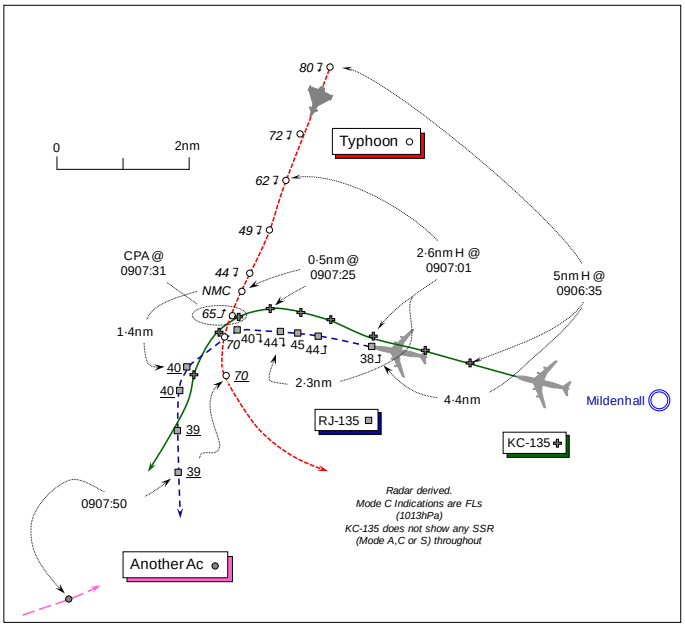
AIRPROX REPORT No 2012060

Date/Time:	27 Apr 2012 0907Z	
Position:	5223N 00018E (7nm WNW of Mildenhall)	
Airspace:	London FIR	(*Class: G*)
	Reporting Ac	*Reported Ac*
Type:	KC-135R	Typhoon T Mk3
Operator:	Foreign Mil	HQ Air (Ops)
Alt/FL:	FL40↑ SAS	↓2400ft QNH (1009hPa)
Weather:	IMC In Cloud	IMC In Cloud
Visibility:	Nil	Nil
Reported Separation:	<100ft/<50m H	NK
Recorded Separation:	Contacts merged (KC-135/Typhoon)	



PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

THE KC-135R PILOT reports he was departing from Mildenhall under IFR as the No2 of a flight of 2 ac lead by an RJ-135. The flight was in receipt of a TS from Lakenheath DEPARTURES (DEPS) whilst executing the Mildenhall 7 SID to the W. [Although the pilot reports that the assigned squawk was selected with Mode C on, with enhanced Mode S and E-TCAS fitted, no SSR was evident from the KC-135 until after the Airprox occurred, only the formation leader's RJ-135 was squawking.]

Whilst climbing to their requested level block of FL90-100 their level was restricted by DEPS to FL40-50 because of transit traffic – the Typhoon - descending towards them from the N. During the climb to FL40 they entered cloud at about 3000ft ALT and remained IMC throughout. Flying about 1½nm behind the lead RJ-135, heading 285° some 4nm WNW of Mildenhall, a TCAS TA was enunciated for traffic descending towards them. Within a few seconds the TA became a DESCEND RA commanding a 6000ft/min descent, which was complied with before the RA abruptly changed demanding a CLIMB at 6000ft/min; however, he was unable to accomplish the demanded ROC because of the ac's gross weight and energy state. Seconds later the intruder ac – the Typhoon – 'dropped off' their TCAS scope and was then seen indicating 5100ft (1013hPa), above them to the S.

The other ac was not seen visually but from his ac's TCAS display was 'listed' as closing to a range of 0.01nm at the same level (<100ft) – the Typhoon being displayed on top of their ac symbol. He assessed the Risk of collision as 'high'. They climbed through FL50 while avoiding the Typhoon and levelled off at about FL54 before regaining level flight at FL50. Lakenheath DEPS was advised to 'mark their tapes' and an Airprox was subsequently filed after the sortie.

The amber strobes were selected to bright & steady, with the nav lights, tail stinger light and landing light on.

UKAB Note (1): The UK MIL AIP (AD) specifies the Mildenhall 7 Departure for RW29 as: 'Ahead to intcp MLD 281R, at MLD 6d right on Hdg 025° to intcp MLD 327R; cross NORD/MLD 23d FL80-FL90. If onward clearance not received, maintain FL90 and advise ATC.'

THE TYPHOON T Mk3 PILOT reports he was flying dual, whilst inbound from Coningsby to Northolt IFR under a TS from London MILITARY. The assigned squawk of A6051 was selected with Mode C on; Mode S is not fitted.

Routeing from Marham via Barkway, descending at 300kt from 10000ft to an altitude of 2400ft, as instructed by the controller, upon reaching 4000ft at a position 7nm WNW of Mildenhall a level-off was initiated due to the proximity of the Mildenhall MATZ and the fact that they were unable to maintain VMC. At the same time, TI was passed from London (Mil) about traffic 2nm to the E, believed to be climbing through 3000ft for 3500ft; to avoid the traffic, which was not seen, an immediate climb to 7000ft was executed. Further traffic updates were given to maintain clear of the traffic and the flight was continued under a DS. Because of the cloud layer, the KC-135 was not seen visually; no contact was observed on the AI radar. He assessed the Risk as 'medium'.

