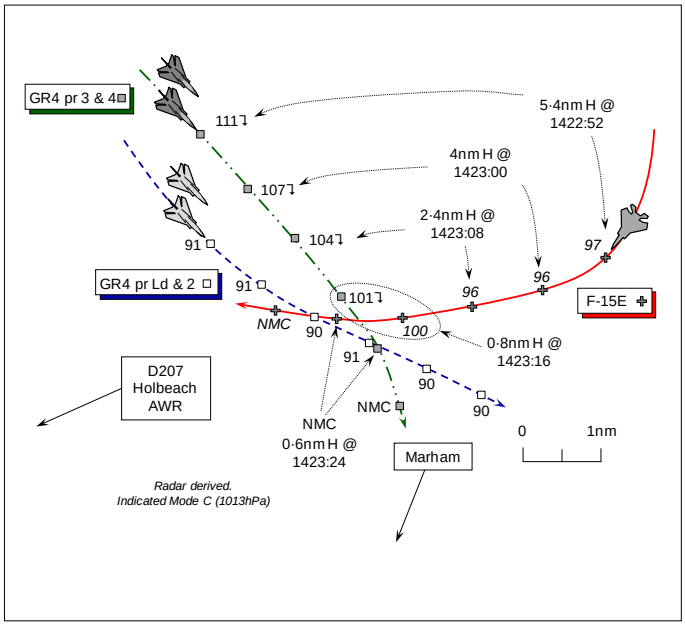
AIRPROX REPORT No 2012031

Date/Time:	12 Mar 2012 1423Z	
Position:	5257N 00044E (20nm NNE Marham)	
Airspace:	London FIR	(*Class:* G)
	Reporting Ac	*Reported Ac*
Type:	Tornado GR4 pr	F-15E
Operator:	HQ Air (Ops)	USAFE-UK
Alt/FL:	↓FL100	FL100
Weather:	VMC CLOC	VMC CLOC
Visibility:	30km	Unlimited
Reported Separation:		
	Nil V/ ~200ft H	<500ft msd
Recorded Separation:		
	100ft V	



PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

THE TORNADO GR4 PILOT reports he was flying as the No3 and leader of the rear section of a 4-ship GR4 formation on recovery to Marham from the N on a stepped descent at FL100 in VMC. Nos 3 and 4 were in loose arrow trailing the Ldr and No2 by about 2nm, to facilitate a formation split for pairs GCAs. They were in receipt of a TS from London MILITARY and the assigned squawk was selected with Mode C.

About 30nm N of Marham, heading 140° at 350kt, London MILITARY called manoeuvring traffic 5nm to the E at FL100 and he became 'tally' with a single F-15E 5nm away. The aspect of the F-15E was initially difficult to judge, but after a few seconds it became clear that it was turning R through W towards his rear pair. No immediate collision risk was apparent so no avoiding action was taken, but the closure rate quickly increased and a call was made by the No4 that the traffic was closing from the L. The crew of No4 initiated a break to the L and the F-15E passed down their RH side, whilst he, flying No3, initiated a roll inverted and pulled. The F-15E crossed from L – R at a minimum distance of about 200ft from his pair with a 'medium' Risk of collision. It was unknown at the time whether the F-15E crew were visual with his pair, but it appeared that they took avoiding action at a similar time.

THE F-15E PILOT reports that the planned mission was a 2-ship close air support sortie to Holbeach Range in support of air-to-ground operations school training. The F-15E flight lead 'ground aborted' his ac for a mechanical reason and the No2 subsequently departed as a single-ship. There was a broken/overcast layer from 500 to 2000ft agl but clear above with unlimited visibility. Departing initially under a DS with Lakenheath DEPARTURES, once VMC above he climbed to FL100 and proceeded to the Wash hold point under VFR. Radar service was terminated and a squawk of A7000 selected with Mode C. Upon reaching the Wash hold at FL100, he turned onto a heading of 105° outbound and switched to the Holbeach Range ICF. After reviewing the ac's armament status and weapons delivery programs prior to range entry, they switched to the Holbeach RANGE PRIMARY and initiated a level R turn back towards Holbeach Range onto about 285° at 350kt. Clearance to join the range was issued, and he was passed the altimeter setting and advised to squawk A7002 [Danger Areas – General]. As he completed the 180° turn inbound, he visually acquired two GR4s off the L side of the nose, slightly low. For deconfliction, he checked the ac to the R [offset the ac's flightpath R] and initiated a slight climb. As the initial pair of GR4s passed on the left side, the Weapons System Operator (WSO) spotted another pair of GR4s on the nose and level with the horizon. About 2sec later – he quoted a time of 1423:28, but probably moments before

