



## **1.0 THE CONTEXT**

**1.1 Introduction.** This paper provides an unclassified summary of a series of recent and related reports concerning Royal Air Force (RAF) Puma HC1 helicopters flown within the Joint Helicopter Command (JHC). These reports, which include studies into Puma and the findings from inquiries into accidents, are vital to ensure that incidents, especially those sadly involving fatalities, are fully understood and allow the Ministry to learn and act upon the lessons identified in the investigation process. Many of the detailed reports and associated documentation connected with the subject are classified, principally because they refer directly to current operations and therefore have implications for the safety of serving military personnel. Other sensitive aspects within the reports refer directly to named individuals; these have Data Protection implications. As a result, and in keeping with MOD policy, the normal redaction process has been applied to those documents that have been, or are to be, released into the public domain. However, this can lead to disjointed texts that fail properly to convey the sequence and detail of events. Therefore, this document seeks to provide a clear narrative, allowing the reader to understand the context in which a series of incidents has occurred and the actions taken and planned as a result. Additionally it seeks to set the various reports in the context of the Puma Force of today while also providing an indication of future plans



**1.2 Role of the Puma.** The Puma was acquired by the Royal Air Force in 1971 and is a medium sized Support Helicopter used primarily in the troop carrying and cargo role (internal and external loads) and is capable of carrying up to 16 soldiers in temperate conditions. The crew comprises either two pilots or one pilot plus a navigator, and a crewman. Like other helicopters, performance reduces when operating in high air temperatures and/or at altitude. The Puma fleet currently comprises 34 flyable airframes of which around 26<sup>1</sup> are normally available to the two front line squadrons: No 33 Squadron based at RAF Benson in Oxfordshire and No 230 Squadron at RAF Aldergrove in Northern Ireland. These two

---

<sup>1</sup> This is known as the 'forward fleet'. The balance of the aircraft are either in 'depth' (deep servicing) or are 'sustainment' aircraft which can be used to supplement the overall fleet following the loss of an aircraft.

squadrons form the Puma Force, which is commanded by the RAF Benson Station Commander. The RAF Aldergrove Station Commander is the deputy Force Commander.

### **1.3 Command and Control.**

**1.3.1 Full Command.** The Puma Force is an integral part of the RAF, which exercises Full Command<sup>2</sup> over the personnel within the Puma Force and imbues its ethos and discipline over the units therein.

**1.3.2 Operational Command.** Following the creation in 1999 of the JHC, and along with all other 'battlefield helicopter' assets, the Puma Force became part of this new joint formation. The JHC Headquarters (JHCHQ), based at Wilton, exercises the next level of command - Operational Command<sup>3</sup> - over these battlefield helicopters, including Puma for peacetime duties and training. In essence, this allows the JHC to prepare forces for operations. This role is embodied in Commander JHC, a two-star officer. He derives this authority from his superior (Commander-in-Chief Land Forces) and, in turn delegates, control of day-to-day activity to the Puma Force Commander at RAF Benson.

**1.3.3 Relationships, Transfer and Functional Control.** This command structure means that the Commanders-in-Chief Land Forces and Air Command each have elements of the command responsibility. Furthermore, when deployed on operations, operational command of the aircraft and crews shifts to the Chief of Joint Operations at the Permanent Joint Headquarters based at Northwood, with local authority delegated to the appropriate Aviation Group and Joint Helicopter Force Commander for the theatre of operations. Additionally, for certain other operations, operational command and control is delegated to other military commanders. At all times, Commander JHC retains what is called Functional Control by virtue of his role as the Aircraft Operating Authority<sup>4</sup> – in short, the JHC sets most of the professional standards and rules for operation of battlefield helicopters.



---

<sup>2</sup> Full Command – the military authority and responsibility of a commander to issue orders to subordinates, covering every aspect of military operation and administration.

<sup>3</sup> Operational Command – the military authority granted to a commander to assign missions or tasks to a subordinate commander.

<sup>4</sup> AOA - the military commander of a discrete organization empowered by a Letter of Delegation from the Secretary of State through the Chiefs of Staff to operate specified types of UK Military Aircraft (AOA is a command chain function).

**1.4 Training.** Puma aircrew are selected for flying duties by the RAF and undergo initial training at the Defence Helicopter Flying School (DHFS) at RAF Shawbury. This is a joint organisation that also trains Royal Navy and Army aircrew; much of the early training is common to all three Services. Puma aircrew complete their specific-to-type training within the Operational Conversion Flight which is part of 33 Squadron. Personnel leave this final phase of training qualified as Limited Combat Ready. This allows them to join a front line unit and be capable of deployed operations, albeit in a limited capacity. Following further experience and training within the front line unit, personnel should achieve Combat Ready status within six to nine months, meaning they are trained and capable in all the normal Puma aircrew skills, and pilots can act as aircraft commander on operations.

**1.5 Operations.** Puma aircraft are widely deployable and have supported a variety of operations around the world. In recent times support has been confined to Northern Ireland and operations in Iraq. In the latter, the flying has been in a hot, dusty and dangerous environment with crews regularly experiencing significant tactical threat, and often operating near the limits of the Puma's capability. They have had to make rapid life or death decisions under considerable pressure, and neither they nor their commanders in the field have had the luxury of normal peacetime judgements. Given the success of United Kingdom helicopter operations, it is acknowledged widely that the JHC is, in many areas, the world leader in operational Support Helicopter flying. The Puma Force is in the vanguard of this effort. This, more than anything else, sets the context within which the recent Puma issues are set.

## **2.0 RECENT INCIDENTS**

2.1 There have been no Puma accidents since late 2007; however, during that year, Puma aircraft were involved in three serious incidents. These resulted in the deaths of seven military personnel, and the loss of three airframes; another aircraft was very seriously damaged. The main details of these incidents are as follows:

2.1.1 **15 April 2007.** While undertaking operations in Iraq at night and therefore using night vision devices, Pumas XW211 and XW218 were part of a larger formation of aircraft tasked to deploy troops. As Puma XW218 attempted to land, its rotor blades came into contact with those of Puma XV211 which had just landed. The force of the impact caused Puma XW218 to crash and roll onto its side; there was also serious damage to Puma XW211. The accident resulted in two fatalities (one crewman and one soldier) while a number of other personnel received serious injuries. A Board of Inquiry (BOI) found that the cause of the accident was a misjudgement in the distance between the two aircraft which occurred when they attempted to land close together in a field. Puma XW218 moved backwards towards its intended landing position rather than turning around and re-positioning. This was done because initially, the two aircraft were hovering in the wrong field and both needed to execute a rapid, short re-positioning manoeuvre in order to offload troops at the right location. The BOI made a number of recommendations to prevent a recurrence of such an incident, all of which have either been completed, are being put into

effect or are still being considered. These are listed at Annex A, and the BOI report can be found on the MOD Publication Scheme<sup>5</sup>. At the Inquest into the deaths of Colour Sergeant Powell and Sergeant McLaren, the Coroner for Wiltshire and Swindon returned a narrative verdict.

**2.1.2 8 August 2007.** Puma ZA934 crashed in Catterick while undertaking familiarisation flying and troop drills for new entry soldiers. This incident resulted in three fatalities (one of the pilots, the crewman and a young soldier). A number of other personnel in the aircraft were injured. A BOI was convened to investigate the accident, but was later suspended pending the completion of a civil police investigation. The Crown Prosecution Service has recently decided not to prosecute and the incident is now with the RAF, who are considering the evidence before making a decision on how to proceed.

**2.1.3 20 November 2007.** Puma ZA938 crashed in Iraq during an operation resulting in the deaths of two soldiers and injuries to other personnel. A BOI was completed in early November 2008 and was released to the families of the deceased in December 2008, following the normal redaction process. It has also been made available through the MOD Publication Scheme. The BOI made a number of recommendations: these are listed at Annex B and the majority have already been implemented. The inquest for the two soldiers who died in this incident is expected to be heard in August 2009.

