

BOARD OF INQUIRY FINAL REPORT DATED 20 JUN 06

**AIRCRAFT CRASH – LYNX AH MK 7 (XZ614)
OF 847 NAS IN BASRA, IRAQ 06 MAY 06**

References:

- A. Commander JHC Board of Inquiry Convening Order dated 07 May 06.
- B. QRRN (BR 2) Revised 1989 Chapters 53 and 57.
- C. JSP 551 Edition 1, Change 3 dated 01 Nov 05.
- D. JHF(I) Flying Order Book Edition 3, Change 2 dated 20 Mar 06.
- E. CHF Lynx Det (847 NAS) SOPs, Amendment 8, Issued 05 Feb 06.
- F. MASU Confirmation of Categorization Signal SIC HEL/H8C/IRL/O3A DTG 161501Z May 06.
- G. Royal Navy Pilots Flying Log – Lt Cdr D A Chapman RN.
- H. Army Aviation Pilots Flying Log – Capt D I Dobson AAC.
- I. Royal Navy Aircrew Flying Log – Mne Collins.
- J. Annex A to Chapter 87 of QRRN (BR 2) Revised 1989.
- K. Annex Q to Chapter 090 of AGAIs Volume 3 Issue Number 137.
- L. Annex 36A to QRRAF (Fifth Edition) AL 13.
- M. Dst/AWSP/609285/8 dated 08 Jun 06 – Lynx Mk 7 – Basra Incident on 6 May 06 – Preliminary Report to the BOI.
- N. TES(G)/060585/1.15/15650.1/MIG dated 13 Jun 06 – Interim report on the Investigation of the Embedded Fragment Within the Fire Bottle Ex Lynx XZ614.
- O. Service Deviation LX7/144 Issue 12 Missile Approach Warning System (MAWS) and Countermeasures Dispensing System (CMD5) dated 23 Feb 06.
- P. AP101C-1307-14B Issue 2 dated Feb 06 – Weapons, Avionics and Role Equipment Flight Reference Cards.
- Q. JSP 550 Edition 1, Change 3 dated 01 Nov 05.
- R. APC101C-1301-15 AIL 7/05 – Aircrew Manual Defensive Aids Suite Leaflet.

INTRODUCTION

1. On Sat 06 May 06, a Lynx AH Mk7 XZ614 (call-sign XXXXX) of 847 Naval Air Squadron (NAS) Detachment (Det), assigned to the Joint Helicopter Force (Iraq) (JHF(I)) based at Basra Air Station (BAS), was conducting a local area recce overhead Basra city. The aircraft exploded in mid-air and crashed onto the rooftop of a residential building in the centre of Basra. The 5 occupants of the aircraft were fatally injured. There were no immediate fatalities on the ground, however the incident sparked local unrest and there were reports that several civilians died during the resultant rioting. The initial accident signal is at **Enclosure 2**. A Naval Board of Inquiry (BOI) was convened on Sun 07 May, under the authority of the Commander Joint Helicopter Command (JHC) (Reference A), to conduct an investigation into the circumstances surrounding the crash.

METHODOLOGY

2. Following briefings from the Convening Authority and a FLEET legal advisor the Board flew immediately to BAS and spent 6 days interviewing key witnesses, visiting the

crash site, witness locations and gathering additional evidence in theatre. Simultaneously, a technical investigation team from the Royal Navy Flight Safety and Accident Investigation Centre (RNFSAIC) commenced a preliminary technical investigation of the crash site and wreckage, which had been recovered to a hangar at BAS. On return to the UK the Board reassembled at the RNFSAIC at Royal Naval Air Station (RNAS) Yeovilton on Mon 15 May 06 and sought advice from Subject Matter Experts (SME) as required. The Board conducted the Inquiry in accordance with References B and C. A list of abbreviations and acronyms is at Annex A.

NARRATIVE OF EVENTS

3. The following table summarises key events and is compiled from witness statements, the aircraft Form 700, the JHF(I) Tactical Supply Wing (TSW) refuelling log and various Ops and ATC logs:

Fri 05 May 06 (all timings local (D))

Time	Event
1700	Crew take over 'Lynx 2' duty for the next 24 hr period.
1717	Lt Cdr Chapman (Aircraft Captain) signs out Lynx XZ614.
1800	XZ614 departs on Lynx 2 sortie.
2045	XZ614 returns from sortie.
2200	Lt Cdr Chapman visits Bde G2 cell with
2245	Lt Cdr Chapman returns from Bde and retires to bed.