this - the pilot visually acquired the trailing pair of GR4s and to avoid them immediately pulled straight back on the control stick forcing an abrupt pitch-up into an aggressive climb straight ahead. The trailing GR4s themselves initiated an aggressive manoeuvre away and down. He called out 'the merge' on Holbeach RANGE PRIMARY, who reported they were not aware of any outbound traffic. After the Airprox he continued inbound to Holbeach Range and completed the mission uneventfully.

Based on visual estimations, it appears that the ac passed within 500ft of each other and he assessed the Risk as 'Medium'. After landing, the Airprox was reported to the Squadron Operations Supervisor with details of the event. His ac has a dark grey colour-scheme; the position lights and anti-collision lights were on.

THE LATCC (MIL) LJAO NE TACTICAL CONTROLLER (LJAO NE) reports she was screening a trainee controller on E/NE. A formation of GR4s was recovering to Marham from the N under a TS, and the leader requested a split into 2 pairs for recovery about 30nm N of Marham. At the time, there was an ac executing general handling to the NE of Marham – the F-15. At that point it was no factor but the trainee elected to provide TI to the GR4 formation. Her trainee then split the formation vertically, instructing the first pair (Ldr & 2) to descend to FL90, and the second pair (Nos3 & 4) to descend to FL100. The trainee then called Marham to effect a radar hand-over of both pairs. During the handover, the previously called traffic that was general handling - the F-15E - turned onto W at FL100 and was heading towards the two pairs. The trainee interrupted the handover and called the traffic [the F-15] to both pairs. The handover was then completed and both GR4 pairs instructed to contact Marham APP.

THE LATCC (MIL) SUPERVISOR (SUP) reports that he received a call from a GR4 pilot who was part of a 4-ship formation on recovery to Marham that had experienced an Airprox. He noted the details and requested a radar replay of the event to investigate the circumstances. On reviewing the incident the following was observed.

The Tornado was recovering to Marham from the North in the descent to FL100 under a TS. Approximately 35nm NW of Marham they requested to split into 2 pairs for recovery. The LJAO controller instructed the second pair – [C/S] No3 - to squawk for identification. Meanwhile TI on an ac transponding A7000 and indicating FL100 Mode C was passed to both pairs of GR4s and acknowledged by the crews. At the time when the TI was initially passed the conflicting ac – the F-15E - did not pose a significant threat. The controller then instructed the leading pair to descend to FL90 to execute the split, before initiating a handover to Marham APP. During the handover the conflicting F-15E had turned and was closing on the formation, so it was called again to both pairs of GR4s. Shortly afterward the F-15's contact was observed merging with the rear pair and then indicated a descent to FL78, but this did not appear to be noticed by the LJAO controller. Neither of the two GR4 pairs reported an Airprox at the time on the LJAO frequency before they were transferred to Marham APP.

THE HOLBEACH RANGE SAFETY OFFICER reports that an F-15E was inbound to Holbeach Range on RANGE PRIMARY. The crew was given a joining clearance, then called a 'merge' with a formation of Tornados GR4s at 1425 before they entered the Range. At no point did the F-15E pilot report an Airprox.

BM SAFETY MANAGEMENT reports that this Airprox occurred about 10nm S of airway Y70, between the trailing pair of a 4-ship formation of GR4s recovering to Marham under IFR in receipt of a TS from LJAO NE, and an F-15E operating VFR in the Holbeach AWR hold, in communication with Holbeach Range.

All heights/altitudes quoted are based upon SSR Mode C from the radar replay unless otherwise stated. Unusually, the investigation was able to utilise HUD recordings from the No3 GR4.

As the Holbeach AWR controllers do not have access to a surveillance radar, they had no way of affecting the outcome of this Airprox; consequently, this investigation has focussed on the ATS provided to the GR4 formation.

Analysis of the LATCC (Mil) and Marham tape transcripts showed that they were 11 and 3-secs slow respectively. Timings have been amended to reflect the radar replay timings.