THE LAKENHEATH DEPARTURES CONTROLLER (DEPS) reports with RT transcript, that Mildenhall TOWER called for a departure release for the RJ-135 flight from RW29. MARSA – Military Accepts Responsibility for Separation of Aircraft - was being applied between the RJ-135 and KC-135 flight elements. Shortly after releasing the flight, he observed a fast moving radar track squawking A6051 – the Typhoon - about 15nm N of Mildenhall descending through FL110 Mode C heading SW. At 0905, the RJ-135 crew called DEPARTURES, was radar identified, placed under a TS and a climb to FL80/70 issued due to the A6051 observed descending out of FL100. At 0906, he issued a 'traffic advisory' to the RJ-135 flight on the A6051 code and assigned a level of FL40 [for the RJ-135 and 3000ft QNH for the KC-135]. A L turn onto a heading of 180° was issued to the RJ-135 flight at 0906:52 as the A6051 code and the radar contact on the second element of the flight – the KC-135 flown by the reporting pilot - were on a converging course. As the flight started the L turn, the A6051 code continued to descend out of FL53. At this point, he issued a traffic alert and instructed an immediate turn onto a heading of 180° and to maintain FL40, but a few seconds later, the KC-135 crew reported a TCAS CLIMB to avoid the Typhoon. Some 30sec later, the TCAS RA was complete and the KC-135 crew were given a separate clearance to proceed en-route as per their FPL.

During this entire event, the assistant controller was attempting to contact London (Mil) - LJAO - for coordination. The LJAO line was not answered for about 3min. He believes this entire situation could have been averted if LJAO had answered the line so that co-ordination could have been effected.

UKAB Note (2): The DEPS RT Transcript reflects that at 0907:35, the KC-135 crew reported on the RT without a C/S, *"T-C we're TCAS climb"*. DEPS perceived this to be from the RJ-135, acknowledged the call and then passed TI on 'Additional traffic 2 miles ahead, not above 2000ft'. At 0907:55 the RJ-135 crew reported *"we're level"* [at FL40] before at 0908:16, the KC-135 crew advised, "[KC-135 C/S] *recovering 4-0-0 (sic) after TCAS climb request a vector and a squawk".* The KC-135 was subsequently identified and placed under a TS by DEPS before it was established that the flight were no longer 'MARSA', a vector issued and TI passed on the Typhoon *"..4 miles east of you at flight level 7-0".* With the KC-135 crew reporting in IMC until passing FL80, further TI and vectors were subsequently issued for the re-join.

THE LATCC (MIL) LJAO NE TACTICAL CONTROLLER (NE TAC) reports that he was working 3-4 ac on frequency. In the same airspace, LJAO E was extremely busy with multiple F-15s conducting GH, tanking on AARA 8, and FIR transits. On frequency at the time of the Airprox were: the subject Typhoon conducting general handling in East Anglia before transiting to Northolt; a foreign air force ac being handed over to LJAO SE; Typhoon (B) formation from D323B to Coningsby and a BE200 on a NAVEX in East Anglia. The geographical split of traffic was in excess of 100nm. Due to the traffic loading, there was a PLANNER in situ to facilitate handovers and coordination.

Typhoon (B) formation free-called in D323B for recovery to Coningsby and a squawk was issued. As the subject Typhoon crew completed their GH, he instructed them to take up their own navigation to a point 10nm N of BKY under a TS and descend initially to FL100. The unrelated Typhoon (B) formation was identified when he saw the squawk change, but he got no response to the transmission before he issued TI to Typhoon (B) formation on a non-squawking contact.