Sat 06 May 06 (all timings local (D))

Time	Event
0803	Lt Cdr Chapman signs out XZ614.
0830	XZ614 lifts for rotors running refuel.
0840	XZ614 conducts rotors running refuel at JHF(I) refuel point, then departs on Lynx 2 sortie (search in local area).
1010	XZ614 returns from sortie and refuels at JHF(I) refuel point.
1020	XZ614 repositions to Lynx dispersal and shuts down.
1045	XZ614 signed back in by Lt Cdr Chapman to allow LX/B6A320 and LX/B6A321 magnetic probe samples to be taken.

before crashing onto a rooftop in a position approximately 500m SW of the OSB. The estimated route of the aircraft from BAS to SAAH to BP to the crash site is shown at Annex B.

7. The Crash. Evidence from witness statements suggested that whilst overhead grid reference 38R QU 716788, a mid-air explosion occurred emanating from the starboard rear quarter of the aircraft, between the fuselage and the tail pylon [A350/351, A599, A615]. This partially severed the tail cone leaving it loosely attached to the fuselage [A599,A355]. The aircraft was engulfed by a fireball and plummeted to the ground, impacting at grid ref 38R QU 71147883. The main fuselage struck and was held by a reinforced concrete roof with the aircraft wreckage orientated facing an ESE'ly direction (Site 1). Much of the cockpit was severed at the point of impact with the building and fell a further 2 floors to a narrow enclosed alleyway below (Site 2). It is suspected that shortly before or during impact the tail cone fully separated from the fuselage. It came to rest on the roof of a separate building 3 metres in front of the fuselage (Site 3). This was the only area of the crash site not to burn. A diagrammatic representation of the crash site is at Annex C whilst photographic evidence is presented at Figure 1.



Figure 1 - Photographic Evidence of Crash Site

8. Suspicion of Hostile Attack. Further evidence submitted to the Board suggested that the aircraft was subjected to hostile attack from the ground. The main evidence centred on witness statements describing an object hitting the starboard side of the helicopter from

the N, the nature and violence of the airborne explosion, noises heard prior to the aircraft explosion, witness statements detailing observed potential weapon firing points and smoke trail(s), and finally forensic evidence taken from the aircraft wreckage. The main evidence is summarised below concentrating on 5 principal areas, namely: the route and height of the aircraft; the airborne explosion; the potential firing point; smoke trail evidence linking the two and the crash site itself.

9. Route/Height/Airspeed of Aircraft Immediately Prior to the Crash. An estimation of the route followed by the aircraft, between BP and the area of the airborne explosion, is presented at Figure 2.

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Figure 2 - Estimated Route of Aircraft

XZ 614 departed in a NE'ly direction from BP XXXXX transitioning low level over a line of street lights before turning left and routing, still low level, NW'ly up the Shatt Al Arab river [A117, A146, A154, A201]. Shortly thereafter, whilst approaching the bridge abeam XXXXX, the pilot executed a rapid climb to an estimated height of between XXXXXXXXX ft above ground level (agl) (see Annex D for explanation of calculations based on witness evidence) and, after levelling, turned left onto a more W'ly heading [A117, A146, A154, A201]. Evidence suggests that the aircraft followed a SW'ly track just to the S of a

tributary linking XXXXX to XXXXX [A369] passing to the S of the OSB (XXXXX). The aircraft maintained approximately level flight at medium level (estimated as approximately XXXXX ft agl) [A158, A191]. Immediately prior to the airborne explosion, the aircraft was observed by 2 witnesses to manoeuvre, including a bank to the left, but the degree of manoeuvring or the angles of bank achieved are not clearly defined [A603, A630]. During this period the aircraft's speed was described as both 'slow' [A595] and 'hovering' [A168]¹. Following recovery of the wreckage, the investigation focused on the technical evidence provided by the heading indicator, the radalt indicator and the Ground Speed and Drift Indicator (GSDI) as shown in Figure 3.