LJAO NE report that they were mentoring a trainee at the time of the Airprox. Unfortunately, they did not submit a DASOR for the occurrence until almost 6-weeks after the event; consequently, their recall of events and the level of detail contained within the report has suffered.

The GR4 formation was operating as 2-pairs in a "loose trail," with the subject pair trailing the leading pair by 1.2nm, routeing S to Marham. At 1417:30 the GR4 formation was placed under a RCS having entered Y70. The trailing pair of the formation exited CAS at 1421:09; LJAO NE omitted to amend the type of ATS from a RCS. Prior to entering Y70, the formation had been in receipt of a TS and reported that they were in receipt of a TS at the time of the Airprox. Moreover, LJAO NE's subsequent actions suggest that their mental perception was that the formation was operating under a TS.

The incident sequence commenced at 1420:59, as the lead pair of the 4-ship of GR4s left CAS. LJAO NE passed TI to the GR4 formation Ldr on the F-15E stating "*traffic 12 o'clock..8 miles, crossing right-left, flight level 1-0-0*." This TI was acknowledged by the 4-ship formation leader. At this point the GR4 formation was descending to FL100; the F-15E was 9.3nm SE, squawking A7000, indicating FL101, in a right hand turn passing through NE.

At 1421:12, LJAO NE amended the lead GR4 pair's descent instruction to descend to FL90 and then, at 1421:44, re-confirmed with the subject trailing GR4 pair the instruction to descend to FL100. At 1421:27, LJAO NE transmitted a request to unrelated traffic to restrict their manoeuvring for coordination with civil traffic outbound from Norwich.

At 1422:04, LJAO NE commenced a radar handover of the lead GR4 pair with Marham, however, it is clear from the subsequent landline conversation, that LJAO NE believed that they were handing over both pairs of the formation. During the handover, at 1422:39, Marham APP pointed out the F-15E traffic to LJAO NE as, "*traffic left..11 o'clock, 5 miles, crossing left-right, flight level 1 hundred, non-squawker*." At this point, the F-15E was 6.5nm E of the lead GR4 pair, indicating FL98, in a right hand turn passing through SW. LJAO NE replied that, "*that traffic has been called*" however Marham APP asked, "*to both flights has it*?" LJAO NE then passed TI on the F-15E to the subject GR4 pair at 1422:53 stating, "*traffic east 5 miles manoeuvring indicating flight level 1 hundred*." The leader of the subject GR4 pair replied 5sec later that, "[No3 GR4 pair C/S] *flight is looking,* "[No3 GR4 pair C/S] *flight is levelling flight level 1-0-0*." At this point, the subject GR4 pair was descending through FL107, with the F-15E 4.3nm ESE indicating FL96, continuing the right hand turn through WSW. LJAO NE informed Marham APP that the, "*traffic had been called and he* [the subject No3 GR4 pair] *is levelling flight level 1 hundred*." Marham APP replied at 1423:05, "*okay,* [GR4 formation C/S] *are you handing him over as well*?" LJAO NE then repeated the previously passed handover details and was involved in the handover until 1425:12. No further TI was passed by LJAO NE to the GR4 formation.

Following receipt of the TI, the crew of the subject No3 GR4 pair can be heard on the HUD tape discussing the TI on the intercom and had visually acquired and identified the F-15E. The GR4 crew reported that 'there was no immediate collision apparent…but the closure rate quickly increased.' At this point at 1423:11, as the subject GR4 pair descended through FL104, one crew member said, "*he's coming right for us*." The F-15E was 2.4nm ESE, indicating FL096, turning through W. None of the GR4 crews reported to LJAO NE that they were visual with the F-15.

At 1423:16, the F-15's SSR code changed to A7002 and the ac had climbed to FL100. The subject GR4 pair was 0.8nm WNW of the F-15E at FL101. Based upon the F-15E pilot's report, it is likely that the climb to FL100 accords with the 'check right and slight climb' that they referred to in their

report having gained tally on the lead GR4 pair. The next sweep of the radar at 1423:24 displays the F-15E with no Mode C and it is likely that this was as a result of the 'abrupt climb' that was initiated having sighted the trailing GR4 pair. This suggests that the F-15E initiated the climb at about the CPA, which accords with the GR4 pilot's report. The CPA occurred, in between sweeps, at about 1423:20 with the incident GR4 pilot reporting 200ft lateral separation.

