SECTION 1.4.6 – OTHER

1.4.6.1 The accident involved two aircraft from different formations. Together, the formations numbered four aircraft and eight crewmembers. The actions of the eight crewmembers, interwoven with the maintenance and Flypro of the four aircraft, create a complex picture. Further complication was added by personnel performing multiple supervisory duties due to half of the Sqn having deployed to Cyprus on exercise. The similarity of the formation callsigns, ASTON and ABBOT, can also create confusion.

1.4.6.2 The crews were allocated as follows. The descriptors in the left hand column will be used to describe each crewmember throughout the report:

a. **ASTON 1 – ZD743**
(1) Pilot: Student Pilot. (Deceased)
(2) WSO: OC B Flight (Programming), Stand in OC XV(R) Sqn, Qualified Tactics Instructor (QTI). (Deceased)

b. **ASTON 2**
(1) Pilot: Student Pilot.
(2) WSO: Sqn WSO, QTI. Set the scenario for ASTON sortie.

c. **ABBOT 1**
(1) FS Pilot: Student Pilot.
(2) RS Pilot: Supernumerary Sqn Ldr on XV(R) Sqn, Qualified Weapons Instructor (QWI), was 1st Duty Authoriser, gave phase brief to student pilot before going flying.

d. **ABBOT 2 – ZD812**
(1) FS Pilot: Student Pilot. (Deceased)
(2) RS Pilot: STANEVAL(Synthetic). QWI. Led the plan for ABBOT sortie. (Survived)

Introduction

1.4.6.3 This section covers the following topics and factors:

a. SAR Standard Operating Procedures (SOPs)

b. Personal Survival Pack Design and Configuration

c. Personnel Emergency Locator System (PELS)

d. Sea Survival, Aircrew Survival Training and UK SAR

e. Electronic Planning (Deconfliction) Aids

f. Medical Policy and Care of ASTON 1 WSO

g. Engineering Assurance

h. Tornado Ground Reconnaissance 4 Force (TGRF) Assurance

i. Air Weapons Range (AWR) Governance

j. RAF Kinloss Monopulse Secondary Surveillance Radar (MSSR) and Tactical Air Navigation (TACAN) Safeguarding

k. Information Management

l. Risk Management and History of the Tornado Collision Warning System

SAR Standard Operating Procedures (SOPs)

1.4.6.4 The RAF SAR Force works to a set of SOPs. The SOPs are issued for the guidance and information of all units operating Sea King HAR Mk3/A helicopters in the Search and Rescue Role. The foreword to the SOPs states: Exhibit 452

"These procedures are considered best working practice for RAF SARF Sea King helicopter units. However, given the extremely varied nature of Search and Rescue operations, it is unlikely that these procedures will cover all eventualities. In those situations where these SOPs do not provide sufficient guidance or where a safer method to execute the operation exists, crews are to exercise their best judgment."

1.4.6.5 In the cases of the ASTON 1 Pilot and ASTON 1 WSO, the situation in which they were found is specifically covered in Chapter 7 – Rescue Lifts, para 17 Aircrew Survivor in Water. Exhibit 452 Exhibit 44 Exhibit 42

"The rescue by helicopter of an aircrew survivor from the water is potentially hazardous to the survivor, the winchman and the aircraft. On gaining visual contact with the survivor a thorough reconnaissance must be carried out. The survivor may be in a variety of situations:"

> *"b. **Survivor in life raft or water, parachute attached acting as a sea drogue.** All RAF fast jet parachutes have water pockets. If the aircrew finds himself in the water and unable to release his harness, the parachute may well be sunk, acting as a sea-drogue; this may not be immediately apparent to the rescuers. The parachute harness could well be pulled out of position placing the release mechanism out of the winchman's reach. Although there is no immediate danger of the canopy deploying, the winchman's priority is still to cutaway or release the parachute. The survivor may then be lifted and recovered to the aircraft."*

1.4.6.6 Detailed guidance on the rescue method is provided in para 18. Method, sub para c. Exhibit 452

*"Once with the survivor, the winchman must release him from the parachute harness **before** attempting to secure him."*

1.4.6.7 Further guidance is provided throughout SAR Force SOPs. The following statements are extracted from other sections and are used in differing scenarios, but the inclusion of mandatory language is the same. Exhibit 452

Chap 3, para 9. *"The winchman must free the parachute and other hazardous entanglements BEFORE attaching himself to the survivor by one of the normal methods."*

Chap 3, para 11. *"The winchman MUST NOT attach himself to the survivor until the parachute is freed and no longer a hazard."*

Chap 7 para 6. *"If it is discovered that a survivor is still attached to a parachute the winchman is NOT TO CONNECT THE SURVIVOR TO HIMSELF OR THE WINCH HOOK until he has disconnected or cut away the parachute."*

1.4.6.8 In the two cases where aircrew were recovered by SAR helicopter, the casualties were attached to the winch hook first, and their parachutes and entanglements were cut away afterwards. Exhibit 42 Exhibit 44