Luton had requested a radar handover on the subject Typhoon at 10nm N of BKY, at 2400ft Luton QNH (1009hPa) and these details as well as the squawk and frequency were written in the scribble line on his electronic fps (EFS). Instructing the Typhoon crew to set the Luton QNH (1009hPa) and descend as requested by Luton to 2400ft, he issued a terrain alert before an ac appeared on the radar screen climbing out from Mildenhall wearing an LJAO E squawk – the RJ-135 - which he had not noticed initially. Typhoon (B) formation re-established 2-way comms and was released 'own navigation' to Coningsby. At this point he saw the RJ-135's Mode C indicating 3800ft and climbing. The subject Typhoon was approaching 7000ft in descent and he called the RJ-135 as climbing traffic. At this point, he opined that he should have stopped the Typhoon's descent to prevent any potential confliction; however, he was distracted by the BE200 on handover from Cranwell. He called the RJ-135 to the Typhoon crew again, but did not initiate a stop of his descent, he then observed the RJ-135's Mode C descending to avoid the Typhoon. Upon reaching 4500ft the Typhoon crew requested a climb to 6000ft together with an upgrade to a DS. The Typhoon crew was instructed to climb to 6000ft and the DS provided by giving the Typhoon crew an avoiding action turn onto a heading of 140° and calling further traffic [Another ac on the diagram] 9nm to the SW squawking A7000. A silent handover of the foreign AF ac was then initiated to LJAO SE. The KC-135 then climbed out from Mildenhall squawking a Lakenheath SSR code [after the Airprox had occurred] and began to climb towards the RJ-135. Both ac then turned towards the Typhoon so he gave further avoiding action onto a heading of 360°. The two ac continued to turn towards the Typhoon and a further avoiding action turn onto 040° was given; the Typhoon crew then requested a climb to 10000ft to gain VMC. At this point, NE PLAN was co-ordinating the Typhoon against the Lakenheath traffic. Instructing the Typhoon crew to climb, once the pilot informed him that he was VMC and was clear of all traffic he turned the Typhoon back towards BKY and instigated a descent to 7000ft prior to a handover to Luton.

The busy traffic picture across LJAO E and NE, coupled with the lack of available manpower on the day certainly played a part in the occurrence; however had there not been a PLANNER in place, prompting his actions and priorities, he may not have been able to call the traffic and initiate avoiding action in good time. Additionally, whilst the Typhoon was under a TS, he could have better implemented his 'Duty of Care' towards the Typhoon by stopping the ac's descent earlier.

LATCC (MIL) did not obtain a report from the LJAO NE PLANNER (NE PLAN).

THE LATCC (MIL) LJAO SUPERVISOR reports that the LJAO North Bank was extremely busy at the time of the Airprox. LJAO E Sector was fully manned with the addition of an extra controller on the overload console to accommodate a surge in traffic levels. The NE Sector was manned with TACTICAL and PLANNER controllers, both of whom were relatively inexperienced, but with only 4 ac on frequency they did not appear to be operating at full capacity. At the time of the Airprox his focus was on the E Sector due to their high traffic loading and he was unaware of the large geographical split that the NE sector was experiencing. The high traffic loading on the Unit resulted in no controllers being available to open a second TACTICAL position on the NE Sector while breaks were accommodated.

He was made aware that the Typhoon was manoeuvring to allow the RJ-135 to climb out from Mildenhall but was informed that the Typhoon pilot was visual with the RJ-135 so was not overly concerned at the time. Following a call from Lakenheath informing him that they were filing an Airprox he reviewed the radar replay. This revealed the geographical split on NE Sector of over 100nm and the fact that another flight had failed to respond to NE TAC's instructions and had distracted the controller's attention to the N, away from the Typhoon operating to the S. At the time the instruction to descend to 2400ft was passed to the Typhoon crew, the RJ-135 was painting on the radar recording but TI was not passed at this stage due to the distraction of the other flight. When NE TAC passed TI to the Typhoon the crew responded 'roger', which was misinterpreted by NE PLAN as the crew being visual with the RJ-135; this influenced the SUP's level of concern regarding the incident. The SSR data block for the RJ-135 indicated that the flight was going to climb to FL190 and was due to be handed over to LJAO. At this point NE TAC should have stopped the descent of the Typhoon until the potential confliction was resolved. He would also have expected

Lakenheath to have requested co-ordination from LJAO on seeing the Typhoon descending close to their climb out. NE TAC did reiterate TI on the RJ-135 to the Typhoon crew as they continued their descent. At approximately 4500ft the Typhoon crew requested a climb to 6000ft and an upgrade to a DS. This was applied and an avoiding action turn onto 140° was issued against a A7000 squawk further to the SW – Another ac. The RJ-135 and the KC-135 that had departed Lakenheath squawking A0432 followed a similar track to the Typhoon, which resulted in further avoiding action and a climb to 10000ft before the situation was eventually resolved.

BM SAFETY MANAGEMENT reports that the Typhoon was operating IFR in receipt of a TS and latterly a DS from LATCC (Mil) LJAO NE; the KC-135 was operating IFR, in receipt of a TS from Lakenheath DEP.

The Typhoon crew had been conducting GH in the vicinity of East Anglia and the incident sequence commenced at 0903:37 as the Typhoon crew reported their GH was complete, "*requesting descent Flight Level 1 hundred direct BARKWAY*" inbound to Northolt. At this point, the Typhoon was 3.6nm NW of Marham; the KC-135 formation was not visible on radar.