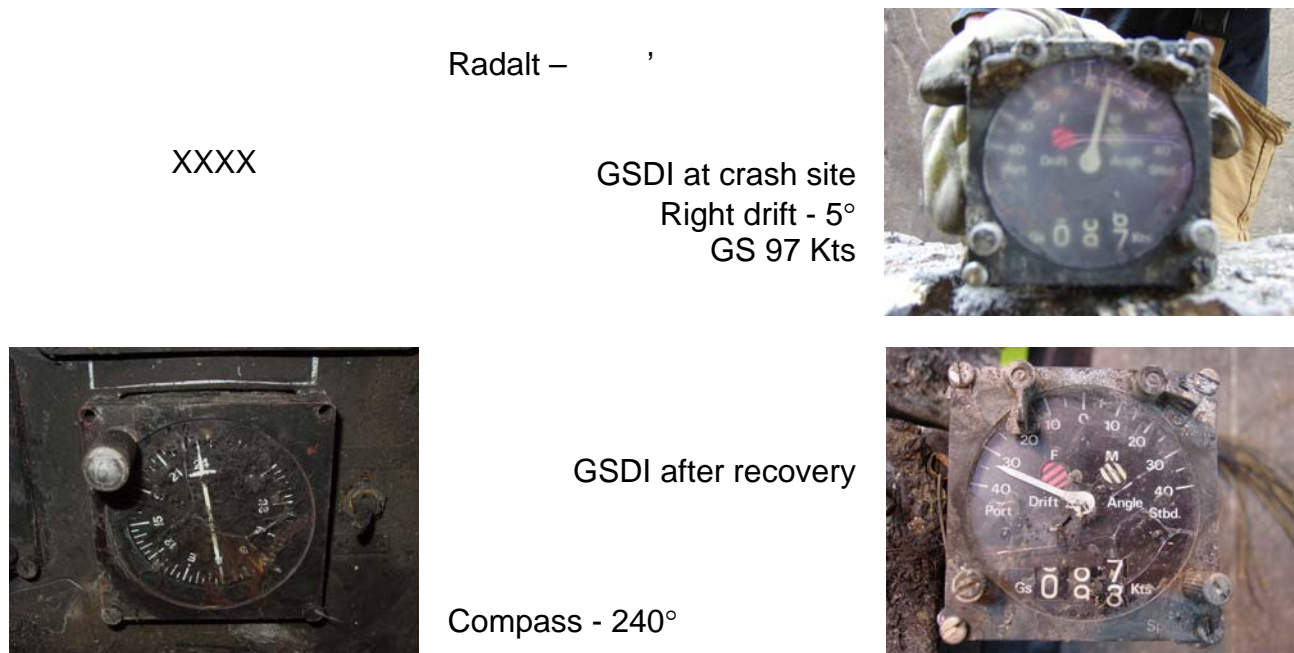


Figure 3 - Flight Instruments Recovered from Wreckage

Advice from SMEs [RNFAIC (Field) Report – Enclosure 1] highlighted that these instruments are likely to have frozen at their indications at the time of the airborne explosion, showing that the aircraft was heading approximately 247°, at a height of approximately XXXXX ft agl and a groundspeed of approximately 98 kts (representing an airspeed of approximately 110 kts into a headwind of 12 kts).

10. Airborne Explosion. Witnesses at the SAAH [A271, A454a] recalled seeing the airborne explosion in their peripheral vision from the hotel, some 9 km to the N of the event. Witnesses from the OSB saw it almost directly above them [A595], and witnesses also viewed the explosion from BP [A118, A146, A164] some 3½ km to the SE of the event. Witnesses from BP all heard an explosion and then saw the aftermath in the form of a fireball, as did further witnesses from the OSB [A356, A393]. All witnesses described a fireball with black smoke plummeting in an uncontrolled manner to the ground broadly from E to W in an area to the S of the OSB. While all witnesses stated that the

¹ Due to the distances from which the witnesses were observing the aircraft, and the aspect presented to the viewer, the aircraft may have appeared to be moving slowly, but was unlikely to have been flown below 60 to 70 kts at any stage and certainly would not have been hovering at altitude.

rotating only very slowly at the point of impact with the ground **[RNFSAIC (Field) Report – Enclosure 1]**.