**2.2** In addition to these incidents, there was also one earlier accident on 19 July 2004 when Puma XW221 crashed while making an approach to land at Basra Airfield in Iraq. This resulted in one fatality (the pilot) and the loss of the aircraft. The BOI concluded that the accident was the result of an inappropriate downwind approach to land. On 4 June 2007, at the Inquest into the death of Flt Lt Gover, the Deputy Assistant Coroner for Oxfordshire returned a narrative verdict.

### **3.0 SUBSEQUENT REVIEWS**

**3.1** As a consequence of these incidents, particularly those in 2007, concerns were raised within JHC and the RAF over whether these individual events were an indication of more general shortcomings within the system, perhaps pointing to a wider, systemic problem. These concerns were given some credence by early reports from the BOI investigating the crash of ZA938 in November 2007 which suggested that some deployed personnel may not have completed, or have adequately recorded all of their mandatory pre-deployment training.



<sup>5</sup> <http://www.mod.uk/DefenceInternet/AboutDefence/CorporatePublications/BoardsOfInquiry/>

The overall commitments of the Puma Force were therefore examined in detail and various options were considered to reduce the operational burden.

**3.2 Documentation Review.** The first specific action undertaken was a review in February 2008 of training documentation and records on No 33 Squadron. This review highlighted a number of problems with the recording of training for deploying forces. It also raised some concerns over the standard of routine evaluations conducted on squadron aircrew. A series of recommendations regarding the maintenance of training records were made which were subsequently checked to ensure that action had been taken. Once this short review was complete and following submission of its preliminary report, it was agreed between Land Forces and Air Command that a more in-depth review of the Puma Force was necessary. Having implemented the Documentation Review recommendations, No 33 Squadron has recently been assessed by the internal examination unit as a model of best practice within the JHC regarding the documentation of training.

**3.4 The Puma Review.** This review was launched jointly by the Commanders-in-Chief of Land Forces and Air Command. It was tasked to consider the standard of Puma operations in Iraq in the light of the recent fatal accidents; to identify any systemic factors that may have impacted the force; to consider whether risks to safe operations had been adequately recognised, and to recommend remedial action as required. The review was a wide-ranging study that reached across the Puma Force and explored all aspects in great detail. Due to its detailed examination of the Puma's operational commitments, it is of necessity highly classified in places. The key findings from this work are as follows:

**3.4.1 Technical Aspects.** The Review looked in detail at the technical and safety aspects of the Puma aircraft and concluded that the fleet was airworthy. It also noted that plans are in place to upgrade the aircraft in order to extend it in service until at least 2022. It recognised that the Puma has certain well known design features which require particular aircrew focus. Specifically, the lack of an anticipator device<sup>6</sup> in the engines can result in a slow response and loss of rotor speed if a rapid power demand is made, particularly when heavy. Further, the Review recognised that the Puma's high centre of gravity makes the aircraft prone to rollover during a forced landing on uneven ground. It was noted that crews were given extensive training to minimise the implications of this older engine configuration, and that new



---

<sup>6</sup> A device that detects demands for more power and increases the fuel flow to accelerate the engines in anticipation of the load about to be felt by the rotor blades.

engines that include an anticipatory function are part of the planned upgrade (details are at paragraph 5.4).

**3.4.2 Analysis of Recent Accidents.** This analysis revealed that, although Human Factors (Aircrew)<sup>7</sup> is the predominant factor, there is no single causal theme linking the recent incidents. However, contributory factors in Iraq included a combination of operating the aircraft close to the limits of its capability, and the unique challenges of extremely demanding operational missions.

**3.4.3 History and Culture.** The Review suggested that having evolved from a single pilot *modus operandi*, the Puma Force was noted for its 'independent and individualist self-reliance'. As more capable aircraft joined the Support Helicopter fleet, and with the Puma concentrating on Northern Ireland tasking, it may have seemed to some that its best days were gone. That said, the deployments to the Balkans in 1999 and to the Iraq War in 2003 proved that the Puma still had significant utility. Nevertheless, the Review expressed the opinion that crews may have felt marginalised as newer helicopters arrived, perhaps prompting a competitive spirit and a desire for some crews to prove themselves. This is necessarily a very subjective assessment drawn from interviews and it lacks firm evidence in terms of behaviours seen over the past years. Indeed, both the Review and rigorous examination of the Puma Force failed to discover any individual crewmember that fitted this description and the MOD is content that there is no systemic cultural issue within the Puma Force – indeed, evidence at home, and particularly on operations firmly indicates that their commitment has been entirely consistent with the values of their Service.

**3.4.4 Crew Dynamics.** The Review also implied that a Puma crew, with just one crewman to monitor and influence two pilots might be less effective than other Support Helicopters (which routinely have two crewmen) in ensuring effective decisions. This assertion suggests an imbalance in aircraft decision-making but potentially fails to recognise the respect afforded to the professional advice provided by the Puma crewman. Indeed, one of the key strengths of the RAF crew ethos (referred to as 'crew co-operation') is the full integration of the crewman into the flying and decision process. This process began in the Puma and was migrated to newer RAF Support Helicopters such as the Chinook and the Merlin. It follows that although some subjective views



---

<sup>7</sup> Errors by the aircrew.

may have led to this opinion, again, there is no hard evidence to substantiate an issue over crew dynamics, despite exhaustive examination by JHC and the RAF.

**3.4.5 Communication.** The Review recognised that communication between the JHCHQ and RAF Benson could, on occasions, have been better. The Review also suggested that there was a different perception between the JHCHQ and RAF Benson of the long-term capability of the Puma Force to deliver the levels of commitment on operations. Specifically, the Review pointed to a difference in the perception of the nature and difficulty of the flying and over the utility of the full spectrum of Puma crews. The Review considered that at all levels there was an inclination to agree to an increase in the numbers of aircraft and crews on operations without fully assessing the long-term consequences of doing so. However, this view masks the highly complex and incremental analysis and decision-making that took place over a 12-month period. It also tends to isolate the Puma decision-making from the wider operational imperatives that the United Kingdom faced in 2006/7.

**3.4.6 Synthetic Training.** The review noted that the civilian-run simulator complex at RAF Benson is good for building an effective crew dynamic and for developing crew confidence. The adoption of the 'Fight-by-Flight' structure has ensured that Puma aircrew undergo a full simulator pre-deployment training package. There is a planned upgrade to the Puma simulator as part of the Puma Life Extension Programme. It was assessed that scope existed to undertake reorientation training for aircrew returning from operations in order to prepare them for the considerable difference in regulatory issues between operating in the United Kingdom and on operations. This was already in place following action after the crash in 2004 but has been further emphasised as part of the Puma Reset (see paragraph 4.0).



**3.4.7 Quality of Aircrew and Basic Helicopter Training.** The Review concluded that in common with other Support Helicopter aircrew, the behaviour and attitudes of Puma crews are initially shaped during basic and advanced helicopter training at DHFS at RAF Shawbury. The quality of potential aircrew arriving at DHFS Shawbury was assessed by the Review as excellent. The standard of instruction, coaching and mentoring by the DHFS staff was also found to be first-class.

**3.4.8 Flying Supervision.** The Review noted that the operational missions undertaken in Iraq by Puma crews were often completed in a highly complex and dynamic tactical environment. At the same time, with

increased demand for crews in Iraq, experience levels were becoming diluted and there was a requirement to fly close to the limit of Puma and crew capabilities during some demanding sorties. It was recognised that, in some instances, missions should have been planned and executed with a greater knowledge and understanding of the capacity and capability of the individual crews. The detailed flying supervision required for this may too have been diluted through the sheer complexity and breadth of the flying operations. Again, Puma flying cannot be fully isolated from a range of military activities that were planned and executed during the period.