LJAO North Bank's workload was high; the East Sector was fully manned with an extra controller on the overload console. The NE Sector had TAC and PLAN in place, both of whom were relatively inexperienced. The SUPERVISOR has stated that his main point of focus was the E Sector due to the surge in traffic levels affecting their workload. NE TAC reported their workload as high to medium. At the start of the incident sequence, NE was controlling 3 speaking units within relatively close proximity; the subject Typhoon, a medium level transit around Rutland and East Anglia and a high-level transit necessitating a handover to LJAO South. At 0904:00, an unrelated FJ formation – Typhoon (B) formation - free-called LJAO NE requesting an ATS in transit from D323B to Coningsby. This additional task created a 110nm split between the Typhoon (B) formation and the subject Typhoon, significantly increasing NE TAC's workload and task complexity. Subsequent to completing their written report, NE TAC has related that whilst some of their traffic was within LJAO East Sector AoR, they and NE PLAN had decided to maintain control of the traffic due to the ongoing workload issues on E Sector.

Following landline liaison with Luton RADAR, at 0905:30 NE TAC transmitted to the Typhoon crew, "*instructions from Luton, taking your own terrain clearance, descend 2 thousand 4 hundred feet, 1-0-0-9.*" Initially the descent instruction was readback incorrectly which was detected by NE TAC and a correct readback obtained from the crew; the exchange of RT was complete at 0905:53. At the point that the descent instruction was issued, the Typhoon was 10.8nm NNW of Mildenhall at FL100, and the KC-135 formation was not visible on the LJAO NE controllers' display. Extrapolation of the Typhoon's track demonstrates that it would have passed 6.3nm through the extended centre-line of RW29 at Mildenhall. The dimensions of that portion of the Combined MATZ directly relating to Mildenhall are a circle 5nm radius centred on the airfield and non-standard stubs extending 5nm either side of the RW centre-line (see Figure 1), extending from the surface to 3000ft above Lakenheath's A/D elevation of 32ft.

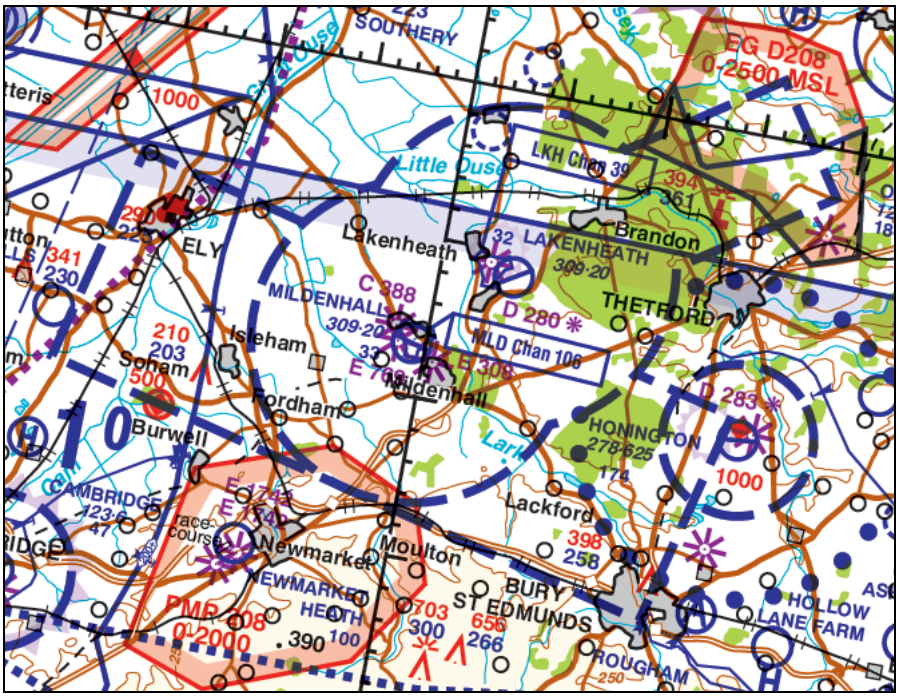


Figure 1: Combined MATZ RAF Lakenheath/RAF Mildenhall.

The lead RJ-135 became visible on radar at 0905:37, 1.3nm WNW of RAF Mildenhall and 9.9nm SSE of the Typhoon.

Between 0906:03 and 0906:27, NE TAC was involved in an exchange of RT with the unrelated Typhoon (B) formation to the N. At 0906:29, NE TAC passed accurate TI to the subject Typhoon crew on the RJ-135 stating, "*traffic left 11 o'clock, 5 miles, crossing left right, flight level 3-5, climbing flight level 1-9-0*", which was acknowledged. The LJAO SUPERVISOR reports that they were informed that the Typhoon was visual with the RJ-135 and having reviewed the incident, believed that NE PLAN had erroneously interpreted the Typhoon crew's acknowledgement of the TI at 0906:29 as a declaration that they were visual with the RJ-135. This suggests that the SUPERVISOR and NE PLAN were maintaining a dialogue over the traffic situation on the NE Sector and that NE PLAN informed the SUPERVISOR that the Typhoon was visual. Whilst the Typhoon pilot has stated that they initiated a level-off prior to the TI being issued due to their proximity to the Lakenheath/Mildenhall CMATZ, this is not apparent on radar. [The Typhoon's descent is not arrested until just before 0907:31.]