14. Post Crash Management. The crash site was confined to 3 principal areas; Site 1 contained the main fuselage, MRGB and engines on one reinforced concrete roof, Site 2 contained the cockpit in the base of a narrow alley and Site 3 contained the tail cone and TRGB on an adjacent similar roof on the other side of the alley **[Annex C]**. There was evidence of wreckage on the ground beneath the point of the initial explosion but the local population largely collected this wreckage with only a few pieces recovered by the investigators. Following the crash, the fuselage and cockpit section were ablaze, while the tail section was not. The strength of the building's roof withheld the impact within a 1.2 m deep crater. Basra City Battle Group (BCBG) were informed of the crash within 5-6 minutes of the event **[BG Comd Net radio log – Enclosure 9]**, and quickly deployed to the area. The local authorities were the first on the scene and the Iraqi Fire Service extinguished the fire within approximately 45 minutes **[BP CCTV – Enclosure 10]**. At around the same time an inner and outer cordon was established by MND(SE), although there had been plenty of opportunity for local access to the wreckage **[Local TV news footage – Enclosure 11]**. Throughout the recovery phase, the cordon troops were subjected to sniper and mortar fire as well as blast and petrol bombs. Sizeable aggressive crowds continually harassed them, however they maintained the cordon throughout the night. This followed advice from JHF(I) Command that recovery of the wreckage would be crucial to the subsequent investigation and, more importantly, recovery of the bodies was essential. During the incident BCBG troops defended themselves with both baton rounds and small arms fire. Some UK military personnel sustained minor injuries and several civilians were reported killed in the post-incident riot.

15. Injuries. The 5 persons on board were fatally injured. There were no civilian injuries (directly attributed to the crash). The pathologist's report was not available at the time of writing this report, but pathological details will be referenced in the RNFSAIC final technical report. However, the extreme violence of the aircraft explosion, fire and subsequent high-g near-vertical impact resulted in this crash being considered unsurvivable.

16. Aircraft Damage. The damage to the aircraft is consistent with an explosion, a high-speed vertical impact and intense fire. The initial explosion is considered to have occurred within the rear electrical bay, and there is considerable evidence of fragmentation damage to the aircraft emanating from this area **[RNFSAIC (Field) Report – Enclosure 1]**. XZ614 was categorised as Cat 5 (Scrap) at Reference F.

17. Building Damage. The aircraft came down on top of a 2 storey Iraqi residential dwelling. The roof of the building (described here as floor 3) was constructed from steel reinforced concrete. The aircraft had partially penetrated the roof and was held in place by the steel reinforcing bars. Damage was sustained to the roof, a first floor room and ground floor windows. HQ MND(SE) is liaising with the owner of the building in accordance with local procedures.

18. Salvage and Recovery Details. The roof was at third floor level and the narrow alleyway had no direct street access to it, making physical recovery of the wreckage extremely challenging. The severity of the local situation meant that an initial decision was

taken to recover man-portable wreckage only, as there was a risk that the cordon would be over-run. The RAF Fire Immediate Response Team (IRT) from BAS arrived on site at 2100 and, with the Royal Engineers (RE) and an 847 NAS engineering downbird party, proceeded to cut the wreckage into manageable sections for quick recovery using oxyacetylene torches and XXXXX hydraulic cutting equipment **[A01, A567]**. Preparation continued until 0400, when a lighting failure forced work to cease. Throughout the morning of Sun 07 May the aircraft parts were lifted from the 3 principal sites with considerable difficulty by both hand and by RE crane and recovered by road to a disused hangar at BAS. Although huge efforts were made to recover as much wreckage as possible, some of it was removed by local Iraqi members of the public **[Local TV news footage – Enclosure 11]** and many smaller pieces were left unsecured at the site following the collapse of the cordon during the afternoon of 07 May. A further inspection of the crash site by the Board, accompanied by the RNFSAIC team, on 11 May 06 revealed significant quantities of smaller pieces of wreckage throughout the crash site. The RE were then tasked to remove all of the remaining wreckage for further analysis. The crash site was open to contamination and interference from the outset².

BACKGROUND DETAILS

19. Aircrew Details. The crew was properly constituted and they were all fit, well rested and fed prior to the sortie. There is no evidence to suggest any personal or professional distractions from the task in hand. They were all current in all relevant respects (References G, H and I), the exceptions being minor anomalies considered by the Board to have no bearing on the circumstances leading to this crash.³ Specific aircrew details are contained in Annex G.

20. Seating Positions. The aircraft was fitted in a conventional layout with the 6-man seat aligned longitudinally and the 3-man seat athwartships. The crew positions were not confirmed by eye-witnesses but the Board surmised that the positions, (based on Lynx SOPs and the photographic evidence taken from BP just prior to the crash), were as follows: Lt Cdr Chapman (Aircraft Captain) in front LHS, Capt Dobson (handling pilot) in front RHS and Mne Collins (Air Door Gunner (ADG)) in the cabin, port side, secured by a dispatcher's harness. The passenger locations were: Wg Cdr Coxen seated in the forward stbd position on the 6-man seat and Flt Lt Mulvihill seated on the aft stbd position of the 6-man seat **[Person I photo – Enclosure 8]**.