1.4.6.9 The conduct of subsurface recoveries is not covered within SAR Force SOPs. The summary of SAR activity stated that *"Using the aircraft hoist to attempt to recover this person was not an SOP; however, it was conducted in a considered and safe manner."* The winchman paramedic was mistaken in his assumptions with regard to the risk to the aircraft in attempting the recovery. A parachute acting as a sea drogue could very easily exceed the Safe Working Loads (SWLs) of the aircraft hoist and attached lifting equipment. This does not necessarily mean that the hoist or lifting equipment would break. It would certainly create a hazard to operation of the aircraft. In the worst case it could have affected the ability of the aircraft to maintain the hover, and it may have been necessary for the aircraft captain to release the load and winchman paramedic with it. Exhibit 452

After Action Review and Identification of Lessons

1.4.6.10 The actions of the crews of R137 and R138 on 3 Jul 12 were subject to After Action Reviews (AARs) in the form of hot debriefs in D Flight and the submission of a report to their Sqn OC, followed up with a phone call. The Sqn OC asked whether there were any overriding concerns or lessons that required immediate communication to the rest of the Force. No concerns or lessons were raised. Witness 6 Witness 18 Witness 5 Witness 17

1.4.6.11 It is understandable that OC 202 was reticent to thoroughly interrogate the SAR Force actions with a view to identifying and acting upon lessons, as she did not want to prejudice the ongoing police investigation and Service Inquiry by releasing or publicising sensitive information. That said, there is no reason why the thorough and robust interrogation could not have taken place, with appropriate liaison between OC 202 and the Panel (who in turn could liaise with the investigating police force) to ensure that any lessons identified at that stage could be publicised without fear of prejudicing the ongoing investigations. Witness 69

1.4.6.12 A summary of the SAR actions which took place on 3 Jul 12 was submitted to AOC 2Gp on 7 Aug 12 by the Sqn OC, and was copied to the SAR Force Commander. Detail of the actions contrary to SOPs were contained within an annex which had been provided by OC D Flight, but the covering letter did not identify them. The letter stated that *"The use of good CRM and SOPs reduced the risk significantly during the winching operations."* Exhibit 453

1.4.6.13 In Jan 13 there was a SAR STANEVAL review of actions during the recovery, with the aim of capturing any significant lessons that could be learned. The review of actions resulted in a conclusion that both crews acted within SOPs, along with a minor amendment that: Exhibit 453 Exhibit 641 Witness 17 Witness 18

"***Attachment of winch cable**. Ch 7 (Rescue Lifts) be amended to include advice that attachment of unusual items to the winch hook should be done with caution and the Winchman should make best effort to ensure that the ac crew are made aware of any intention to do so."*

1.4.6.14 The Panel **observed** that the direction, worded in mandatory language, within RAF SAR Force SOPs was contravened in both instances where aircrew were recovered, but this was not identified by the Sqn OC or highlighted as a significant safety lesson. The Panel identified a contradiction where in a STANEVAL review of the actions, the conclusion reached was that both crews acted within SOPs, however the winchmen stated they did not follow normal procedures and the SOP, worded in mandatory language, directs different Exhibit 453 Exhibit 641 Witness 17 Witness 18 actions to those which they followed.

1.4.6.15 The Panel **observed** that the SOPs retain the same mandatory language (Chapter 3 para 9 and 11 and Chapter 7 para 6), and can convey confused/mixed messaging particularly with the new suggested amendment (unusual items attached to the winch hook), which could be considered as inviting another contravention. Exhibit 453 Exhibit 641

1.4.6.16 The Panel **observed** that the recovery of subsurface loads is not covered in RAF SAR Force SOPs. However, this only occurred on this occasion due to the winchman paramedic carrying a diving mask. Exhibit 452 Exhibit 45

1.4.6.17 **RN SAR SOPs**. A comparison of SAR SOPs was sought in order to benchmark the methods described in RAF SARF SOPs. The Panel **observed** that RN SAR had not developed a set of SOPs outside of the Maritime Sea King Flying Guide. RN SAR crews are taught from a training syllabus that incorporates all the skills and procedures required to safely conduct SAR operations, and ACNS(A&C) is assured by Naval Flying Standards (Rotary Wing) that standards are maintained. No specific guidance is provided within the guide, for example, where aircrew are found attached to parachutes in the sea. RN crews were fully conversant with the safe procedures for recovery of casualties attached to parachutes in the sea, but had no live document to reference. BR9352 Exhibit 653

Personal Survival Pack (PSP) Design and Configuration

1.4.6.18 **Introduction.** This subsection describes failures[1] of the Survival Equipment PSP, and identifies aspects of the failures which can be used to improve the current design/configuration of Survival Equipment and influence future designs. The subsection is divided as follows:

a. ASTON 1 Pilot and WSO, ABBOT 2 FS Pilot

b. Liferaft Failures

(1) Puncture

(a) Failure Mode

(b) Analysis

(2) Valve Assembly Failure

(a) Failure Mode

(b) Mod 02266

(c) Comparison with other Ejections

(d) Analysis

(3) Summary

c. Conclusions

[1] The term failure is used to describe the point at which an engineered system ceases to perform its intended task. Use of the term failure does not imply that the failure was premature.

ASTON 1 Pilot and WSO, ABBOT 2 FS Pilot

1.4.6.19 The equipment failures of the ASTON 1 Pilot and WSO were attributable to the violence of the impact during the mid air collision and any subsequent secondary impacts with aircraft parts.