Meanwhile at 0906:44, a primary (PSR) contact appears on the radar recording 1.6nm in trail of the RJ-135, falling exactly at the end of the lead ac's radar trail, which is the reporting pilot's KC-135. At this point, the Typhoon was descending through FL75, tracking SW'ly, 3.5nm NNW of the RJ-135 and 4.3nm NW of the KC135.

Military Manual of Air Traffic Management (MMATM) Chapter 11 Para 43 states that:

> 'formations should be considered as a single unit for separation purposes provided that the formation elements are contained within 1nm laterally and longitudinally, and at the same level or altitude. Within Class F and G airspace only, at the controller's discretion, these limitations may be increased to 3nm and/or up to 1000ft vertically.'

MMATM Chapter 11 Para 46 states that outside CAS:

> 'the lead aircraft [in a formation] **should** squawk Mode 3A and C. If the stream extends for 3nm or more, the last aircraft **should** also squawk.'

Between 0906:50 and 0907:02, NE TAC was involved in an exchange of RT with the ac conducting the medium level transit and then, at 0907:09, provided an accurate update of the TI to the Typhoon on the RJ-135; no mention was made of the KC-135. At that point, the Typhoon was 1.7nm NW of the RJ-135 and 1.8nm NW of the KC-135, tracking SW'ly and descending through FL51. The RJ-135 was at FL40 and had entered a L turn passing through WSW; the KC-135 was tracking WNW'ly. The Typhoon crew acknowledged the TI as they descended through FL45 and stated at 0907:19, that they were, "*re-climbing 6 thousand feet and requesting Deconfliction Service*"; lateral separation was now 1.5nm against the RJ-135 and 1nm against the KC-135.

Responding to the Typhoon crew's request for a DS, NE TAC stated at 0907:27, "[Typhoon C/S] *roger Deconfliction Service avoiding action set heading 1-4-0 degrees traffic was right 1 o'clock 5 miles crossing left right indicating 2000 feet*." This deconfliction advice was against an un-related conflicting ac [Another ac] 6.4nm SW of the Typhoon, tracking ENE'ly, indicating 2100ft; no reference was made to the KC-135 which was 0.6nm ESE of the Typhoon, tracking WNW'ly, nor the RJ-135 which had precipitated the Typhoon pilot's decision to climb and request DS.

The CPA between the Typhoon and the KC-135 occurred at about 0907:31, whilst NE TAC passed deconfliction advice to the Typhoon. No lateral separation was discernible on radar and vertical separation was un-recordable as the Typhoon's SSR Mode C had dropped out as a result of their avoidance climb. [UKAB Note (2): The Stansted 10cm Radar Recording shows the Typhoon climbing through FL65 at this point, before levelling at FL70.]

In terms of the ATM aspects of this Airprox alone, a key issue is that NE TAC and PLAN did not see the PSR contact of the KC-135. Based on examination of the radar data at the Swanwick Radar Replay facility, the yellow cross representing the PSR-only contact of the KC-135 falls exactly within the trail of the lead RJ-135 (represented by yellow vertical lines) and remained within that trail throughout the incident sequence. BM SM attempted to emulate this scenario and, even in an artificial zero-workload environment, those controllers involved failed to acquire the PSR-only contact.

BM SM contends that as a result of the large range scale that NE TAC was operating to due to the geographic spread of their traffic, the workload generated by that traffic and the lack of colour differentiation between the radar contact and the trail, NE TAC was unable to detect the PSR-only contact of the KC-135. Moreover, whilst some further optimisation of the surveillance display may have been possible, this would not have affected the ergonomic issues associated with the display of PSR-only contacts and the improvement in detectability that such manipulation would have achieved is arguable.

BM SM Recommendations:

RAF ATM Force Cmd is requested to:

> Ensure that BM pers at LATCC (Mil) and ScATCC (Mil) are briefed on the issues raised by this investigation, specifically the difficulties of detecting PSR-only contacts when using large range-scale settings.
>
> Task the ARCS IPT to investigate the ergonomic issues associated with the presentation of PSR-only contacts.

HQ USAFE-UK comments that this Airprox has highlighted a number of both procedural and systemic shortcomings which will be subjects for discussion during the meeting of the Airprox Board. That said, the Airprox would not have occurred had coordination taken place before the Typhoon was cleared to descend to 2400ft QNH, a course of action which appeared to take no account of the Lakenheath/Mildenhall CMATZ.