From the F-15E crew's perspective, they appear to have visually acquired the lead pair of GR4s relatively late (approximately 0.8nm lateral separation) and acquired the subject trailing pair very late. From the GR4 formation's perspective, they were able to utilise the generally accurate TI at 1422:53 to visually acquire the F-15E reasonably early. An aggravating factor in the timeliness of the GR4 formation's avoiding action was the high closure speed of the 3 ac, which resulted in reduced safety margins.

From an ATM perspective, the handover between LJAO NE and Marham APP had become protracted and, arguably, this distraction led to LJAO NE not providing a further update to the TI to the GR4 formation. However, they had previously provided TI at 1420:59 and 1422:53, which the GR4 pair had utilised to become visual with the F-15. Notwithstanding that LJAO NE was unaware that the GR4 formation was visual with the F-15E, the lack of a further update between 1422:53 and 1423:20 was consequently neither causal nor contributory to this Airprox. Moreover, given the closing speeds of the ac, any additional update to the TI would have occurred very close to the time of the CPA and would therefore arguably have been of nugatory value. That said, given LJAO NE's response at 1422:50 that, "*that traffic* [the F-15] *has been called*" it appears reasonable to argue that they had not planned on providing updated TI, despite the changed geometry between 1420:59 and 1422:53. On that basis, it may have been the intervention by Marham APP that caused the updated TI to be passed at 1422:53, facilitating the subject GR4 pair's visual acquisition of the F-15.

THE GR4 PILOT'S UNIT commented that following the Airprox a meeting was convened to follow-up initial information exchange of the incident. The aim of the meeting was to identify 'quick wins' that could be implemented locally which might reduce the risk of a similar incident occurring.

It is recommended that the following is briefed locally to provide 'quick win' risk reduction:

> F-15E ac utilise a hold based on CGY 105/27-32 2000'-8000' (above airspace previously designated as PMR 225B). Ac squawking A7000 in this hold are likely to be preparing to enter PMR 225 or D207 and switching RT between LATCC (Mil)/Lakenheath and Holbeach AWR Control. Aircrew and controllers are to be aware that traffic in this hold may not be under a radar service and crews are likely to be task focussed on pre-range entry procedures.
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> F-15E ac regularly use Wash ATA (N) and ATA(S) for BCM prior to recovery to Lakenheath. These areas represent areas of high intensity activity as they lie on the recovery track from the North for Marham RW24 and climb out North from RW06. Additionally, AARA 8 also lies within this airspace. Aircrew and Controllers are to be aware that there is regular activity in ATA (N) and ATA(S) and that radar contacts may be engaged in high energy manoeuvres below airway Y70.

It is recommended that 1 Gp STAR task relevant agencies to investigate the following:

> Current weapon release profiles for both GR4 and F-15E require ac to operate outside the protection of D207 and D307. This currently results in ac conducting high energy manoeuvres in Class G airspace without an ATS. This puts GA traffic at risk as they transit close to D207 and D307. It also conflicts with regular routeings of both GR4 and F-15E traffic transiting N/S to and from respective airfields. It is recommended that dimensions of D207 and D307 are re-examined and changed to better reflect weapon profiles for Holbeach and Donna Nook AWR. Consideration of RAF Marham IFR patterns (including TACAN hold) must be included. Initial discussions suggest a staggered 10nm upper radius would provide protection.

Confirmation is required whether London Mil can provide and operate a discreet frequency for ac positioning or operating in D207 and or D307, that will allow them to monitor a Traffic Service for factor traffic. F-15E ac are able to utilise up to 3 radio frequencies simultaneously which will allow them to use AWR, in-house tactical and LATCC (Mil) frequencies. GR4 are unable to utilise more than 2 frequencies simultaneously. Investigation and analysis is required to establish if formation range profiles can be managed using the AWR frequencies for in-house tactical and Range Control aspects whilst maintaining a listening watch on a LATCC (Mil) discreet frequency.

HQ AIR (OPS) comments that the incident occurred in Class G airspace in the vicinity of the Wash Air Weapons Range Danger Areas. TI from the LATCC (Mil) controller allowed the GR4 crews to gain visual with the F-15E in good time, although they did not initially react which probably caused the Airprox to be more severe than if they had taken earlier action.