1.4.6.20 The equipment failures of ABBOT 2 FS Pilot are attributable to high speed entry into the sea and or collision with ejection seat.

1.4.6.21 **Life Preserver Aircrew Failures.** The Life Preservers Aircrew (LPA) belonging to ASTON 1 Pilot and ABBOT 2 RS Pilot were both punctured. In both cases the puncture was caused by a force compressing the LPA stole and corner of the Automatic Life Preserver Inflation Unit (ALPIU) together. The undetermined forces were most likely caused by collisions with aircraft components.

Liferaft Puncture – Failure Mode

1.4.6.22 The ABBOT 2 RS Pilot's liferaft was found fully inflated in the sea. Although he was not able to board the liferaft, ABBOT 2 RS Pilot had used it to stay afloat until he was rescued. The liferaft was subsequently recovered by the crew of the Emergency Rapid Intervention Craft (ERIC) 2 from the Beatrice Alpha oil rig, fully inflated. But while moving the liferaft from ERIC 2 to the Beatrice Alpha oil rig the crew noticed that it had deflated. Inspection found a laceration to the liferaft's fabric in the area immediately forward from the head of the ALIU shown in Figure 55 below. The size of the tear is such that the liferaft would have deflated rapidly.

Exhibit 42
Exhibit 44
Exhibit 46
Witness 6
Witness 18

1.4.6.23 The means of recovery and handling of the liferaft has not been determined; the ERIC 2 crew were first asked about the recovery five months after the incident and could not recall how the puncture occurred.

Exhibit 46

1.4.6.24 After operation the operating levers of the three recovered ALIUs seized in different positions. The head of each operating lever protruded beyond the end of the ALIU. Figure 55 identifies the location of the puncture mark in relation to ABBOT 2 RS Pilot ALIU on the raft. Of note, Figure 55 shows the ALIU after investigative disassembly, and the position of the operating lever is not representative of how it was found (it was found with the lever protruding further). ABBOT 2 RS Pilot's liferaft had operated as designed.

Exhibit 627
Exhibit 15

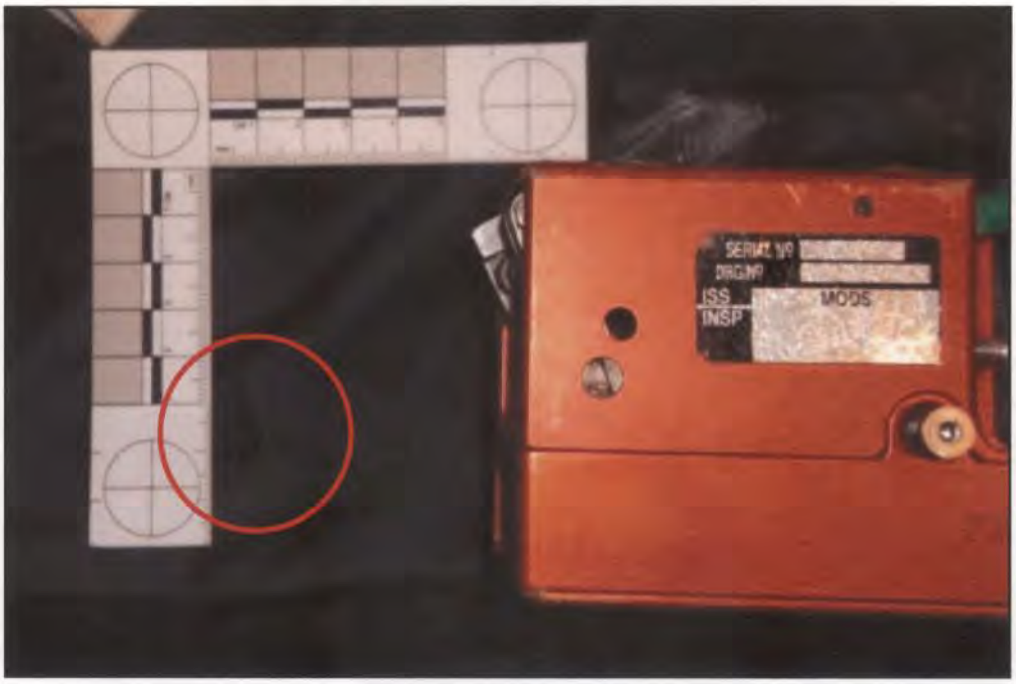


Figure 55. ABBOT 2 RS Pilot ALIU and Adjacent Puncture.

Analysis

1.4.6.25 The liferaft belonging to the ABBOT 2 RS Pilot performed a secondary role in keeping the Pilot afloat (he was not able to board the liferaft to gain protection from the elements). It is not possible to establish precisely how the liferaft was subsequently punctured. A number of possibilities were considered by the Panel:

a. **Piercing by crew member of the ERIC 2**. This could not be discounted, although the Panel considers this less likely because the crews were aware of evidence gathering and would not routinely deflate or damage items when tasked with their recovery.

b. **Piercing by sharp object on the ERIC 2**. This was discounted because the ALIU housing would offer a degree of protection for the buoyancy chamber in the immediate surroundings. The laceration 7 cm from the ALIU, although not impossible, was deemed unlikely.

c. **Piercing by the ALIU operating lever**. The Panel regarded this as the most likely due to the shape of the tear matching the protruding operating head and its location being in a <u>possible</u> position for the lever to gain contact.