**3.4.9 Understanding Operations.** The Review recognised the importance of carefully managing the growth of any operational task to ensure that it remained within the capacity of the Puma Force to deliver. It concluded that, although some flying training in preparation for deployment had gone well, planning for the longer term had not been so thorough. This had not been helped by a difference in perception between the Puma Force and the JHCHQ over the level of complexity of the flying which was required on operations. This was exacerbated by two factors. First the planned task requirement was at times exceeded by the actual mission requirement – a factor recognised in theatre and accepted by highly motivated crews and supervisors; but critically not seen in detail back in the United Kingdom. Second, there was a slow but incremental increase in the duration and scope of the task while the wider perception was that the commitment was short-term only. This underscores the fact that war is unpredictable, dangerous and not without risk; but that to win, military personnel must be able to make decisions and operate to the limit of their capability – both at home and on operations. With frequently little margin for error in-theatre, the management of operations is not a precise science. The significance for the Puma Force was that a full and mutually-agreed MOD understanding of Puma operations was not in place during the spring of 2007 but was regained with the ‘Puma Reset’ (see paragraph 4.0).



**3.4.10 Puma Force Administration.** Set against a strong record of professionally flown Puma tasking in Iraq, the Review concluded that there could have been a greater focus on routine administration at home, particularly with the maintenance of training records. It also noted that the Support Helicopter Standards and Evaluation Unit could have been more critical in their evaluation of the Puma Squadrons at home. Both these aspects were addressed immediately and have now been rectified (see paragraph 4.0).

**3.4.11 Future Direction.** In considering the future, the Review suggested that the benefits of Puma deployments to Iraq should be

reviewed, especially when set against the costs and associated risks involved. The Puma Review generated a number of other more specific recommendations which have received close attention. All these actions were completed by the end of 2008. A full list of the recommendations and actions is shown at Annex C.

## **4.0 ACTIONS TAKEN**

4.1 Following the crash of Pumas XW218 and XW211 in Iraq in April 2007 and the initial review of the findings of the related BOI, action was initiated to address the concerns emerging within the JHC and the Puma Force. This work gained impetus following the accident in November 2007 and was reinforced by the reviews outlined earlier.

4.1.1 **Puma Reset.** The reset comprised a series of actions across training, operations and command and control. It commenced in July 2007 following the interim BOI report on the April 2007 accident and was focused on a need to sustain the Puma Force on operations over the longer term. The cornerstone of this work was a reduction in the deployed operational commitment, freeing up both experienced training staff and aircraft to support the training of junior aircrew who could then be deployed. The Reset instigated a ‘train as you would fight’ approach to the preparations for operations. This included adjustments to the Conversion to Type training provided by the Operational Conversion Flight. This narrowed the focus towards current operations and on ‘the war’ rather than the contingent capabilities designed for ‘a war’ that had hitherto been the focus of Puma Force training, and was an acknowledgement that the Puma commitment to Iraq was no longer short-term.

4.1.2 **Fight-by-Flight.** Previously, personnel deploying to Iraq had done so on a ‘trickle’ basis, replacing those who had completed their tours on an individual basis. They were not deployed as a formed group because due to the dynamic and unpredictable nature of the operation, the commitment was thought to be short-term and hence a wider unit deployment was deemed unnecessary. However, once the enduring nature of the task was recognised, the Puma Force began to be grown, under the ‘Fight-by-Flight’ regime, to a sufficient size to allow five deployable Flights and one Operational Conversion Flight to be maintained. The five Flights now each train, prepare and deploy as cohesive units. Each Flight comprises personnel with a range of flying experience, and deploys together in a more predictable and regimented cycle. This system also provides a longer period of rest and recuperation at home between operational tours.



**4.1.3 Constraining Operating Capability.** A decision has been taken by the MOD to constrain some operational activity. It was recognised that the dynamic nature of the operation in Iraq over a protracted period had seen a blurring of the boundary between routine flying in-theatre and the most demanding operational flying. There was therefore a potential danger that some of the crews could inadvertently place themselves in a situation which exceeded their expectations, experience or capability. A matrix listing Puma capabilities and matching this to aspects such as training, mission risk and crew experience has now been implemented. This allows commanders to gain a better understanding of the capability that can actually be expected and has the effect of constraining operations if the parameters are likely to be exceeded.

**4.1.4 Operational Risk Management.** Allied to the above measures, a formal process of operational risk management has been instigated whereby all missions are assessed for inherent risk before being authorised.

**4.1.5 Crewman Restraint.** The Puma crewman harness has undergone a recent modification which makes it easier for the wearer to adjust the strap length. This was necessary because crewmen need a longer restraining strap when working fore and aft in the cabin, but because of the narrow cabin width, the strap could then allow egress from an open door before the tension took effect. This modification will reduce the chances of inadvertent egress in the case of an accident. Additionally a new combined Aircrew Life Preserver and integral dispatcher harness is being introduced. This harness also has an improved method of strap adjustment.

**4.1.6 Power Margins.** In order to create a better margin of power available when operating at heavy weight in hot conditions, when planning operations, crews are now required to allow for an additional 5% of power over and above that required to hover the helicopter. This provides an additional safety margin.

**4.1.7 Flight Safety Initiatives.** The Puma Force has conducted a series of Flight Safety events. From this, issues such as the conditions precipitating the need to overshoot an approach have been better understood throughout the Puma Force, and the wider JHC. This has ensured that safety remains at the forefront of commanders' and crews' minds as they plan and execute missions.

**4.1.8 Training Directive.** To codify these changes and the series of training objectives that have arisen through the detailed examination of Puma issues, a new Puma Force Training Directive has been devised. This directive stipulates the precise training requirements for crews as they develop their capability for the demanding conditions imposed by desert flying. It also addresses the transition requirements for crews returning from flying on operations to normal peacetime, home-base flying.

4.1.9 **Crew Culture.** Throughout the process of addressing the issues arising from incidents on operations, there has been a carefully implemented programme to encourage crews to resist the natural inclination to allow operational pressure to induce a 'must do' approach. Instead crews are taught to revert to the more measured 'can do' attitude that allows free use of initiative along with appropriate risk-taking without crews getting drawn into situations outside their ability to control. This is perhaps the most significant yet subtle change implemented in the wake of the foregoing issues, and it illustrates how demanding the flying operations are for our crews, and what degree of risk they are accepting in order to produce flying that achieves true operational effect. This is the mark of the Puma Force and is a natural consequence of producing the sort of success that the United Kingdom's Service personnel consistently achieve.

## **5.0 FUTURE PLANS**

5.1 **Operations and Training.** It is anticipated that the current level of operational activity will continue in the short term but, as conditions continue to improve in Iraq, the Puma commitment should diminish. The MOD should then be in a position to use this part of the JHC to deliver a reserve capability against other Defence commitments. Puma will conduct support to Army training prior to their operational deployments and will also be available for world-wide short-notice tasking. It is intended to maintain the five Flight structure as this allows the Puma Force to continue to deliver a robust, enduring and balanced capability. The training that will be undertaken will see a return to broader Support Helicopter tasks, including winching, basic troop carrying and low-level navigation. It will also potentially include training in cold, hot, dusty, jungle and maritime environments. This will need to be carried out in a measured and progressive manner.

5.2 **Equipment and Situational Awareness.** A problem routinely experienced by helicopter crews in desert conditions is 'brown-out'; which is the loss of visual references due to re-circulating dust when hovering close to the ground. Considerable effort is being made by the MOD to tackle this problem through improved aircraft sensors. Since the last Puma incident, UK military helicopters deploying to Iraq or Afghanistan are equipped with Display Night Vision Goggles (DNVG) if integration is feasible. DNVG is not a panacea, but it does greatly improve situational awareness and make dust landings at night safer.

5.3 **Structure and Organisation.** As part of the overall reduction of military capability in Northern Ireland, No 230 Squadron will move from RAF Aldergrove in County Antrim to RAF Benson in Oxfordshire in late 2009; thus co-locating all Puma assets at one base in central southern England. This should provide greater resilience across the Puma Force. There is considerable confidence that the structure of five deployable Flights and an Operational Conversion Flight across Nos 33 and 230 Squadrons provides the best possible framework for resilience and corporate identity. During the Puma Reset, experience of the new, developing structure has reinforced this view.

