated a climb to a BARO altitude of 5740ft, levelling at that altitude at 2104:10. This position was approximately 1.6nm SSE of the lead C130, which was descending through 5100ft, and 1.2nm SE of C130 No2; consequently, the CPA occurred between 2103:45 and 2104:10 as the Tornado climbed through the C130 flight's height.

The No2 C130 crew stated that they first sighted the Tornado at around ½ to ¾nm and increased their RoD to increase separation. The Tornado crew did not visually acquire the C130 and stated that at the time of the incident they were conducting reversionary night flying, with a transition to NVG planned later in the sortie. The No2 C130 crew assessed minimum separation as 25 to 50ft vertical and 100-300ft horizontal.

ATC provided a good level of service to the C130s. Although a little over 1000ft vertical separation existed, cognisant that the Tornado was VFR en-route (albeit squawking a Lossiemouth code) and that the C130s were IMC, ATC stepped beyond the bounds of a TS to attempt to provide a measure of deconfliction between the C130s and Tornado.

APPs description of the relative motion of the C130 relative to the Tornado however has greater relevance. Based upon the Tornado crew's report, the use of the word "*crossing*" by APP indicated

to the Tornado's crew that they would pass behind the C130 formation. As has been stated in previous Airprox investigations, many aircrews interpret the word "*crossing*" as a motion at approximately 90° to their track; in this instance, around 140° angular difference existed between the respective tracks; however, in the absence of a definition of "*crossing*" the term is interpretable and, arguably, the C130 flight was on a track that would cross that of the Tornado. Whilst CAP413 permits the use of "*converging*" as a descriptor for relative motion, again there is no definition and perceptions of its meaning amongst ATCOs appear to differ. Moreover, the wording of CAP413 suggests that "*converging*" and "*crossing*" are mutually exclusive terms. What is clear from the evidence is that the Tornado crew linked the TI passed by APP with their expectation to shortly be within the UKLFS and thus below the height of the C130 formation and elected to change to their en-route frequency. Unfortunately, the unexpected reaction of the TFR to what the crew believed to be weather returns conspired to climb their ac into the thin cloud layer at 4000ft and through the level of the C130.

Accepting the part that the TI played in the Tornado crew's initial decision making process, it remains that the Tornado had gone en-route approximately 80sec prior to the CPA and as such was responsible to 'see and avoid' other ac. An equally likely course of events could have been for ATC to issue a vector to the C130 formation which would have markedly changed the event geometry and rendered the Tornado's previously obtained TI worthless. On that basis, the Airprox was caused by a conflict of flight paths within Class G airspace. Given the separation reported by the C130 crew, it is reasonable to argue that the conflict was resolved by ATC and the C130 and that without the 10° right turn, coupled with the increased RoD, the outcome could have been much worse.

RAF ATM Force Cmd, in association with RAF FS, is reviewing the issues highlighted in this report.

HQ AIR (OPS) comments that the supervisor in the GR4 crew identified several key learning points from this incident. The incident formed the basis of a flight safety discussion amongst the staff with a view to educating other crews who might face similar circumstances in future. There are a myriad ways in which the situation could have been prevented but the primary cause was the automatic pull up generated by the TFR. The potential for a TFR pull up in this scenario was one of the hazards identified in hindsight by the crew. The activation of the pull-up feature of the TFR is much like an autopilot actioned TCAS RA and as such must be followed as it can indicate an undetected failure of the TFR system; hence, it was reasonable for the crew to permit the pull-up to proceed but there was clearly no concern over a potential confliction, as the pilot reports. With the TI provided by the controller, particularly the use of the phrase "crossing", and the increasing height separation being generated by their intended profile, the decision to go en-route was not unreasonable. However, the call they heard to the C130s that they (the GR4) were crossing left to right, which by the same token should have implied they were passing ahead not behind the C130s, was not fully processed. If the "crossing" call is to relate to a track crossing angle an additional descriptor of "passing/tracking ahead", "passing/tracking behind" or "converging/conflicting etc" is required to communicate an appropriate level of SA. Therefore, the GR4 crew's SA regarding the potential for conflict and the decision to engage TFR were contributory.

HQ USAFE-UK comments that there is little to disagree with the post flight analysis by the Tornado crew. Furthermore, we endorse the above comments with regard to phraseology used for certain types of conflictions; CAP413 cannot cover every eventuality so, where applicable, controllers should surely "tell is how it is" rather than feel constrained by the inadequacy of permitted phrases.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

Information available included reports from the pilots of both ac, a recording of the Tornado Head Up Display (HUD), transcripts of the relevant RT frequencies, radar recordings, reports from the air traffic controllers involved and reports from the appropriate ATC and operating authorities.

The Board agreed that this was a most complex incident. Murphy's Law (Capt Ed Murphy USAF Edwards AFB 1949) – "If anything can go wrong, it will".