1.4.6.26 Under normal inflation and activation, the buoyancy chamber is rigid and the shape of the liferaft holds the ALIU and CO_2 cylinder parallel to its side. The ALIU does not naturally come into contact with the side of the liferaft. The Panel considered it <u>unlikely</u> for the operating lever to normally come into contact with the buoyancy chamber.

1.4.6.27 The most regular users of the liferaft are personnel under training at the Defence SERE Training Organisation (DSTO). Liferaft punctures are a common occurrence at DSTO due to repeated inflation and boarding of the same liferafts. The ALIU is not used in training at DSTO, a simpler unit (which must be operated manually) is used instead. That unit does not feature an operating lever which remains exposed after use. There is no history of use of the ALIU at DSTO and there is no record of the ALIU operating lever having caused a puncture whilst in use in Front Line Commands (FLCs).

1.4.6.28 The hazard is only realised when an external force causes the two to come together. Although there is a possibility that a crew member of the ERIC 2 pierced the liferaft in order to minimize its size on deck, the Panel believes the most likely cause for the laceration to the liferaft buoyancy chamber was the ALIU operating lever being brought in to contact with the liferaft during the recovery and stowage by the ERIC 2. The design of the ALIU poses a possible risk to the integrity of the buoyancy lever due to the operating lever protruding from the ALIU.

Valve Assembly Failure – Failure Mode

1.4.6.29 The ABBOT 2 FS Pilot's Liferaft was found with one end protruding from the sea. It was described by the crew of R137 as being inflated but weighted down in the sea. (Figure 56).

Exhibit 43
Exhibit 44
Exhibit 45
Witness 5
Witness 6
Witness 17
Witness 18

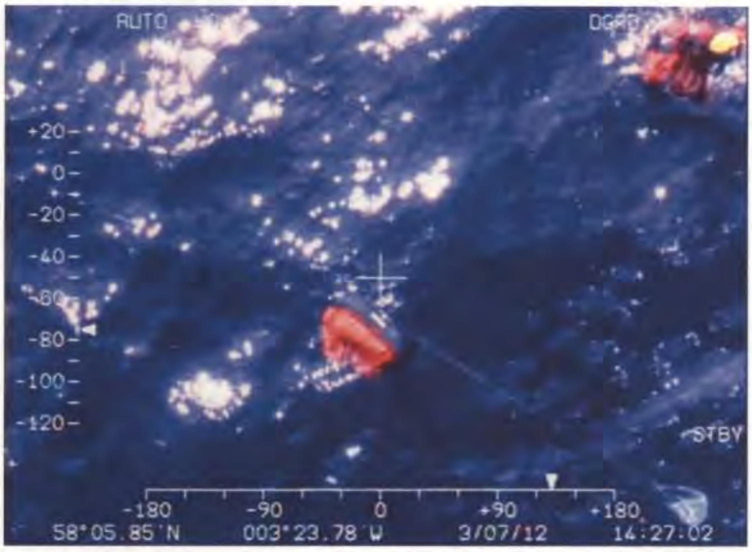


Figure 56. ABBOT 2 FS Pilot's Liferaft on Discovery.

1.4.6.30 In the ensuing rescue attempt, the liferaft could be seen to react to the intervention of the winchman paramedic (Figure 57). When it moved, the section below the surface was not inflated, and only the top section acted in a buoyant manner. The point at which the valve attaches the ALIU to the side of the liferaft was below the surface of the water and could not be seen.

Exhibit 43
Exhibit 45
Witness 17

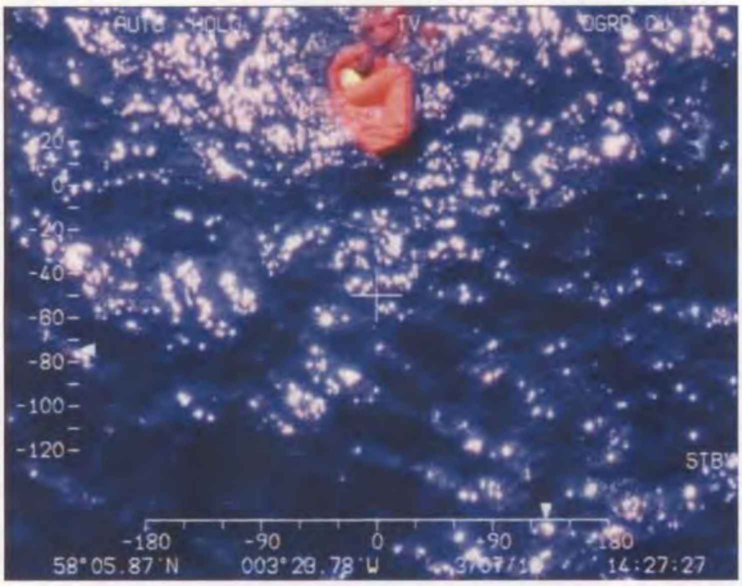


Figure 57. ABBOT 2 FS Pilot's Liferaft Reacts to Intervention by R138 Winchman Paramedic.