5.4 **Puma Life Extension Programme.** The Puma Life Extension Programme is an upgrade programme to the current Puma fleet that will deliver re-worked Puma

Mark 2 aircraft, extending the life of the Puma to at least 2022. The upgraded aircraft will provide a forward fleet of more capable helicopters, with the first Puma Mark 2 aircraft arriving with the front line squadrons in 2012. The major component upgrades centre around the Makila engines and a modified glass cockpit. The Makila engines will be electronically governed. This will address the issue of a noticeable lag in the delivery of thrust following the demand for power that has been associated with the Turbomecca C4 engines on the Mk 1 aircraft, and supersedes the need for anticipators. The Puma Mark 2 Integrated Project Team is working on improvements to the safety aspects of troop carrying seats and the cockpit 'observer' seat. It is also planned to include the Puma flight simulator within the programme in order to maintain coherence between the synthetic training facilities and front line aircraft.



. Puma Life Extension Programme – Main Details

## 6.0 SUMMARY

6.1. During 2007, the Puma Force suffered a series of serious accidents which resulted in a number of fatalities and injuries, in addition to the loss of several aircraft. These accidents precipitated a period of intense scrutiny of the Puma Force from across Defence as attempts were made to understand the causes and determine whether there were any common threads to the incidents. A series of wide-ranging and detailed reviews were then undertaken to examine all aspects of the Puma Force, from individual record keeping to a broader consideration of the UK's strategic intent. These various studies and reviews highlighted a number of shortcomings and problems with a Puma Force that was in the forefront of the UK's efforts in Iraq but was incrementally attempting to deliver more than was originally anticipated. The output from this work triggered a number of programmes of remedial action as each aspect of Puma Force activity and commitment was considered in detail. This resulted in the Force being restructured to sustain support to operations more effectively and, together with other measures, has placed it on a more sustainable footing. Whilst the risks to the Force operating in Iraq and at home can never be removed completely, they are now better understood, and mitigated by more focused training, improved structures and an enhanced supervision and authorisation process.

*Tony Johnstone-Burt*

CA JOHNSTONE-BURT OBE  
Rear Admiral  
Commander, Joint Helicopter Command

List of Supporting Annexes:

- A. BOI Recommendations and Actions – XW211 & XW218 - 15 April 2007.
- B. BOI Recommendations and Actions – ZA938 – 20 November 2007.
- C. Puma Review Recommendations and Actions.

ANNEX A

BOARD OF INQUIRY PUMA XW211 & PUMA XW218 – 15 APRIL 2007  
RECOMMENDATIONS AND ACTIONS – AS AT 9 APRIL 2009

No	BOI Ref	Recommendation	Status
1	Part 2 Para 66a	A full investigation is undertaken to determine what distance can safely be used between aircraft when landing at an unmarked landing site. The investigation should examine the physiological ability to judge distances to and from a rotating disc. It should also evaluate what technical aids could be made available that might assist the judgement of small distances. It should also establish the training requirements needed to achieve and maintain this ability to judge the specified minima.	<b>Complete &amp; closed</b> The JHC Flying Order Book Minimum Separation Criteria of 10' stipulated at order J330.110.4 - this is not a target distance but an absolute minimum. The RAF Centre for Aviation Medicine (RAFCAM) report recommended that rotary crews are instructed to judge distance on another aircraft's fuselage in all circumstances based on known safe disc clearances. During Puma Operational Conversion 10' Minimum Separation Criteria at night is demonstrated during serial 54 of the Puma Pilot Long Course.
2	Para 66b	Pending the results of the investigation at para 66a, an interim minimum distance (greater than 10ft) be specified to ensure that aircraft can land safely next to each other at unmarked Helicopter Landing Site.	<b>Complete &amp; closed.</b> Superseded by action above.
3	Para 66c	The crewman's safety equipment and working practices (including Mk 60 jacket, harness, crash position and grab handles) are all reviewed with the aim of ensuring that the crewman does not fall out of the aircraft, and has adequate crash protection.	<b>Complete &amp; monitoring.</b> <b>Mk 60 jacket.</b> Current Mk 60 jackets have been modified by a Routine Technical Instruction (RTI) - (RTI/AEA&SE/00240) that shortens the overall length of the harness. A Rotary Wing Operational Evaluation Unit (RWOETU) trial took place 26 November 2008 - 13 January 2009 with redesigned Aircrew Life Preserver and Tail Unit Assembly. Report recommended that these are cleared for use on Puma HC Mk1. Rear crew operations require the Tail Unit Assembly to be lengthened so the rear crewman can exit the aircraft. Aircraft Commanders will be instructed to be aware of the rear

No	BOI Ref	Recommendation	Status
			<p>crewman’s location and at what length the Tail Unit Assembly is being used during various stages of flight. Service Deviation SD143 (CAT1) Issue 7 dated 21 Nov 08 permits use of jacket for pre-deployment training and operations.</p> <p><b>Complete.</b>  <b>Crewman Harness</b>                      New Crewman Harness (Part No. GQ 1091) introduced. Service Deviation SD149 (CAT1) Issue 5 dated 24 October 2008 issued; available and in use in UK and theatre.</p> <p><b>Complete &amp; Closed</b>  <b>Crash position</b>                      A crash attenuating seat for the crewman will be fitted to Puma Mk 2 as part of the Life Extension Programme. Options for an interim solution for Puma Mk1 are also being investigated by the Integrated Puma/Gazelle Project Team.</p> <p><b>Investigation on-going.</b>  <b>Grab handles</b>                      The grab handles fitted to the Puma are routinely removed in order to fit the fast roping capability or the General Purpose Machine Gun. The grab handles were originally introduced to assist entry into the aircraft and not to prevent accidental egress in the event of an accident. The Puma/Gazelle Project Team are currently investigating the positioning and design of a grab handle that may provide a more suitable emergency grab position in the event of a crash.</p>
4	Para 66d	A check of aircraft seat inertia reels is carried out to ensure that they are maintained in accordance with Air Publication: 108D-0511-1, Chapter 2 Page 5, para 8.	<p><b>Complete &amp; closed.</b>                      A Routine Technical Instruction (RTI) was released on 15 Oct 07 (Puma/RTI/02049).</p>

## Puma Force – A Review of Contemporary Operating Issues

No	BOI Ref	Recommendation	Status
5	Para 66e	Consideration is given to investigating how operating power can be better maintained for tactical ground radios to ensure that the batteries have sufficient power.	<p><b>Complete &amp; closed.</b> Procedures have been changed to ensure that unused batteries are fitted to the radios and are changed at regular intervals removing any risk of operational batteries draining prior to use.</p>
6	Para 66f	The Helicopter Emergency Egress Lighting System (HEELS) is modified so it can be deliberately disabled once all personnel have safely egressed.	<p><b>Rejected &amp; closed.</b> Modification S941 introduced the Helicopter Emergency Egress Lighting System (HEELS) as a safety modification to assist emergency egress of the Puma in reduced light conditions. At a meeting on 16 Apr 08 attended by Rotary Wing Operational Evaluation and Trials Unit, Puma/Gazelle Project Team, Augusta Westland Helicopters Limited and the Release to Service Authority, it was decided that despite the tactical issue of HEELS potentially giving away an aircraft location in the event of a crash, the over-riding issue was safety and emergency egress. Introducing switches, timers or plug breaks into an emergency system triggered by a crash switch would introduce a single point of failure which could potentially stop the system working when it was most needed; this was deemed unsatisfactory and so the recommendation will not be taken forward.</p>
7	Para 66g	All aircrew are trained and tested to operate to Night Vision Goggle (NVG) minima appropriate to their new qualification when upgrading to NVG Cat A/B.	<p><b>Complete &amp; monitoring.</b> Puma aircrew are required to meet the training objectives laid down in Chapter 26 of the Night Tactical Formation Syllabus prior to upgrading their Night Vision Goggle qualification from level C. Aircrew on the Puma Force are trained and tested to Night Vision Device Category B; this requirement is included in the Puma Force Training Directive which is placed under Section 10 of Training and Standardisation Instructions (TASIs).</p>