Of further note, Marham Ops Sqn inititiated an investigation into this incident; the report has been made available to the UKAB. The report gives details of extra deconfliction measures that have been put in place since this incident which should reduce the likelihood of re-occurrence. HQ Air supports the recommendations made in the report.

USAFE-UK comments that Lakenheath ac routinely hold prior to using Wainfleet on CGY 105/27-32 or, in the event of an adverse sea state, over land to the S of that position. Notwithstanding the TI that LATCC (Mil) passed to the GR4s, the decision to keep the second element of the GR4 formation at FL100 in the vicinity of unknown traffic orbiting at the same level is surprising.

USAFE-UK supports the recommendations made as a result of the meeting between Marham and Lakenheath.

PART B: SUMMARY OF THE BOARD'S DISCUSSIONS

Information available included reports from the pilots of the No3 GR4 and F-15E, transcripts of the relevant RT frequencies, radar video and HUD recordings, reports from the air traffic controllers involved and reports from the appropriate ATC and operating authorities.

Whilst the reporting No3 GR4 pilot was plainly part of a 4-ship formation the Board considered this Airprox to be between the Nos 3 and 4, ie the rear pair, and the F-15.

For their part, the F-15E crew were operating VFR in an unofficial hold in Class G airspace without the benefit of a ground-based radar service, but equipped with a capable AI radar. However, having been cleared to enter D207 and preparing for air-to-surface weapon events, they were probably focussed on their pre-range entry procedures and may not have been operating their AI radar in an air-to-air mode. The F-15E crew were plainly relying on the principle of 'see and avoid' to fulfil their responsibilities to remain clear of other traffic but the Board noted that the F-15E crew changed their SSR code to A7002, which was displayed on the radar sweep recorded immediately before the Airprox occurred. This was barely moments before the contacts merged and perhaps indicative of at least one of the crew being heads-in at a critical moment. The F-15E pilot's comprehensive account reveals that his attention had been captured by the leading pair of GR4s as they crossed ahead and cleared to port and the HQ Air (Trg) Member perceived that he had concentrated on avoiding the leading GR4 pair whilst at that point oblivious to the greater threat posed by the trailing pair. Noting that the F-15E crew were responsible under the RoA to 'give way' to the GR4s to their R, it was apparent from the pilot's laudably frank report that he had gained visual contact with the trailing GR4 pair approaching from his starboard side at a late stage, moments after his WSO had spotted them and so had immediately pulled straight back forcing an abrupt climb to avoid them. The Board considered that this was an occasion when the WSO should have directed the pilot into avoiding action rather than providing information. Nevertheless, the Board agreed that this late sighting by the F-15E crew was part of the Cause.

The LJAO trainee first passed TI on the F15E to the GR4 formation as, "*traffic 12 o'clock..8 miles, crossing right-left, flight level 1-0-0*", whilst the F-15E crossed ahead, in a right hand turn passing through NE and on the northern half of its orbit as it turned out. Whilst some thought the controller could have been more descriptive in his TI - perhaps emphasising that the unknown ac was in a R turn could have been more helpful – it did generally paint a satisfactory picture and no update was requested. The Board discussed the apparent lack of appreciation by LJAO NE that the F-15E was holding waiting to enter D207. Controller Members recognised that the F-15E was an unknown unpredictable contact squawking the general conspicuity code of A7000 and operating in Class G airspace. Without local knowledge, it was not until the F-15E crew selected A7002 [Danger Areas General] moments before the Airprox occurred that LJAO NE might have perceived that this was traffic about to enter D207. Had the LJAO controllers known that the A7000 squawk was an aircraft holding before range entry they might have appreciated that it would remain at FL100 and avoid using this level for the GR4s. As it was, when the GR4 formation was split into two pairs, the trainee controller elected to stop-off the rear pair at FL100 – the same level indicated by the F-15. At that stage LJAO NE should have detected that the F-15E was in a RH turn but the direction it would subsequently take back toward the formation would not have been clear. With the clarity of hindsight, it might have been appropriate to have continued the descent to FL80 and FL90 respectively, but the LATCC (Mil) Area controller Member emphasised the general demarcation between area control and terminal ATC of FL100. LJAO NE would have been keen to hand-off the GR4s to Marham as quickly as possible as they descended into the realms of terminal ATC airspace where Marham would have a much better grasp of the traffic at these levels. Conversely, Marham ATC was undoubtedly making sure that LJAO NE had called all the relevant traffic in the area before they accepted control of the two pairs, but the handover was far more protracted than the norm, increasing the controllers' workload and lasting over 3min. BM SM noted that the updated TI was passed at the request of Marham ATC. This TI on the F-15E to the subject GR4 pair was passed about 28sec before the merge, "*traffic east 5 miles manoeuvring indicating flight level 1 hundred";* the range given was undoubtedly accurate at 5·4nm but in one pilot's view the phrase "*manoeuvring"* did not help the two GR4 crew's appreciate what the F-15E was doing and did not 'paint' a complete 'picture', which is important. Nevertheless, it should be remembered that area radar controllers are usually viewing a 120nm range display with a data update rate of 6-8secs and a wide traffic split across the country, therefore it can be difficult to determine what is happening at close quarters. The Board accepted that under the TS being provided to the No3 & 4 GR4 pair, LJAO NE had fulfilled their responsibilities to call in TI on other observed traffic and it did ensure that the GR4 crews were looking in the right direction enabling them to spot the F-15E at a range of 5nm, the No3 pilot reports.