1.4.6.31 The liferaft and Survival Aids Container (SAC) became detached from their anchor in the attempted recovery. The liferaft and SAC (Figure 58) were taken aboard R138. The crew of R138 noted that the liferaft was completely deflated and the CO_2 cylinder and ALIU were missing.

Exhibit 43
Exhibit 45
Witness 5
Witness 17

1.4.6.32 The CO_2 cylinder, ALIU and the metal valve body of the liferaft valve assembly were recovered eight days later from the sea bed. They were still assembled, and attached to the PSP lowering line at the neck of the CO_2 cylinder. On inspection it could be seen that the liferaft valve assembly had broken in two. The metal valve body remained screwed onto the ALIU, illustrated in Figure 58 with the normal connection shown alongside.

Exhibit 15

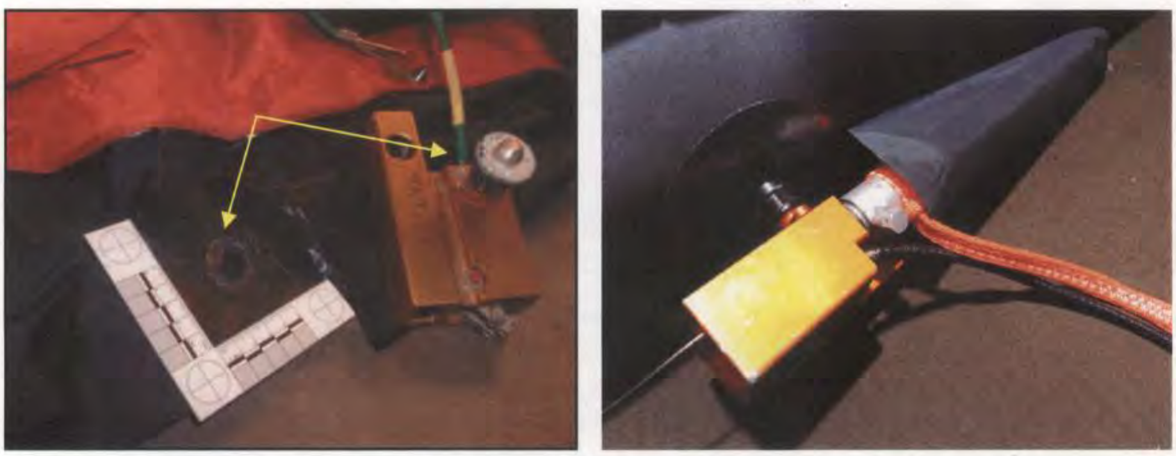


Figure 58. Valve Body Screwed onto ALIU and Normal Position.

1.4.6.33 On further inspection of the liferaft, the circular rubber patch of the liferaft valve assembly was found still attached to the buoyancy chamber, shown in Figure 59. The liferaft valve assembly had failed at the point where the metal valve body is moulded into the rubber section of the assembly. The patch securing the valve assembly to the liferaft exhibited puckering around its inner edge, evidence that it had been stretched and failed to return to its original shape (plastic deformation).

Exhibit 15

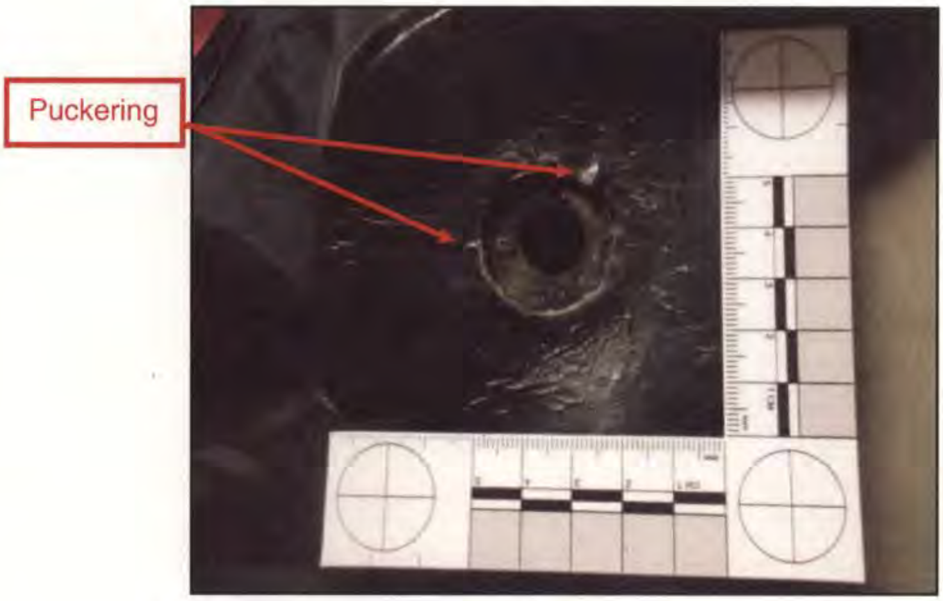


Figure 59. Rubber Section of Valve Assembly retained in Liferaft.