No	BOI Ref	Recommendation	Status
			In addition, the requirement to check the crew's ability to assess 10' Minimum Separation Criteria is also included in pre-deployment work-up flying course syllabi.
8	Para 66h	Provision of helmet-mounted NVGs for downed aircrew that are suitable for use on the ground be investigated.	<p><b>Investigation Ongoing.</b>                      Defence Clothing Project Team (DC PT) has recognised the requirement in the design of the new helmet (which is under development) to integrate various accessories including night vision goggles. In the meantime, MoD's intention is to fit a permanently fixed night vision mount to the Mk 7 Helmet for Op HERRICK 12 and beyond. This will fill the gap until the new helmet comes into service. There is currently no evidence to suggest that drilling the required holes into the front quartile will have a detrimental effect upon the integrity of the helmet, but testing is underway. Once these tests conclude, MoD expect to authorise a waiver to allow a mounting plate to be permanently affixed.</p>
9	Para 66i	Powers of authorisation categories be standardised across the Puma Force and ideally across the SH Force.	<p><b>Complete &amp; closed.</b>                      Merlin and Puma now share a standardised authorisation process, and Chinook uses an almost identical version (minor differences have to remain due to the different theatres of ops and the unique nature of some Chinook flying). A new form granting authority from Station Commander to Squadron authorisers to authorise sorties (Form F1575C) was issued to 33 and 230 Squadrons in December 08.</p>
10	Para 66j	The 'Detachment Powers of Authorisation Summary' sheet be annotated as such with reference made to the home base F1575Cs and should not be called a 'RAF Sub-form 1575C'. Copies of the home base F1575Cs must be held by the detachment. Powers of	<p><b>Complete &amp; closed.</b>                      This has been completed. Under "Flight by Flight" whole Flights deploy under their Flight Commander which means that continuity and supervision is improved. This action is captured in JHC Command</p>

## Puma Force – A Review of Contemporary Operating Issues

No	BOI Ref	Recommendation	Status
		authorisation categories on the Detachment Powers of Authorisation Summary Sheet must match the categories on the home base F1575C.	Instruction, J3/CI/14, which provides in-theatre commanders with details of the delegated powers of authorisation that individuals are granted by the home unit. This ensures local statements of powers of authorisation match master documents.
11	Para 66k	Aircrew and engineers are reminded that all aircraft faults must be recorded in the aircraft F700 until such time as the fault can be rectified.	<b>Complete &amp; monitoring.</b> All aircrew and engineers have been informed through the chain of command. Subsequent flight safety days at RAF Benson as well as the RAF 'Can Do Safely' Campaign have re-iterated the message of recording all faults found including 'marginal' faults, many of which can be acceptably deferred but require a clear and unambiguous audit trail.
12	Para 66l	Recovery procedures for unserviceable aircraft should be reviewed to ensure that recovery teams have access to aircraft specific recovery advice, and wherever possible equipment and a suitably qualified liaison officer, to minimise further damage occurring during recovery.	<b>Complete &amp; closed.</b> Procedures in place at Joint Aircraft Recovery and Transport (JART) are well tried and tested. Recovery in this instance was by coalition forces using different procedures due to the tactical situation.
13	Para 66m	A third party is allocated specific responsibility for knowing which routes and landing sites the aircrew plan to use to underpin this element of flight supervision.	<b>Complete &amp; closed</b> Air Detachment Commander and Air Adviser's Terms of Reference have been amended to ensure that the Air Co-ordinator is aware of the planned route and landing sites. This requirement is articulated in JHC 6530_23_Capability Document dated 22 January 2009.
14	Para 66n	Full Mission Qualified pilots and Basic Mission Qualified crewmen should not deploy on this specific operation unless they have proven their ability to operate in these roles in multi-ship formations.	<b>Complete &amp; monitoring.</b> The restructure to "Fight by Flight" has enabled a more structured training regime, backed by a new Puma Force Training Directive implemented 22 April 2008. Adherence to this directive and more robust supervision has ensured that those deploying are appropriately trained/qualified for theatre.

**Puma Force – A Review of Contemporary Operating Issues**

<b>No</b>	<b>BOI Ref</b>	<b>Recommendation</b>	<b>Status</b>
15	Part 3 Para 22a	As Mark 60/61 life preserver jackets are only currently worn on operations, consideration should be given to procuring extra jackets to allow crewmen to wear them in UK in order to ensure full and unambiguous familiarity with their equipment.	<b>Complete &amp; monitoring.</b> An additional quantity of 10 jackets have been procured and are available at RAF Benson. Service Deviation SD143 (CAT1) Issue 7 dated 21 Nov 08 has been issued as authority to wear them on pre-detachment training.
16	Para 22b	A review of parking clearances at operating sites of detachment should be conducted.	<b>Complete &amp; closed</b> This has been superseded by a move to a different location with greater parking clearances. Under the JHC 6530_23_Capability Document (dated 22 January 2009) minimum clearance between aircraft is 2 rotor spans at unfound sites. At found bases the minimum clearance on the ground is the aircraft Minimum Operating Distance (MOD).
17	Para 22c	JHC HQ should remind all JHC rotary wing operators that standing regulations require passengers to be strapped in during flight.	<b>Complete &amp; monitoring.</b> All operators and passengers are mandated to adhere to the regulations set out at order J130.103 (Restraint of Crew and Passengers) to the JHC Flying Order Book, as well as those outlined in operational directives to deployed forces and through exercise instructions. JHC HQ has re-clarified restraint dispensation. An amendment to JHC Flying Order Book J130.103 has been submitted, clearly stating any dispensation to the restraint regulations can only be approved in theatre by the Air Detachment Commander. This power can only be granted by the Deputy Commander JHC in the Aviation directive.

**ANNEX B**

**BOARD OF INQUIRY PUMA ZA 938 – 20 NOVEMBER 2007  
RECOMMENDATIONS AND ACTIONS – AS AT 9 APRIL 09**

No	Ref	Recommendation	Status
1	Part 1.2 Para 80a	<p><b>Supervision.</b> The supervision of this Detachment should be strengthened in a number of areas:</p>	
		<p>i. Properly experienced crews should be selected for this Op based on their general skill sets and experience levels not simply the number of hours they have flown or their combat ready status. If crews are not suitable then they should not be given a qualification.</p>	<p><b>Complete &amp; Closed.</b> Puma Reset/Fight by Flight Crews are trained in accordance with the Puma Capability Document and Puma Force Training Directive. Deploying Flights are validated shortly before detachment. Written submission is sent to JHC detailing any shortfalls in training the Flight has received or capability that the Flight can deliver, as per Aviation Directive to Puma Force Commander.</p>
		<p>ii. Sustaining the capability is paramount therefore the task must be properly resourced with quality individuals and equipment at all levels. This may mean less capability forward whilst experience is gained but the training of individuals must not be curtailed in any way.</p>	<p><b>Complete &amp; Closed.</b> Through the Puma Capability Matrix/ Document.</p>

**Puma Force – A Review of Contemporary Operating Issues**

No	Ref	Recommendation	Status
		<p>iii. Deployed Air Detachment Commander, Air Adviser, Detachment Commanders and authorising officers must be briefed on their responsibilities and fully understand the management of risk at all levels. Risk must be held at the highest practicable level and not simply devolved down to individual crews. The use of a daily non-flying supervisor would address the short-term issue and JHC should consider mandating a Support Helicopter (SH) background for the Air Detachment Commander and Air Adviser where possible</p> <p>iv. The in-theatre authorisation process should be reviewed with a view to making it less generic and more relevant to the task that is to be flown, thereby ensuring the process remains a key link in the supervisory chain.</p>	<p><b>Complete &amp; Closed.</b> Through the Operational Risk Management System and the Puma Reset. The Air Detachment Commander has been selected from within the Puma Force during the reset period. The Air Adviser has continued to be selected by Air Command, with a variety of backgrounds, to provide the valuable impartial view to operations and supervision.</p> <p><b>Complete &amp; Closed.</b> Senior supervision is in place in theatre, along with a comprehensive authorisation process, A supervision flow chart is contained within the Puma Capability Document.</p>
2	Para 80b	<p><b>Cabin Security.</b> The Board notes that this is a repeat recommendation from the fatal crash of Apr 07. Passengers should not be allowed to fly unrestrained without a full risk assessment being carried out. The Aircraft Operating Authority (AOA) must be alive to this requirement on Ops and proactively ensure a suitable assessment has been</p>	<p><b>Complete.</b> JHC HQ has re-clarified restraint dispensation. An amendment to JHC Flying Order Book J130.103 has been submitted, clearly stating any dispensation to the restraint regulations can only be approved in theatre by the Air Detachment Commander. This power can only be granted by the Deputy</p>