21. Duty Status of Service Personnel. As all 3 Services were represented on board the aircraft, the Board investigated the categorisation of duty status from a tri-Service perspective. The categorisation was found to be identical for all 3 Services as defined in the Annexes at References J, K and L. The key paragraph of each of the Annexes is paragraph 1, which details 'activities directly or indirectly relating to Service functions or responsibilities'. Paragraph 1a further defines a person as being on duty if they are 'performing a specific function required by the Service'. The Board concluded that the 3 crewmembers and CO JHF(I) (Desig) were all covered by this definition and they were

² Whilst it is possible that recovery of all the pieces of wreckage from the aircraft may have provided additional evidence, it is considered unlikely that this would have impacted on the Board's overall findings.

³ There is no record of 'reversionary night approaches to recognised aids' for either pilot, as required by JHC Orders, and the Aircraft Commander was 25 minutes short of his rolling 3-monthly General Flying Practice (GFP) requirement of 3 hrs.

therefore all on duty at the time of the crash. The Adjt of JHF(I)'s status is covered by paragraph 1b of the Annexes in that 'her presence was necessary but she was not performing specific Service functions' and therefore, she was also on duty. Consequently all personnel on board XZ614 were on duty at the time of the crash.

22. Weather. Conditions were good and typical for the theatre at the time of day; the surface wind was forecast light NW'ly, although it was more SW'ly at the crash site [A74]. There was broken high-level cloud and nil weather. Visibility was approximately 20 km and the temperature approximately +35°C. The weather was suitable for the task as briefed. A summary of the weather conditions at the time of the crash is presented at **Enclosure 6.**

23. Aircraft Information and Maintenance History. XZ614 had undergone significant maintenance work in the weeks preceding the crash [A562]. In particular, a cracked stringer had resulted in a Mobile Aircraft Support Unit (MASU) team deploying to theatre to carry out a repair and the tail boom was removed and refitted to facilitate this. On rebuild, both engines were rejected and a double engine change carried out. Following the crash the MoD F700 was impounded by JHF(I) and the maintenance documents pack was submitted to RNAS Yeovilton Quality Assurance (QA) Department for detailed analysis. The aircraft documentation was generally to a very high standard and there were only minor issues raised (as might reasonably be expected) following a thorough QA [Enclosure 12].

24. Aircraft Role Fit. The aircraft was fitted with the following modifications relevant to the theatre of operations (further details can be found in Annex H):

- a. XX
- b. Mod 5086/5559 sand filters.
- c. XX
- d. XXXXXXXX Missile Approach Warning System (MAWS).
- e. XX
- f. SM/Lx/1020 Beyond Line Of Sight (BLOS) communications.
- g. XX

25. Communications in Theatre. XXXXX had communicated with the JHF(I) Ops room on their primary VHF FM frequency. They had also received a Flight Information Service (FIS) from Basra Approach through VHF. The aircraft was fitted with BLOS, although this had not been tested during this particular sortie. It is unknown whether the crew were talking to other agencies prior to the initial explosion. The ground stations heard no MAYDAY call and there were no other aircraft from JHF(I) airborne at the time.

26. Air Threat. JHF(I) Intsums in the weeks preceding the crash showed no change to the perceived threat to their assets.
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e. MAWS/MANUAL Switch. The switch is located to the left of the MAWS CIU.
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XXXXXXXXXX

f. The Counter Measures Dispensing System (CMDS).
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XXXXX. The CMDS is controlled manually or automatically to launch decoy chaff
and flares XXXXXXXXXXXXXXXXXXXX when a threat is detected. The system
comprises the following primary components:

(1) CFDCU. The CFDCU (see Figure 4), fitted in the interseat console,
controls the flares firing sequence in a number of pre-programmed patterns.

(2) Chaff and Flare Dispenser Units (CFDUs). The CFDUs are mounted
on the rear of the aircraft's skids. There are 2 'bins' on each
side,XX
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XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

(3) FLARES ARM Switch. The FLARES ARM ON/OFF switch, mounted
on the centre console immediately below the CFDCU, inhibits flare firing at
OFF and enables firing at ON.

(4) Physical Evidence of DAS XXXXXXXXXXXXXXX. The MASS was
recovered from the wreckage
XX. The panel
supporting the FLARES ARM ON/OFF switch was recovered from the
wreckage.
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The CFDCU panel was also recovered from the crash site in a badly
damaged state
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33. At the time of writing this report, the MAWS/MANUAL switch panel had not been
found amongst the wreckage.

34. XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.
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a. XXXXXXXXXXXXXXXXXXXXXXXXXXXX.
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passenger flying in a threat environment⁶. The Board concluded that Command guidance on the carriage of passengers in such circumstances was inadequate and relevant guidance would be beneficial to in-theatre commanders. Therefore, the Board recommends that this issue should be addressed by JHC.

b. Passenger Manifest. The Board noted that there was no passenger manifest recorded within JHF(I) Ops, nor were there any passenger names entered on the Flight Authorisation Sheet (RAF Form 1575B). The Flight Authorisation Sheet for the sortie included only the 3 crewmembers. The authorising officer stated to the Board that the passengers should be detailed on a separate manifest held by JHF(I) Ops [A20]. The Board reviewed the passenger manifest procedures for MND(SE) tasks and found them to be robust, with names being annotated to specific manifests for specific tasks and checked by movements personnel at the HLSs used regularly by JHF(I) assets. However, the Board was unable to obtain a separate passenger manifest for this particular sortie that included the names of Wg Cdr Coxen and Flt Lt Mulvihill. The lack of a passenger manifest was in contravention of Regulation 340.145.2 of Reference Q. Further investigations revealed that for externally generated tasking JHF(I) Ops did maintain a separate manifest as detailed above, but for JHF(I) internally generated tasks there was no clear guidance as to whether passenger details should be entered on the Flight Authorisation Sheet or a separate passenger manifest [A20, A678]. The Board concluded that passenger manifest procedures for internally generated JHF(I) tasks were inadequate. It is recommended that a suitable passenger manifest system should be implemented for all JHF(I) internal tasking, to align internally tasked manifest procedures with the robust system already in place for external (to JHF(I)) tasking.

SORTIE PROFILE

39. Tactical Aspects. This routine sortie was carried out in accordance with the guidance set out in 847 NAS SOP 005 paragraph 8 (Reference E), which requires crews to operate both above and below the threat band. Therefore, JHF(I) assets were flown predominantly at medium level during day tasking, in the height band between XXXX ft agl, which was above the SA and RPG threat band (XXXXXXXX ft agl) and also below the upper operating height for helicopters, (separating them from fixed wing traffic), which was XXXX ft.

40. The Intelligence Picture. J2 reports showed that a
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⁶ The only reference to passenger flying in the JHF(I) FOB is Order 340.108.1.1 which states that, 'CO JHF(I) approves the carriage of all passengers as directed by MND(SE).'

CAUSE

41. Discounted Potential Causes. The following sub-paragraphs detail the Board's deliberations on what *could* potentially have caused the crash but which, for the reasons stated, were discounted:

- a. SA Fire. This was discounted as no automatic fire was heard prior to the explosion. Witnesses saw no tracer. The aircraft explosion was too violent. No evidence of SA attack was found in the wreckage.
- b. Improvised Explosive Device (IED). This was discounted as BAS security is appropriately robust [**Annex I**]. Furthermore, the aircraft had undergone Daily Flight Servicing (DFS) at 060700D May 06 and the crew had loaded the aircraft, therefore several different people had checked it during the course of the morning. The aircraft had already flown that morning without incident and no evidence of an IED was found in the wreckage.
- c. RPG. This was discounted as the aircraft was estimated as flying at a height of approximately XXXX ft agl, which is outside of the threat band for RPG. No evidence of an RPG was found in the wreckage.
- d. UAV Collision. This was discounted as no friendly UAV was reported missing or operating within the area. No UAV was heard or seen by witnesses. UAV flying procedures and deconflictions with manned aircraft operating areas appeared to be adequate to enable separation criteria between manned and unmanned aircraft to be maintained. The violence of the explosion was probably too great for a simple collision. No evidence of a UAV was found in the wreckage.
- e. Artillery. This was discounted, as there is no reported enemy artillery threat or capability within theatre.
- f. Mortar. This was discounted as no mortar fire was heard or seen by witnesses. It is highly improbable that a mortar would be used as an aimed weapon against an aircraft. The conclusion is therefore that it would have been a coincidental impact, which is considered by the Board to be sufficiently unlikely as to be discounted.
- g. Guided Rocket – Command Line-Of-Sight (CLOS). There was no intelligence indicating the presence of a CLOS anti-aircraft rocket capability in theatre. The target profile would not have lent itself to a successful engagement. No command wires were found (indicative of wire-guided CLOS systems).
- h. Unguided Rocket. This was discounted as accuracy is very poor and the likely range would prohibit successful unguided engagement. No evidence of an unguided rocket was found in the wreckage.
- i. Mechanical Failure. Despite the extensive mechanical work carried out on XZ614 in the weeks leading up to the crash, there is no evidence to suggest that the cause of the crash was mechanical failure. This is based on the technical

evidence available at the time of writing this report **[RNFSAIC (Field) Report – Enclosure 1]**. Therefore the aircraft was considered by the Board to be airworthy.