Modification 02266

1.4.6.34 Modification (Mod) 02266 was introduced in Dec 09. The modification altered the configuration of the PSP and strengthened the "Y" strap of the SAC. Exhibit 656

1.4.6.35 The configuration change and strengthening of the "Y" strap resulted from recommendations made in the report into the ejection from Tornado F3 ZE789 in Mar 95. In that incident, a pilot became detached from his liferaft due to failure of the stitching at the pilot's end of the PSP lowering line. The opposite end of the PSP lowering line was tied off on the "Y" strap of the SAC. The "Y" strap had almost detached from the SAC under the force which had caused the stitching to fail. Exhibit 666

1.4.6.36 Additionally, the report noted that in its configuration at the time, a pilot would come to his SAC before his liferaft when pulling it to him along the PSP lowering line. It was considered that it would be more beneficial if the pilot came to his liferaft first. Exhibit 666

1.4.6.37 Mod 02266 introduced the following changes to the Tornado PSP: Exhibit 656

a. The lowering line now attaches the life preserver to the neck of the liferaft's CO_2 cylinder thus enabling the crew member, after descending into the sea, to first recover the liferaft followed by the SAC.

b. The PSP lowering line is modified by the introduction of shock attenuating "brake" stitches, to reduce deployment loads.

c. The "Y" strap is reinforced by the introduction of a length of webbing which will be stitched along the strop and extend up the outer wall of the SAC.

d. The liferaft lanyard is moved from the becket on the rear wall of the SAC to the "Y" strap attachment ring.

1.4.6.38 The fitment of webbing to the "Y" strap and SAC to provide a stronger attachment point is shown in Figure 60. The liferaft is now attached to the to the "Y" strap attachment ring via the liferaft lanyard. The liferaft was previously attached to a becket on the rear of the SAC.

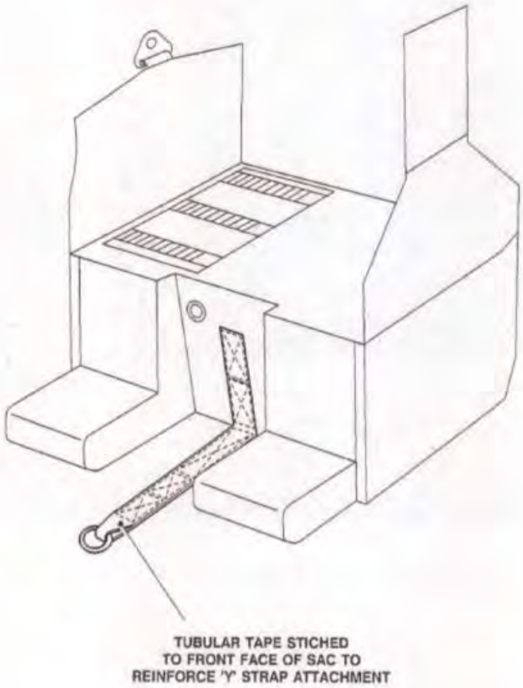


Figure 60. Post Modification 02266 SAC.

1.4.6.39 Several bights of the PSP lowering line were stitched together to produce the "brake" stitching. The stitching is designed to tear, absorbing energy and extending the time over which the line deploys, thus reducing peak loads. Exhibit 656

1.4.6.40 The new configuration of the PSP was designed by Martin Baker Aircraft Company (MBA). Their design was fed by analysis of alternative methods of attachment of the PSP liferaft lanyard conducted by the School of Combat Survival and Rescue (SCSR). SCSR submitted their analysis to MBA in May 96. MBA produced their design in Oct/Nov 96. The new configuration was put through sea trials by SCSR in Dec 96. The sea trials were reported to have been extensive, and to have included dragging at high speeds. No failures occurred. The only concern raised by the Trials Officer was that *". . . all strain is taken in the area of the CO_2 inlet valve and bottle sleeve. However, no damage was found following our trials."* The Trials Officer requested that MBA confirm that the attachment method would not cause damage to the liferaft during PSP separation. Exhibit 605

1.4.6.41 The new configuration was embodied along with the strengthening and shock load reduction measures. That embodiment was subjected to drop trials by the Human Engineering Department (HED) of MBA in Nov 98. No damage was observed to the PSP, SAC, or liferaft assembly. In relation to sea dragging, MBA were satisfied with the outcome of the trials conducted by SCSR and did not perform its own testing. Exhibit 605

1.4.6.42 BAE Systems Ltd validated the modification in Oct 01. The validation certificate was signed off on 4 Mar 02 once assurance was provided by MBA to BAE Systems Ltd that the new configuration would not cause damage to the PSP or its contents. Exhibit 605

1.4.6.43 The modification was subsequently incorporated into the Tornado Aircraft Document Set (ADS) and issued in Dec 09. Exhibit 656

1.4.6.44 This modification was also embodied to the Harrier in Jul 97 (Mod SE225(HAR)). Since the embodiment of Mod SE225(HAR) there have been 11 ejections from Harrier aircraft, one of which was over the sea. No damage was observed to the liferaft[2]. There has been one Tornado ejection event prior to this incident (ZD792) where two aircrew were ejected over the sea. Both liferafts functioned as designed. Exhibit 655

Comparison with other Ejections

1.4.6.45 The valve assembly of the ABBOT 2 RS Pilot's liferaft (Figure 61) also exhibited puckering around the inner edge of the patch securing the valve assembly to the liferaft; evidence of potential deformation of the valve assembly under load. The RS Pilot did not complete the full ejection sequence[3], but entered the sea at a descent rate of less than 9 m/sec.