**Puma Force – A Review of Contemporary Operating Issues**

No	Ref	Recommendation	Status
		<p>carried out prior to the issue of any dispensation from the requirement iaw JHC Flying order Book J130.103.3.</p> <p>Passenger and crewman restraint in the Puma should be fully reviewed with a view to providing more suitable systems that better equip the operations and passengers of today.</p>	<p>Commander JHC in the Aviation directive.</p> <p><b>Complete</b> Current Mk 60 jackets have been subject to an Urgent Technical Instruction (UTI) - (UTI/AEA&amp;SE/00033) that shortens the overall length of the harness. This Urgent Technical Instruction is due to be superseded by a Routine Technical Instruction (RTI) - (RTI/AEA&amp;SE/00240).</p> <p><b>Complete.</b> Crewman Harness. Service modification issued resulting in a new Air Despatchers Safety Harness (Part No. GQ 1091) that is now available in theatre and in UK.</p> <p><b>Complete.</b> The crewman Mk60/61(M) jacket trial is complete (report R&amp;S/J5/7/10 dated 16 Feb 09). Service Deviation SD143 (CAT1) Issue 7 dated 21 Nov 08 permits use of jacket for pre-deployment training and operations.</p>
3	Para 80c	<p><b>Adherence to SOPs.</b> The requirement to adhere to SOPs must be reinforced to all operating crews, as it is clear that they feel they are routinely permitted to go beyond the accepted normality when they believe the task requires it. The flexibility to alter SOPs in extremis must remain in place for the odd occasions when they do not fit the task. However, crews must be taught the difference between adapting a</p>	<p><b>Complete &amp; Closed</b> Addressed as part of Puma Reset</p>

**Puma Force – A Review of Contemporary Operating Issues**

No	Ref	Recommendation	Status
		<p>procedure to fit the moment based on a risk assessment and the amending of procedures as they see fit.</p>	
4	Para 80d	<p><b>Post Crash Management (PCM).</b> The in-theatre PCM measures had several key areas that need to be addressed:</p>	
		<p>i. Thought should be given to impounding all formation aircraft Cockpit Voice Recorders in the event of a major incident. The Board would have benefited greatly from the other aircraft's recordings.</p>	<p><b>Complete &amp; Closed</b> Addressed in Iraq crash plan AL7 Annex A serial 17 which orders that consideration be given to pulling CVRs for all a/c involved in the mission as it will greatly assist any investigation in determining the sequence of events.</p>
		<p>ii. The Board would have had no evidence of note had the crew been less fortunate and not survived. Therefore, an Aircraft Data Recorder (ADR) should be fitted to the Puma.</p>	<p><b>Complete &amp; closed.</b> Aircraft Data Recorder will be fitted as part of the Puma Life Extension Programme. (Ref: URD-158, (legislation), SRD-658)</p>
		<p>iii. A medical examination should be given to all participants following any aircraft accident. This was not done on this occasion and could have had serious consequences if any of the victims had</p>	<p><b>Complete &amp; Closed</b> Addressed in Iraq crash plan AL7 annex A serial 15 'which orders that medical examinations are carried out by a CFMO approved doctor on all crew and passengers directly involved in the accident. These</p>

**Puma Force – A Review of Contemporary Operating Issues**

No	Ref	Recommendation	Status
		hidden injuries.	should be conducted no later than 72hrs post crash in accordance with medical policy.'
		<p>iv. Most operational accident sites are now out of the reach of BOI and other investigation personnel. All Aircraft Operating Authorities (AOA) should consider the requirement to gather as much data as possible from the crash site as quickly as possible. This may require the setting up of teams in country or ensuring that non-UK Combat Search and Rescue crews are briefed on national requirement regarding the taking of pictures etc. Wherever possible the President or one of the BOI members should be consulted on the requirements to gather evidence prior to any attempt to destroy the aircraft. Consideration should be given to creating a standing collection task on JARIC to ensure the correct resources are tasked quickly to gain as much imagery as possible.</p>	<p><b>Complete &amp; Closed.</b> Full review and amendment of all Post Crash Management Plans has been undertaken. This is laid down in the MoD Policy for downed aircraft in Iraq and Afghanistan (Annex A).</p>
5	Para 80 e	<p><b>Aircrew Qualifications.</b>                      i. A review of all training records and qualifications awarded over the past 2 years on the Puma force should be carried out to ensure that crews have completed the recognised syllabus requirements and that the award has been correctly annotated.</p>	<p><b>Complete &amp; Closed.</b>                      Puma Documentation Review complete Feb 08. See para 3.2 in main document.</p>

**Puma Force – A Review of Contemporary Operating Issues**

No	Ref	Recommendation	Status
		ii. The exact categorisations and qualifications that are to be awarded and how these are annotated should be reiterated to all Support Helicopter units to ensure the meaning of qualifications is fully understood.	The categorisations and qualifications that can be awarded and how they are annotated in aircrew logbooks are detailed in Section 1 of Support Helicopter Training and Authorisation Instructions (TASIs). Aircrew logbooks and training records are checked annually during SH Standards and Evaluation (STANEVAL) visits to each Squadron.
		iii. The AOA must re-emphasise the requirement for units to alert them of any shortfalls in training to allow them to manage the risk associated with sending partially qualified aircrew on Ops: this decision should not rest at squadron level.	Two Command Instructions have been produced to address this issue. JHC Environmental Training Policy J7/CI/04 states that known shortfalls in training, accompanied by a Risk Analysis, should be highlighted through the chain of command to JHCHQ at the earliest opportunity. In addition, a JHC Statement of Deployed Aircrew Qualification should be prepared in accordance with Command Instruction J3/CI/14 to report aircrew qualifications and shortfalls in training for the Commander of the receiving Joint Helicopter Force.
6	Para 80 f	<p><b>Engineering.</b> The post-crash fire was a major concern to the Board:</p> <p>i. An investigative report into the consequences of fuel spilling from the Anti-spill valves should be commissioned without delay. The Board can confirm several occasions where fuel leaked from this device and it is likely that this has happened on previous incidents.</p> <p>ii. A maintenance schedule should be introduced</p>	<p><b>Complete &amp; Closed.</b></p> <p>It has not been determined by Boards of Inquiry that anti-spill valves had failed. However, the investigation into this crash identified the possibility of a spill-valve failure which prompted a retrospective look at previous incidents, where valve failure was assessed as a possibility. In order to address this,</p>

**Puma Force – A Review of Contemporary Operating Issues**

No	Ref	Recommendation	Status
		<p>for the Puma anti-spill valves. (This process is ongoing with the Puma IPT).</p>	<p>two technical instructions were issued by the Puma/Gazelle Project Team relating to Fuel Anti-Spill valves which close off this action. These are detailed below:</p> <ol style="list-style-type: none"> <li>1. Puma Urgent Technical Instruction 01022 called for the fuel anti-spill valves to be removed, inspected, cleaned, tested and re-fitted (if serviceable) within 15 flying hours of the release of the Urgent Technical Instruction. The Puma fleet are compliant with the Urgent Technical Instruction.</li> <li>2. Puma Routine Technical Instruction 02053 called for the fuel tank air vent box to be removed and cleaned at the next suitable Depth servicing. Cleaning and inspection of the fuel anti-spill valves has been added to the scheduled maintenance manual (5A1) and is carried out at every Primary Star Maintenance (after every 320 Flying Hours). Cleaning of the fuel vent lines is now carried out at every Minor Maintenance (after every 640 Flying Hours).</li> </ol>