42. Main Cause. Following considerable deliberation based on witness statements and SME advice, (primarily from the AWC and Dstl), the Board concluded that the main cause of the crash was a hostile MANPADS attack. The evidence leading to this conclusion is summarised below:

a. Potential FP. A potential FP was identified through a combination of bearings taken **[Person K Statement – Enclosure 16, A406]** and local knowledge **[A414]**. Its visual signature was reported as being a cloud of smoke at roof top level in the area of XXXXXXXXXXXXXXXX and close to XXXX. Evidence submitted to the Board therefore indicates that the FP was XXXXXXXXXXXXXXXX, although the Board acknowledges that this is based on limited witness evidence only and has not been confirmed by subsequent intelligence information.

b. Smoke Trail. A smoke trail was seen to link the area of the FP observation with the airborne explosion. Two witnesses reported it as a single white smoke trail **[A434, A454]**, while one reported twin darker coloured trails **[A310]**. Two witnesses saw smoke rising left to right from the area of the docks **[A434, A454]**. Only witnesses located to the N of the crash, in the area of the SAAH, reported seeing smoke trails, and this may have been due to their relative position from the potential FP, the position of the sun overhead and the contrast against the background sky. There are no known weapon systems present in theatre that would leave a dark smoke trail, or multiple smoke trails, and there is no evidence of multiple FPs. The Board considered that it is possible that some witnesses may, through ‘memory error’ have ‘coloured’ what they saw in hindsight. It is also possible that the light properties of the day gave the impression of a dark trail. It is further possible that some witnesses mistook the dark trail of the falling wreckage and subsequent billowing of the crash site smoke as a missile trail. The Board therefore considered that the white smoke trail described by most eyewitnesses was likely to have been the white trail of a SAM and that any multiple or dark trails reported would most likely have been due to a systematic error on the part of the witness. Additionally, the smoke trail drawn as ‘going from right to left’ **[A411]** was considered by the Board to be a systematic error based on memory fade.

c. Weapon Effect. There was a large airborne explosion with considerable evidence of fragmentation **[RNFSAIC (Field) Report – Enclosure 1]**. Therefore it is assumed that the weapon had a warhead.

d. Acoustic Signature. Some OSB witnesses reported hearing a ‘whoosh’ followed by a ‘pop’ and then, a split-second later, a loud ‘bang’ **[Annex E]**. Following discussions with SMEs, the Board considered it likely that this was the acoustic signature of a high-speed missile.

43. Discussion on Potential MANPADS Used and Supporting Evidence. The Board considered the evidence available, along with SME advice, in an attempt to identify the most likely MANPADS used during this attack. The following factors were considered:

a. Range. Although most eyewitness accounts of the potential FP focused on XXXXXXXXXXXXXXX, the Board applied a 5° error margin on the bearings taken of the 'ground blast', (based on the graduations and level of accuracy expected from a Silva compass), to generate an 'area of uncertainty' of the potential firing point (see Figure). This placed the potential FP-to-Tgt range as between XXXXXXXXXXXXXXX, as shown in Annex F.

XXXXXXX

Figure 6 - Area of Uncertainty Surrounding Potential FP

b. Firing Solution. Assuming that the potential FP was based XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX, the firer would have been presented with a clear view of the aircraft against an uncluttered background, although the aircraft would have appeared as a very small target above the horizon (see Annex J). The aircraft's initial routing southbound, from the SAAH to BP may have alerted the firer to the possibility of a future engagement. As the aircraft climbed out of BP, approached the bridge abeam XXXXXX and turned to the SW, the firer would have seen an aircraft tracking slowly from left to right, at XXXXXX altitude in level flight, presenting a starboard rear-quartering aspect, as illustrated in Figure . The Board concluded that this provided the firer with a firing solution, notwithstanding the fact that the distance was probably at the extreme range of the likely MANPADS used.