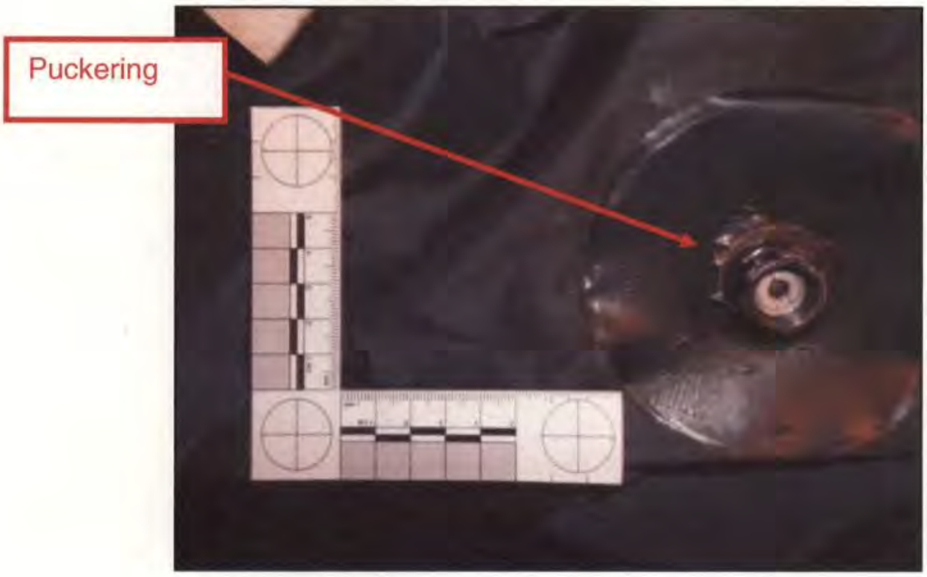


Figure 61. ABBOT 2 RS Pilot Liferaft Valve Assembly

1.4.6.46 The liferaft valves from the previous Tornado ejection (ZD792) are shown in Figure 62. The front seat liferaft valve exhibits no visible evidence of damage. The patch covering the rear seat liferaft valve is puckered around one side of the inner edge; evidence of potential deformation of the valve assembly under load. The ejection from ZD792 was comfortably within the safe height/speed/rate of descent criteria in the aircrew manual, and thus both pilots are expected to have entered the sea at a descent rate of less then 9 m/sec.

[2] The Harrier ejection into water took place from the hover at low altitude over the sea.