Pilot Members pointed out the high closure-rate, with the interval from the No3 pilot's acknowledgement of the TI to the merge little more than 25sec. The radar recording did not show clearly the relative juxtaposition of the GR4 and F-15E at close quarters, with no Mode C shown for several sweeps afterwards because of the robust avoiding action undertaken by all concerned, however, the Board had the added benefit of the HUD recording helpfully provided by the No3 GR4 pilot. This was viewed by the Board and provided graphic evidence of this encounter; the recorded RT/intercom reveals that both the No4 and No3 crew had seen the F-15E, but in the Board's view they had not immediately assimilated the 'threat' or how close it was. The No3 GR4 pilot had commented on this aspect himself stating that no immediate collision risk was apparent so no avoiding action was taken until the relative aspect and geometry became clear. When the No4 crew recognised the F-15E was heading towards them they broke away. Recognising the No4 would be looking towards his leader in formation, fast–jet pilot Members were surprised that a crewmember was not instructed to 'padlock' the F-15E, thereby ensuring that it was monitored continuously. Following the No3 pilot's realisation the F-15E was heading straight towards them at close quarters, the HUD recording revealed that the conflict was 'broken' by the No3 jinking L before breaking R and down away from the F-15E as the latter climbed straight ahead. However, the HUD recording showed the F-15E pilot's climb was only taking effect as it crossed through the No3 GR4's nose and it was the No3 GR4's L turn that was most effective at close quarters. Debating these points at length the Board finally concluded that the other part of the Cause was late avoiding action by the F-15E crew and the No3 GR4 crew. Whilst the HUD recording only showed the F-15E for a very short period as it crossed ahead and above, it was of great assistance to the Members in their assessment of the inherent Risk where the Board was fairly evenly divided. Some Members perceived that at

close quarters at these speeds the safety of the three ac involved had not been assured and listening to the RT and intercom on the HUD recording in isolation certainly supported this view. The Board debated whether earlier avoiding action could have been taken and noted the HQ Air (Ops) comment that the No3 and No4 GR4 crews did not initially react which probably caused the Airprox to be more severe than if they had taken earlier action. However, the HQ Air (Trg) fast-jet Member emphasised that the GR4 crews had seen the F-15E and taken effective avoiding action, the No4 breaking away before the No3 turned L to 'break' the conflict. Other civilian pilot Members accepted this view and by a majority vote it was narrowly concluded that the No3 GR4 pilot's avoiding action had effectively removed the actual Risk of a collision.

The Board was encouraged by the proactive stance of the crews' Units in calling a meeting to discuss the Airprox and their desire to quickly learn from this occurrence. The HQ Air (Ops) Member reported that a meeting had been convened to follow-up the recommendations made to HQ 1 Gp STAR including an examination of the dimensions of the AWRs. However, it was important to stress that look-out was the lesson here, not further segregation of airspace in a benign training environment that does not reflect current scenarios in operational situations.

PART C: ASSESSMENT OF CAUSE AND RISK

Cause: A late sighting by the F-15E crew and late avoiding action by the F-15E and No 3 GR4 crews.

Degree of Risk: C.