HQ AIR (OPS) comments that better communication between the Lakenheath DEPS controller and the LJAO NE Sector would probably have prevented this incident from developing; it is disappointing that there is no explanation as to why LJAO NE Sector did not answer the landline! The Typhoon crew appeared to do all that was asked of them by ATC yet they came close to a tanker ac that they did not see, either visually or on their AI radar. However, given the Wx conditions, a DS for the Typhoon may have been more appropriate; this would have required the LJAO controller to seek deconfliction on the Tanker with Lakenheath and so would probably have averted this Airprox. Furthermore, it behoves all aircrew to use all means available, when IMC, to detect other ac and avoid potential collision.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

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

The formation departed in-trail with the RJ-135, squawking with Mode C, leading the KC-135 that was maintaining about 1½nm spacing from the lead ac during the period of the Airprox. The HQ-USAFE Advisor accepted that the absence of a squawk from the KC-135 was an important factor in this Airprox in Class G airspace just above the Lakenheath/Mildenhall Combined MATZ. The MMATM stipulates that formations can be considered by ATC as a single unit 'for separation purposes' provided that the formation elements are contained within 1nm laterally at the same level; at the controller's discretion, within Class G airspace these limits could be increased to 3nm and/or 1000ft vertically. Furthermore, if the stream extends for 3nm or more, the last ac should also squawk. Therefore DEPS was operating within these parameters in compliance with the MMATM and there was no requirement to issue a squawk to the KC-135. However, this Airprox illustrated the importance of a squawk for conspicuity purposes for the benefit of other ATSUs. The BM SM report shows how the LJAO NE Sector controllers – both TAC and PLAN – were unable to detect the PSR-only contact of the KC-135 because of the lack of colour differentiation between its PSR contact and the RJ-135 SSR track history trail; this, coupled with the way that the PSR tracks are represented on the LJAO displays, made the KC-135 virtually invisible to NE TAC. BM SM advised that the ARCS IPT had reviewed the ergonomic issues associated with the presentation of PSR-only contacts, who stated that changing the size/shape or colour of PSR returns without introducing further complications or additional clutter was challenging, but the difficulty/cost of making changes should not be a barrier if considered warranted. However, the ATM Force contended that there is no requirement to change the way in which PSR contacts are displayed to LJAO controllers. The Board remained unconvinced and Members recognised that military ac, specifically KC-135 tankers, regularly depart from Mildenhall in a stream formation and in the main, following a prenote, would be handed to LJAO for an ATS after departure - as was the formation involved here. Controller Members considered it good practice that the trailing ac in a stream formation is allocated a squawk when ac are more than 1nm apart and the only method by which LJAO controllers could readily detect and identify formation elements would be if trailing ac are squawking. This was at odds with the current guidance contained within the MMATM, so the Members were convinced that this whole topic should be reviewed. Consequently, the Members agreed the first of two Safety Recommendations associated with this Airprox: The Board recommended that the MoD review the SSR requirements for stream formations.

NE TAC's instruction to the Typhoon crew to descend to an altitude of 2400ft followed on from the pre-note to Luton RADAR. LJAO has no mandate to control traffic in the Class A LTMA and the normal routeing inbound to Northolt is to follow the 'C' Arrival, which requires ac to transit Class G airspace clear beneath the 2500ft base of the LTMA, via BARKWAY VOR, under a radar service from either Luton RADAR or Essex RADAR. The military area controller Member emphasised this was the only way into Northolt for non-airways traffic arriving from the N. Hence a descent to 2400ft clear of other traffic was essential prior to the hand-over and had to be accomplished before the LTMA boundary, where all other GA traffic is also being squeezed into the available airspace. The BM SM Advisor opined that this routeing is fraught with difficulty; the density of traffic in the

remaining Class G airspace beneath the LTMA provided a significant challenge for area controllers especially when controlling hi-speed fast-jet traffic. The Board noted that this Airprox was the second of two cases involving traffic under the control of LJAO for a Northolt 'C' Arrival assessed at this meeting. Consequently, in the light of these two Airprox, it was suggested by the Board's ATC Strategy and Standards Advisor that the use of this routeing and the provision of ATSs should be reviewed. Members concurred and a second Safety Recommendation was agreed: The Board recommended that the CAA should arrange, under the auspices of the ASI, a workshop of ATC stakeholders to review the arrangements and ATC provision for Northolt 'C' arrivals via BARKWAY.