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Figure 7 - 'Firer's Eye View' from Potential FP

c. In-theatre Credible Candidate Systems. The evidence presented to the Board highlighted that candidate MANPADS which may have been utilised in this attack were the following:⁷

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XXXXXXXXXXXX
XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXX

d. Discounted Potential for XXXX. Whilst not wholly discounted as the missile involved, the Board considered that the XXXX was an unlikely candidate missile system for the following reasons:

(1) XXXXXXXXXX.
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XX
XXXXXXXXXX

(2) XXXXXXXXXX.
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XX
XXXXXXXXXX

⁷ Candidate MANPADS systems are based on the DIS-published 'MANPADS Threat to Air Operations in Iraq' (Restricted) dated 7 Sep 05 and advice from the DIS desk officer.

e. Discounted Potential for XXXXX.

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XX.

f. Discounted Potential for XXXXXXXX and XXXXXXXXX.

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g. Conclusion – XXXXXX. Having reviewed all available evidence provided by the agencies at paragraph 29, in particular the fragmentation evidence detailed in Reference N, the Board concluded that on the balance of probability the most likely weapon system used in this attack was

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XXXXXXXXXX.

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44. XXX
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45. Routine DAS Aircrew Switching Procedures. (See Figure 4 - Lynx AH Mk 7 DAS Switches and Controls). Routine DAS switching drills are conducted by the aircrew as part of the start-up or shutdown checks, or as after take-off/departure and pre-landing checks. The MASS, MAWS CIU, IRJ and CFDCU mode selector switches are only normally selected or deselected at the start of the sortie or at the end . A system BIT is carried out as a go/no-go check prior to take off. The IRJ has associated IRJ ON and IRJ INOP captions displayed on the Central Warning Panel (CWP), which confirm that it is either switched on, or undergoing a one-minute cooling down period after being switched OFF.

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recognition, this would be strongly supported by the Board. The Board concluded that PCM was conducted to the highest standard possible under the circumstances.

53. The Board's Appreciation of Assistance Received. The Board would like to acknowledge the considerable and much valued assistance provided by various units and agencies during the investigation into the circumstances surrounding this crash. Despite the tragic circumstances and the traumas experienced in the immediate aftermath, JHF(I) personnel were outstanding in their wholehearted support to the Board and the honesty and clarity of their evidence was noteworthy. All of the Board's requests for support were met quickly and with a minimum of fuss, and the Board would like to formally acknowledge the excellent assistance provided by all JHF(I) personnel involved. Additionally, the support provided by the RNFAIC was exemplary and the advice and technical assistance provided was first class in terms of both content and timeliness. All other agencies consulted by the Board and listed in paragraph 29 provided outstanding contributions, often working long hours during off-duty periods, and their wholehearted assistance was also very much appreciated.

54. Further Technical Analysis. The Board considered that there was significantly more evidence to be gathered from analysis of the aircraft wreckage. It is therefore recommended that technical investigations be continued in order to confirm with greater confidence the likely missile type (explosive residue analysis, metallurgical analysis, weapon parts analysis etc).

CONCLUSIONS

PRINCIPAL FINDINGS

55. Hostile Attack. The aircraft was shot down using MANPADS; the most likely weapon system utilised being the XXXXXXXXX. **[Paragraphs 42 and 43]**
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XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.

56. XXXXXXXXXXXXX.
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57. XXXXXXXXXXXXX.
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58. XXXXXXX.
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XX.

59. XXXXXX.
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XX.

9. BG Comd Net Radio Log dated 06 May 06 (c/s H3Ø).
10. BP CCTV Footage (CD).
11. Local TV News Footage (CD).
12. Yeovilton OCHQ E536/2/7 dated 30 May 06 - Report of Aircraft Documentation – Lynx Mk7 XZ614.
13. XXXXXXXXXXXXXXXX on a Visit to 847 Sqn Det, at JHC Basra From 13 Apr to 27 Apr 06, by {Person J} dated 13 Feb 02¹⁰.
14. 847/J4 dated 30 Apr 06 – XXXXXX Countermeasures Dispensing System XXX to XXX series Upgrade Report.
15. MoD F706A(Lynx)(Army) Weapons and Expendable Stores Certificate Sheet No 13 dated 03 May 06 and 2 locally produced Flare Usage Record Sheets for XZ614.
16. SIB Statement – {Person K} dated 08 May 06.
17. MoD F707B(IS) SNOW 0967 for XZ614 dated 14 Apr 06.

¹⁰ The report is incorrectly dated and should be dated sometime after 27 Apr 06.