In an attempt to determine whether the controller had played any part in the incident it was important to determine when the Tornado had disappeared from his display; the display is not recorded. Initially only the Prestwick combined radar recording was examined which showed the Tornado descending below radar cover at 2102:25. In order to try to determine when the Tornado disappeared from the controller's display the Aberdeen single source radar recording was also examined but it too showed the ac disappearing at the same time. Although displaying height (Rad Alt) and Alt, Tornado HUDs do not display real time or position other than from a 'bullseye', so it was not possible to use this information to assist in making an estimation. However, it was considered most likely that the Tornado remained on the APP controller's radar display for some time after disappearing from the recording but, since the Tornado crew declared that they were going en-route (though not at that time changing frequency or squawk), the controller would have been unable to provide the crew with more information regarding the position or track of the C130s (notwithstanding the HQ Air comment about the descriptive terminology regarding their relative tracks). Although the controller informed the Tornado crew that there were 2 C130s, he did not inform them that they were in 1nm trail and it seems that the Tornado crew assumed that they were in 'closer' formation as is often the case when flying night missions; it appeared that they were never aware that the C130s were flying in 1nm trail. Further, although they were passed TI and overheard the TI regarding them being passed to the C130s, they did not assimilate that the C130s presented a significant collision risk on their Southbound track if the Tornado climbed above their intended operating height of 500ft agl.

One advisor commented that a DS might have been more appropriate for the C130s while in IMC; however, they were formation flying on a tactical exercise sortie, self-positioning for an 'internal aids' approach to Lossiemouth and a DS might not have allowed them sufficient tactical freedom to accomplish their mission requirements. In any case, the only other traffic on the Lossie APP radar picture was the Tornado, apparently descending to low level, of which they were aware. It was clear to Members that the avoidance passed to the C130s by the APP controller after the Supervisor intervened, was too little and too late to have had any meaningful effect.

The Secretariat's assessment of the Tornado HUD video was verified by an independent expert; unfortunately there was no audio recording and the TFR E-scope is not recorded. The Board acknowledged that the Tornado pilot was a student and that the entire sequence of events happened very quickly (the ac were closing at about 660kt (11nm/min) and the maximum detection range of the Tornado TFR is 6nm. The Board accepted that:

a. As far as can be determined from the video the Tornado TFR was operating correctly with no failures at the time of the incident.
b. In the lead up to the incident the Tornado autopilot and TFR engaged at 3000ft (alt) and initially the ac was descending correctly to low level in 'auto-TF'
c. While in the descent, 13 sec after engagement, the TFR detected something (i.e. terrain, an ac or weather) that generated a normal auto-TF climb command producing at 20° nose-up attitude.
d. The ac climbed with auto TF engaged then levelled at an alt of about 5600ft when auto-TF was discontinued and the ac flown manually initially remaining the same alt
e. The Lossie METAR showed no probability of weather 'thick enough' to produce such a climb.
f. The C130 was not seen on the Tornado HUD recording at any time. This was consistent with the pilots' reports of a thin cloud layer between the ac and the Lossiemouth METAR showing the cloud as being broken at 3400ft.

Bearing the facts above in mind it was the opinion of the Secretariat, substantiated by the independent expert, that shortly after engagement, the Tornado TFR had 'seen' the lead C130, demanded a climb and attempted to climb the Tornado over the ac by the 'Set Clearance Level' height set at the time (presumed to be 500ft). This opinion was given further credence by respective alts of the ac at the presumed time of crossing [Tornado from the HUD and the C130 Lead from Mode C].

Since the pilot encountered the unexpectedly high angle climb and after passed through the Minimum En Route Alt for the leg, he disconnected the autopilot and recovered the ac to level flight at 5600ft alt (4790ft agl) manually; again no other ac was visible on the HUD video. It was assumed that this would have been just as he passed very close to the trailing C130 crossing from its 1030 to its 0430, as seen by the pilot.

Analysis was not able to determine either the lateral or vertical separation as there was no information regarding the precise time or position of the CPA or any Mode C information from the No2 C130 [the leader was at about 5100ft alt].

The Board noted that both ac had been operating legitimately under VFR in Class G airspace where the principal method of collision avoidance is 'see and avoid'. The cloud layer between the ac prevented either pilot from being visual with the opposing ac until the last moment and the Board considered it unlikely that C130 No2's avoidance would have had time to take effect before the CPA; therefore there had been a risk that the ac would have collided. Members also observed that the sequence of events had taken place very quickly when the Tornado crew was in a very high workload situation. This had prevented them from conducting a full analysis of the situation they faced which might have led to their having better SA.

Members agreed with the points identified by the Tornado crew in their post flight analysis, particularly that it is unwise to commence automatic TFR flying on, or close to, the approach lane to an active airfield.

PART C: ASSESSMENT OF CAUSE AND RISK

Cause: The Tornado crew climbed into conflict with the MC130P which they did not see.

Degree of Risk: A.