The BM SM report shows that on its projected track the Typhoon would have passed through the climb-out to Mildenhall's RW29 at a range of 6.3nm in the descent, potentially flying into the CMATZ. The RJ-135 was showing on the LJAO display when the descent instruction was issued some 2min before the Airprox occurred but the KC-135 was not and the Typhoon had subsequently remained above the CMATZ because the Typhoon crew had themselves become concerned and requested a climb and upgrade to a DS. The absence of co-ordination beforehand was noted but a controller Member suggested that co-ordination was not required because the VFR Typhoon crew had only requested a TS and were responsible for their own separation. However, the civilian area controller Member was certain that LJAO NE Sector should have co-ordinated with DEPS; other controller Members agreed that liaison with DEPS should have been effected by NE PLANNER who could then have co-ordinated the Typhoon against the departing formation: it was unprofessional to descend traffic through a major military A/D's climb-out without checking beforehand if any departures were imminent and resolving any perceived conflict. The RJ-135 flight had been pre-noted to LJAO and Members agreed that good practice would dictate that co-ordination should have been effected by NE PLAN. Moreover, it was evident that DEPS had been trying to initiate co-ordination for some 3 min after he first saw the potential for a conflict, but had been frustrated in his attempts because LJAO did not answer the landline. The disappointing absence of a report from the PLANNER controller was crucial here and the reason why DEPS had been unable to communicate with the Sector was not clear - BM SM advised that the landline recordings were no longer available and had been erased. Nevertheless, Members remained concerned that NE TAC had not stopped the Typhoon descending toward the Lakenheath/Mildenhall CMATZ and through the climbout lane without any form of co-ordination or traffic information being passed by NE Sector, in the knowledge that traffic was departing and climbing. NE TAC's awareness of the RJ-135 was evident from the TI passed to the Typhoon crew at a range of 5nm because it included information that the ac was climbing to FL190; this was not evident from the ac's Mode S Selected Level [SEL] suggesting that NE Sector had accessed the flight data relating to the flight passed to LJAO by Lakenheath in their prenote, which would have shown the KC-135 in the flight of two ac. The Typhoon crew's response to the TI was evidently interpreted incorrectly by NE PLAN who erroneously informed the SUP they were visual with the RJ-135. This same interpretation was presumably also accepted by NE TAC and any concern the controller might have had over the proximity of the RJ-135 would have been allayed, albeit that he was unaware of the KC-135. NE Sector was undoubtedly extremely busy, as was the Unit as a whole, and had a very difficult split of traffic as a result of the free-call from the Typhoon (B) formation 100nm away to the N which 'tipped the balance' in NE TAC's workload it was suggested. The USAFE-UK Advisor recognised this, but was concerned with the supervision of the Unit at the time and was critical that further assistance was not provided to NE Sector, calling upon those controllers on a break if necessary. However, the SUP reports that his focus was with the E Sector at the time due to their high traffic loading and was unaware of the large split on NE Sector. This 100nm split was clearly a factor in distracting NE TAC from the conflict developing with the RJ-135; NE TAC acknowledges that he should have stopped the Typhoon's descent, but was distracted by the hand-over of the BE200. However, when prompted by the Typhoon crew – now IMC in cloud - requesting a DS and climb, NE TAC, passed TI on unrelated traffic 5nm away rather than update the crew on the position of the RJ-135 that was only 1·5nm away about 400ft below it in cloud; NE TAC remained unaware of the KC-135 1nm away from the Typhoon because it was not clearly displayed. The subsequent avoiding action L turn onto 140° inside the RJ-135 was issued by NE TAC to the Typhoon crew about 4sec before the merge between the Typhoon contact and that of the KC-135 that is clearly discernible on the radar recording, but which is shown in a different format to that displayed to NE TAC.

The Typhoon is shown no lower than FL44; the pilot reports he had levelled off at 4000ft ALT due to the proximity of the CMATZ and was unable to maintain VMC, the crew being aware from the last of the two transmissions of TI from NE TAC only that the RJ-135 was near at 1100ft below their level. Pilot Members agreed that the Typhoon crew's request for a DS was made somewhat late and the level-off was evidently of very short duration as the radar recording revealed a quick reversal into a climb over three sweeps. Consequently, having entered cloud just before the CPA, the crew was unable to see the reported RJ-135, did not detect the trailing KC-135 on their AI radar and remained unaware of the conflict with the KC-135 throughout the 'merge'. Although the KC-135 was not squawking Mode A/C, the crew had Mode S selected 'on', thus availing them the advantage of displayed TCAS data. DEPS reports that they attempted to prevent the developing conflict by restricting the RJ-135 flight's levels and subsequently issued a turn in avoidance. However, by this time the KC-135 crew was IMC in cloud, had received a TCAS DESCEND RA followed rapidly by a reversal into a CLIMB RA, demanding a ROC of 6000ft/min, which the pilot was unable to comply with because of the ac's gross weight and energy state. Therefore, although TCAS had ably assisted their SA it was unable to resolve the conflict with the agile Typhoon. Pilot Members suggested that the KC-135 crew should also have requested a DS before they entered cloud as a TS was also inappropriate to their needs in IMC.