**Puma Force – A Review of Contemporary Operating Issues**

No	Ref	Recommendation	Status
		<p>iii. A review should be undertaken as to the current level of fire protection on the Puma, with particular regard to the utility of the hand-held fire extinguishers and the number of engine fire extinguishers.</p>	<p>The hand-held fire extinguishers on the Puma are provided to fight small fires outside of the engine bays. The engines are protected by a separate internal system that has proven fit for purpose. The ensuing fire reported in the crash was more intense than could have reasonably been contained within the resources of the aircraft; the intensity suggests that it would have required a large fire fighting appliance normally associated with an airfield. Hence the resources on-board the aircraft are deemed appropriate given the limitations on the overall weight of the aircraft.</p>
		<p>vi. Given the destruction of the Cockpit Voice Recorder in this accident, investigations should take place by the Puma Integrated Project Team into the location and survivability of the existing Cockpit Voice Recorder.</p>	<p><b>Complete &amp; Closed.</b> The Aircraft Data Recorder (which includes a Cockpit Voice Recorder) is to be fitted under the Puma Life Extension Programme and is positioned in an appropriately designed secure location in the aircraft.</p>
7	Para 80 g	<p><b>Brownout.</b> Further consideration should be given to the procurement of a system that would allow aircrew to effectively see through dust during brownout conditions</p>	<p><b>Action Ongoing.</b> The MoD is pursuing technical solutions for all Battlefield Helicopters. In the short term, an Urgent Statement of User Requirement for Display Night Vision Goggles (Urgent Operational Requirement</p>

No	Ref	Recommendation	Status
			<p>(UOR) IO4356) was endorsed on 24 Jan 08 as a means of increasing crew situational awareness and achieved Initial Operating Capability on 5 February 09. In the medium term, a Low Visibility Landing solution known as Conformal Symbology is being sought in response to an Op HERRICK Urgent Statement of User Requirement (UOR AO1369). This technology is still subject to further maturation before solutions can be implemented. The Defence Technology and Innovation Centre provided a Low Visibility Landing (LVL) roadmap to the LVL Programme Steering Committee on 4 November 08 which indicated that a solution was unlikely to be in service before December 10. On 11 February 09 MoD stated that enhancement options were being run for the incorporation of Display Night Vision Goggles and enhanced navigational equipment into the Puma Life Extension Programme. This equipment will provide the basis for any future LVL capability once a solution has been defined.</p>
8	Para 80 h	<p><b>Aircrew Equipment Assemblies.</b> All aircrew should be reminded of the need to wear multi-layers of clothing wherever possible to increase the protection against fire. The Board fully understands the issues relating to heat stress however the chances of being involved in a fire are real, especially in a high tempo kinetic conflict environment. Thought should also be given to affording proper protection for the hands as</p>	<p><b>Complete &amp; closed.</b> The Aviation Directive to the Puma Force Commander stipulates clothing requirements for Operations. This has been re-iterated through the command chain.</p>

No	Ref	Recommendation	Status
		the present aircrew glove would appear to be less than adequate in the event of a fire.	
9	<p><b>Part 1.3</b></p> <p><b>Para 18c</b></p> <p><b>Part 1.4</b></p> <p><b>Para 7b</b></p>	<p><b>Comms.</b> Several communication failures were apparent throughout the board:</p> <ul style="list-style-type: none"> <li>i. There is a potential blanking of the signal from special-to-type radios in some arcs. This would bear further examination</li> <li>ii. There is a need to try to simplify the fitting of new communication equipment, especially secure radios, by balancing security risks better with the sort of risks exposed by this accident. This issue need to be taken up with MoD and DE&amp;S with the aim of securing faster, and more effective integration of several of our extant Battlefield Helicopter communication equipments.</li> </ul>	<p><b>Action Ongoing.</b> The special-to-type radios were fitted to Puma to provide a secure Air-to-Ground radio system. The radio operates on the Line-Of-Sight principle and as such it could suffer from signal blanking in certain arcs – particularly if used for Air-to-Air communications. Although there are limitations arising from the location of the aerial on the airframe this radio is the only system available to Puma crews for secure Air-to-Air as well as secure Air-to-Ground communications.</p> <p><b>Theatre Secure Radio Capability -</b> The MoD takes the balancing of security risks and operational requirements very seriously. It has a number of processes and procedures to do this across, what is necessarily, a complex and detailed area. Improvements, to quicken and streamline these, are being reviewed. The MoD Security Accreditors are fully engaged in the Puma Life Extension Programme. JHC HQ is currently working with the MoD and the Puma/Gazelle Project Team to determine the ongoing secure radio capability requirement for the current aircraft. A secure Air-to-Air and Air-to-Ground radio installation will be procured and will be fitted as part of the Puma Life Extension Programme.</p>

## Puma Force – A Review of Contemporary Operating Issues

No	Ref	Recommendation	Status
10	<b>Part 1.4 Para 7c</b>	The Puma does not have a dedicated crash-attenuating seat for the crewman. Attempts have been made to solve this with the Puma/Gazelle IPT and Martin-Baker but without success. Renewed effort on this relatively straight-forward equipment issue is required, perhaps using military in-house expertise to expedite the normal processes.	<b>Complete &amp; Closed</b> A crash attenuating seat for the crewman will be fitted to Puma Mk 2 as part of the Life Extension Programme. Options for an interim solution for Puma Mk1 are also being investigated by the Puma/Gazelle Integrated Project Team.

**ANNEX C**

**STRATEGIC REVIEW OF THE PUMA HELICOPTER FORCE  
RECOMMENDATIONS AND ACTIONS – AS AT 9 APRIL 09**

No	Recommendation	Status
1	Review Capability Battlefield Helicopter Working Group membership.	<b>Complete &amp; Closed</b> MoD has reviewed and agreed the membership. (Details in Assistant Chief of Defence Staff (Operations) letter Ops_Cap_RW dated 1 September 2008)
2	Raise as agenda items in the Joint Command Group the following issues:	<b>Complete &amp; Closed</b>
	<ul style="list-style-type: none"> <li>Examine the priority it accords to the procurement of Battlefield Helicopters, with emphasis on replacing legacy platforms.</li> </ul>	Joint Command Group has met and agreed the priority for helicopters. This complements Ministerial intention over helicopter priorities.
	<ul style="list-style-type: none"> <li>The need to reaffirm the responsibility of commanders to say 'no' to operational demands where justified, and to have confidence that the senior command chain will support them.</li> </ul>	Joint Command Group reiterated full support to the chain of command.
	<ul style="list-style-type: none"> <li>A consideration of in-theatre operational Command and Control arrangements in order to define more clearly the respective roles the user and JHC (as Aircraft Operating Authority) in directing operational standards, disposition and appointment of SH commanders in theatre.</li> </ul>	New command and control arrangements agreed between JHC and the Permanent Joint HQ (PJHQ) and implemented.