The radar recording shows that both the KC-135 and Typhoon returns merged in azimuth with little discernible horizontal separation. Plainly the absence of a Mode C indication from the KC-135 did not allow its level to be compared accurately to that of the Typhoon. Moreover, the absence of a Mode C level from the Typhoon just before the merge was indicative of a rapid reversal of the descent into a climb with the Stansted 10cm radar, which has a higher data update rate, showing the Typhoon climbing through FL65 at the CPA. The KC-135 pilot quotes the minimum separation between his ac and the Typhoon registered on his TCAS as 0.01nm horizontally – 20yd - and less than 100ft vertically. However, Members found it difficult to resolve the reported 100ft vertical separation with the maximum level of FL54; it is not clear at what point the KC-135 ascended to this level and thus his ac's range from the Typhoon. Whilst the minimum vertical separation could not be determined the USAFE-UK Advisor opined that it was seen by Lakenheath RAPCON to be a very close encounter. The KC-135 crew followed DEPS instructions, under a TS, but was unable to manoeuvre their ac in response to the final TCAS CLIMB RA rendering the system ineffective; in the event the KC-135's lower than demanded climb rate may have resulted fortuitously in greater separation when the Typhoon climbed abruptly and steeply to achieve VMC. Nevertheless, the Typhoon crew had followed NE TAC's descent instructions and flew into close proximity with the KC-135 that neither the controller nor the crew were aware of. Neither aircrew saw each other's ac. Weighing all these various factors carefully for relevance, the Board agreed that all of them had contributed to causing a hazardous conflict in Class G airspace. However, it was the workload and performance within LJAO that created the conditions which led to the Airprox. With the NE Sector busy working traffic over a large geographic split, initially unaware of the pre-noted departure from Mildenhall and required to hand over the Typhoon to Luton RADAR, TAC's instruction to the Typhoon to descend through the climb-out lanes of the CMATZ without any form of liaison, either by traffic information or direct co-ordination with DEPS, was the critical element that joined all the contributory strands together, from which the conflict resulted. The Board concluded therefore, that the Cause of this Airprox was that LJAO did not liaise beforehand about the Typhoon's flight in close proximity to the Mildenhall CMATZ. Chance played a significant part in keeping these two ac apart and with both crews IMC in cloud the Board was unequivocal that an actual Risk of collision had existed in these circumstances.

Post Meeting Note (1): The Typhoon is not fitted with an ACAS and Members were disappointed to learn that there are currently no plans to fit one in the future. The HQ Air (Trg) Member had suggested that if the Typhoon was fitted with a Mode S/TCAS system it would, in all probability, have detected the presence of the KC-135's Mode S, alerted the Typhoon crew to its proximity, and generated a co-ordinated RA that would have resolved the conflict - see Post meeting Note (2). Therefore, Members were asked to consider whether they would support a third Safety Recommendation viz: that the MoD review the requirement for Typhoon ac to be equipped with a suitable Mode S/TCAS system. A number of Members responded favourably to the proposal; however, it did not receive unanimous approval. Moreover, with only one Airprox of this nature it was

considered that there were insufficient grounds upon which to forward a recommendation in this instance. However, the topic will be kept under review and should further examples be identified then it could be re-examined by the Board in the light of that additional data.

Post meeting Note (2): Further consultation with TCAS experts has revealed that the enhanced ModeS/TCAS (E-TCAS) – fit of some military ac, including the KC-135R, includes a number of role specific enhancements that are not included in more conventional TCAS II equipments fitted to CAT ac. The UKAB has been advised that it was foreseen that a cluster of TCAS fitted ac – ie a formation - could cause another TCAS unit to unnecessarily limit its interrogations and thus reduce the protection that TCAS equipage provides. E-TCAS was therefore developed, which overcomes this problem while still allowing TCAS-fitted military ac to fly in formation. With E-TCAS, when flying in formation mode, the lead ac has TCAS and Mode S operating in normal active mode, but the remaining formation elements operate in a passive mode. TCAS surveillance is performed by the lead ac and the information is passed by a data-link to other formation ac. The other formation elements (knowing the relative position of the lead ac and the other non-formation ac that the lead aircraft has under surveillance from the Mode S data link) determine for themselves whether any other ac under surveillance by the lead ac's TCAS constitute a 'threat' to the individual formation elements. If another ac does constitute a threat then the individual formation ac will no longer remain passive and start standard TCAS active interrogations and generate the appropriate alerts.

As the TCAS equipage of the 'threat' ac is known to the formation ac:

> If the 'threat' ac is not TCAS-equipped, then the formation ac will not 'enable' its own responses to Mode S interrogations because the threat ac cannot interrogate the formation ac and an un-coordinated RA will result if necessary.
>
> If the threat ac is TCAS-equipped, then the formation ac will communicate a Resolution Advisory Complement (RAC) message containing also its Mode S address to the 'threat' ac. The formation ac will then enable responses to addressed Mode S interrogations because the threat ac will be expected to start actively interrogating the formation ac and a co-ordinated RA will result if necessary.

In the case of the Non TCAS-fitted Typhoon and the E-TCAS fitted KC-135R there would, therefore, be value in the Typhoon being TCAS equipped and the RAs on the two ac would have been co-ordinated providing greater prospect that any collision risk would be successfully resolved.

PART C: ASSESSMENT OF CAUSE AND RISK

Cause: LJAO did not liaise beforehand about the Typhoon's flight in close proximity to the Mildenhall CMATZ.

Degree of Risk: A.

Recommendation: i. The MoD reviews the SSR requirements for stream formations.

ii. The CAA should arrange, under the auspices of the ASI, a workshop of ATC stakeholders to review the arrangements and ATC provision for Northolt 'C' arrivals via BARKWAY.