## Puma Force – A Review of Contemporary Operating Issues

No	Recommendation	Status
3	Explore opportunities for enhanced collaboration between Air Command and JHC HQ in co-developing Joint helicopter initiatives.	<p><b>Complete &amp; Closed</b>                      Commander-in-Chief Air Command and senior staffs remain fully engaged and have re-invigorated Air/JHC relationships at all levels. Regular meetings and an effort to further embed this relationship were agreed in an initial exchange of letters between Commander JHC and Air Officer Commanding 1 Gp (AOC 1 Gp dated 3 July 2008 and JHC/001 dated 19 June 2008)</p>
4	Consider introducing safety thrust margins for Puma operations, and mandating appropriate margin for all Battlefield Helicopters.	<p><b>Complete &amp; Closed</b>                      See para 4.1.6 of main document.                      Safety thrust margins have been mandated for Puma operations in accordance with paragraph 16 of the Puma Force Capability Document dated 22 January 2009. Similar restrictions are being incorporated into other platform Capability Documents shortly due for release. A safety thrust margin has been introduced for field sites. This was initially introduced as direction from the Puma Force Commander to Squadron Commanders (Puma Performance Planning Guidance Ref: 22080320-R-PU-Perf-PUFORCOMD). Capability Documents are being produced for all JHC Helicopter types. Capability Documents are being produced for all JHC helicopter types.</p>
5	Establish, through the Integrated Project Team, the accuracy of Puma Operating Data Manual (ODM) All Up Mass data and to check on the status and accuracy of other Battlefield Helicopter Operating Data Manual.	<p><b>Complete</b>                      The work required to complete this task is fully funded. Interim work to produce new performance graphs covering the full operating temperature range up to 50°C has been completed and released into the Operating Data Manual as AIL01/09. Clearance to use the graphs is issued under Service Deviation 213 in the aircraft Release to Service document.</p>

## Puma Force – A Review of Contemporary Operating Issues

No	Recommendation	Status
		<p><b>Ongoing</b> Further work is ongoing by QinetiQ to complete a full review of the Operating Data Manual and is estimated due for release September 2009.</p> <p>A review of the status and accuracy of other Battlefield Helicopter Operating Data Manuals is ongoing by individual platform safety working groups.</p>
6	<p>Consider the interventions recommended by Directorate of Aviation Regulation and Safety which covers all recent Puma BOIs. Specifically:</p> <ul style="list-style-type: none"> <li>• Rear Crew Restraint and restraint of passengers.</li> <li>• Policy on use of Cockpit Voice Recorder data.</li> <li>• Implementation of Operational Risk Management Policy.</li> </ul>	<p><b>Complete &amp; Closed</b> – JHCHQ has re-clarified restraint dispensation. Service Deviation on new crewman harness has been issued (part no GQ 1091).</p> <p><b>Complete &amp; Closed</b> JHC Command instruction J3/CI/04 details that Cockpit Voice Recorders (CVRs) are to be enabled at all times. It is also stipulated in the Flying Order Book (order number J230.105.1). If a CVR is to be disabled for operational security reasons, specific authorisation must be sought.</p> <p><b>Complete &amp; Closed</b> See para 4.1.4 of main document.</p>

**Puma Force – A Review of Contemporary Operating Issues**

No	Recommendation	Status
	<ul style="list-style-type: none"> <li>• Training of Supervisors.</li> </ul>	<p><b>Complete &amp; Closed</b>                      All Air Advisers and Air Detachment Commanders now undertake a training package prior to deploying to theatre. This includes Special Operations Air Course to be attended by all Air Advisers and pre-deployment training and visits by Air Commanders and Air Advisers to JHC to discuss Aircraft Operating Authority issues.</p>
	<ul style="list-style-type: none"> <li>• Puma engine control upgrades</li> </ul>	<p><b>Complete &amp; Closed</b> - Part of Puma Life Extension Programme. ( Ref: URD-158 (safety), SRD-49,50,67 - also see main document para 5.4). The new Makila engines will be electronically governed . This will address the ‘droop’ issue experienced on the Mk 1 without the need for separate anticipators.</p>
7	Ensure that optimum use is made of the Medium Support Helicopter Aircrew Training Facility.	<p><b>Complete &amp; Closed</b>                      This has been captured by the Fight-by-Flight process and the Puma Capability Plan. The Puma simulator is now being utilised either at, or very close to 100% capacity.</p>

## Puma Force – A Review of Contemporary Operating Issues

No	Recommendation	Status
8	Conduct a review of BH simulator training, including arrangements for converting new RAF unit commanders and to consider, where capacity exists, implementing an additional mandatory 'Return to Unit' training package for crews returning from theatre.	<p><b>Complete &amp; Closed</b>            This review has been completed and crews returning from theatre now undergo a 'Return to Unit' flying package as part of the Fight-by-Flight process. The Puma Force Training Directive (at section 10 of Training and Standardisation Instructions) stipulates that a tailored recovery package is to be flown to recover lapsed currencies and that maximum use is to be made of the simulation facilities at MSHATF. Packages are flown but tailored to the individual dependent on experience, what they have been doing on ops and how long they have been away.</p>
9	Consult with Defence Helicopter Flying School (DHFS) and HQ 22 Group on ways in which the DHFS syllabus might be enhanced and the regular feedback on output/input standards is instituted as policy.	<p><b>Complete &amp; Closed</b>            Annual customer liaison day established including all stakeholders. The regular informal feedback loop is working very well.</p>
10	Coordinate a review with RAF PMA, HQ 22 Gp, and DHFS to investigate SH instructional policy, selection and tour lengths; and that, depending on its findings, consideration be given to broadening the work to include the Royal Navy and Army.	<p><b>Complete &amp; Closed</b>            Review of training and career structures for Support Helicopter Qualified Helicopter Instructors has been conducted – Qualified Helicopter Instructors drawn from the force now consolidate skills at Defence Helicopter Flying School or the Puma Operational Conversion Flight prior to returning to a front line squadron.</p>
11	Address Puma instructor establishments.	<p><b>Review Complete</b>            Puma Instructor establishments have been reviewed as part of wider work looking at manning requirements for all Support Helicopter Forces. The output of this review is contained within a Support Helicopter Manning Paper (JHC/002 dated 9 April 2009).</p>

## Puma Force – A Review of Contemporary Operating Issues

No	Recommendation	Status
12	Monitor, through Support Helicopter Standards Evaluation (STANEVAL), 33 Sqn Operational Conversion Flight administration.	<p><b>Complete &amp; Closed</b> A review of Operational Conversion Flights processes and administration was completed during the SH STANEVAL visit to 33 Sqn conducted in May 08 and will continue to be included in the annual formal visit. SH STANEVAL is also engaged with the OCF throughout the year, which provides opportunity to monitor and provide advice where required.</p>
13	Make provision for pre-deployment training between different aviation elements, through the Air Manoeuvre Capability Planning Group, seek to establish joint simulator training.	<p><b>Complete &amp; Closed</b> JHCHQ has improved the collective training programme to address this issue.</p> <p><b>Complete &amp; Routine Business.</b> Part of a MoD Capability Planning Group initiative seeking ways to improve linking of simulators using Joint and multi-nation high band width links. Efforts to achieve this are going on across JHC platforms but it is likely to be some time before a final solution is available for Puma.</p>
14	Conduct a high level review with MOD Commitments staffs which should include branch plans to cater for the planned upgrade of Puma and its subsequent possible re-employment in other theatres.	<p><b>Complete &amp; Closed.</b> MoD is developing detailed plans for Puma dependent on the operational requirement.</p>
15	Complete a staff check of Army Air Corps (AAC) units to ensure that none of the issues determined in respect of Puma are extant.	<p><b>Complete &amp; Closed.</b> HQ Army Air Corps and JHC have teams of examiners and standards instructors that continuously check all Army Air Corps units.</p>
16	Review the Puma Force Commander's Directive, particularly to reflect any changes made in C2 agreed with the user.	<p><b>Complete &amp; Closed.</b> A review of the Aviation Directive to Puma Force Commanders (JHC/6530/23) was last completed 18 October 08. This identified command agreements which are detailed within.</p>

## Puma Force – A Review of Contemporary Operating Issues

No	Recommendation	Status
17	Determine, with relevant single-Service standards bodies, an agreed approach to RW Standards and Evaluation.	<b>Complete &amp; Closed.</b> Approach agreed and a study into Standards, Evaluation and Training (SET Study) is in progress. This will evaluate potential to merge/align single-Service functions. Initial changes implemented on 1 April 2009, full implementation by 1 April 2010.
18	In the short-term, Comd JHC may consider a change to OC R&S Wg's reporting chain to make it more explicit that he reports directly to Comd JHC.	<b>Complete &amp; Closed.</b> OC R&S Wing now reports directly to JHCHQ.
19	Consider greater use be made of Reserve Service Instructors and training Captains.	<b>Complete &amp; Closed.</b> JHCHQ has asked industry to quote for limited numbers of civilian crews (as currently at Middle Wallop Air Station for Apache). Single-Service manning agencies remain fully engaged over use of reserve personnel.