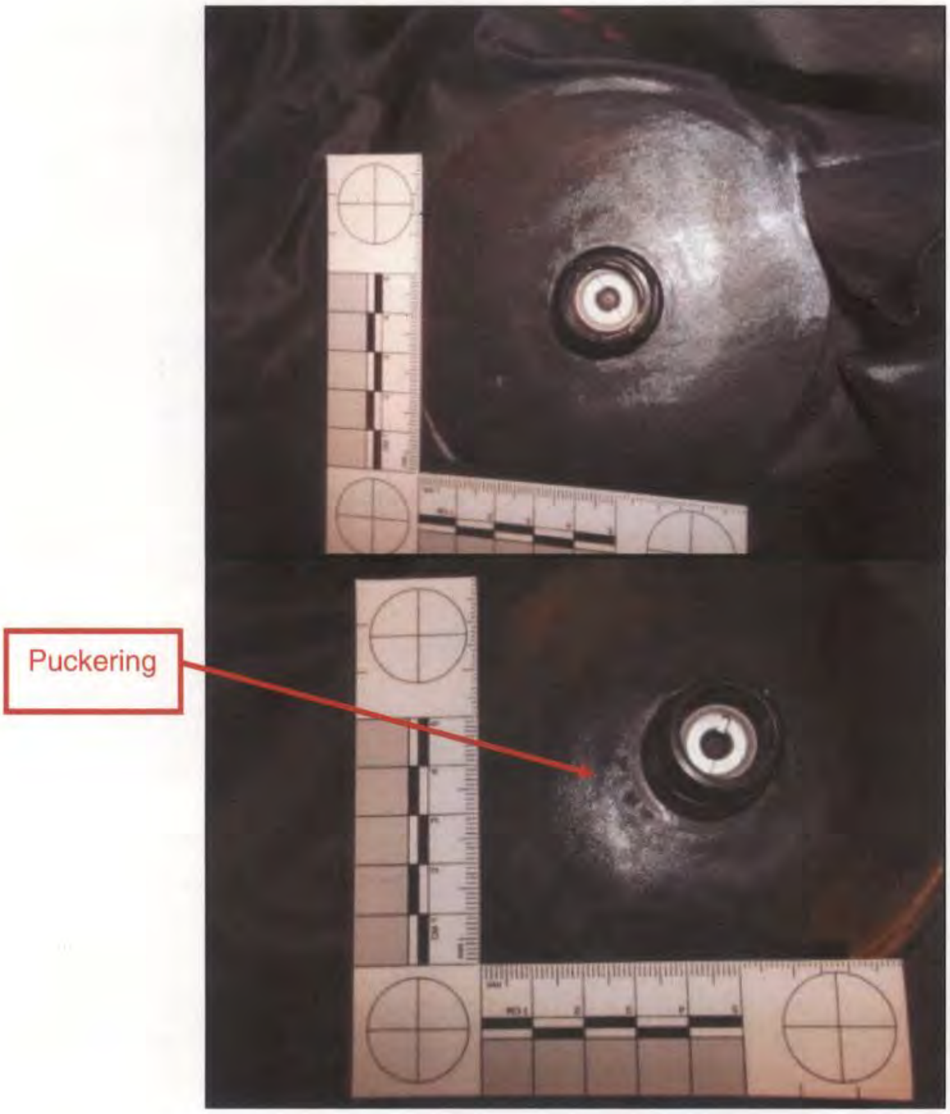


Figure 62. The Front (top picture) and Rear Seat (bottom picture) Liferaft Valve Assemblies from ZD792 following Ejection.

Analysis

1.4.6.47 The liferaft of the ABBOT 2 FS Pilot had failed before recovery was attempted. When found by the SAR aircraft, the liferaft was partially inflated, indicating that at some stage the CO_2 cylinder had been attached, or partially attached, during liferaft deployment. Subsequently sufficient damage had been done to release gas from the portion of the liferaft below the surface, as shown in Figures 56 and 57. The hole in the valve was below the waterline and the liferaft was being weighted down by the parachute, so the top portion remained inflated. Once the hole in the liferaft breached the surface of the sea it deflated. Exhibit 43

1.4.6.48 Analysis of the ejections established that the ABBOT 2 FS Pilot entered the sea less than 4 secs after man-seat separation had commenced. As such, the PSP would not have separated from him. The liferaft would have been stowed within the SAC and PSP shell as they entered the sea. Entry into the sea was violent and complicated by collision with the seat. It is possible that the liferaft separated from the PSP either through collision with the seat or on inflation when initiated by contact with seawater. Exhibit 15

[3] The PSP had not deployed to its full length below the ejectee.

1.4.6.49 The impact with the sea and subsequent deceleration and deployment of the liferaft was complicated, but there was no evidence of impact damage to the valve assembly, rather it indicates it failed under tension. Whilst there could be other initiators, the Panel believes it is most likely that the tensile force causing the failure was applied through the PSP lowering line: there is no impact damage or witness marks from forces being applied in another way. The opposing force applied at the opposite end of the valve could have been asserted by water drag against the inflating/inflated liferaft or through the liferaft lanyard attached to the SAC. In either circumstance the forces could have been due to: Exhibit 15

a. ongoing entry into the sea at high speed;

b. parachute dragging if the parachute remained inflated on the surface;

c. the parachute filling with seawater and acting as an anchor.

1.4.6.50 The valve assembly has not been designed to resist large forces in tension. The patch and body are secured to the liferaft using adhesive. The rubber of the patch is moulded onto the metal valve assembly; it is not chemically bonded or mechanically retained. The tensile strength of the valve assembly is the strength at its weakest point. Test work is ongoing, but it is the Panel's view that the weakest point in tension is the thinnest section of rubber retaining the metal valve body. This can be seen on the sectioned valve assembly and component diagram in Figure 63. Exhibit 604

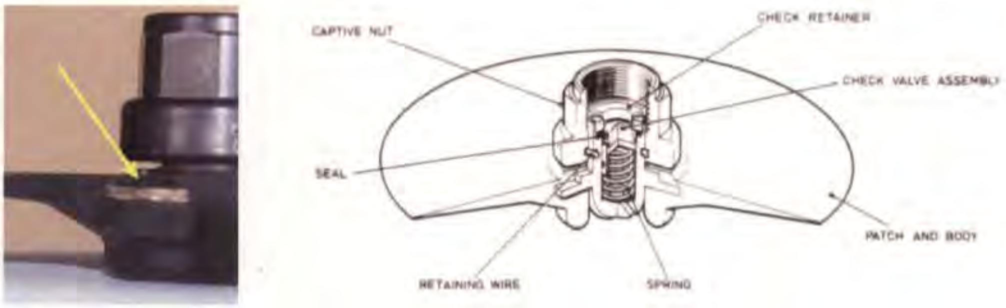


Figure 63. Sectioned Valve Assembly and Component Diagram.

1.4.6.51 Similarly, failure of the valve assembly in tension would always have resulted in deflation of the liferaft buoyancy chamber. In normal operation, the weight of the CO_2 cylinder and ALIU is borne between the CO_2 cylinder sleeve and the valve assembly. This is the load that the valve assembly was intended to support. The valve assembly exhibits no deformation when supporting that load on a fully inflated liferaft (see figure 64).

1.4.6.52 In Mod 02266, the liferaft lanyard is fastened to the floor of the liferaft at one end and to the SAC "Y" strap at the other. This provides one means of exerting an opposing force. The liferaft was previously at the end of the chain of PSP components, and only had to support its own weight/drag. The force from its own weight/drag acted through the floor of the liferaft to the liferaft lanyard. Mod 02266 now places the liferaft within the chain and it is now required to support the weight/drag of the SAC. If a force is applied at the SAC end of the chain (i.e. weight/drag), that force is applied through the floor of the liferaft, and acts across the body of the liferaft through the valve assembly to the CO_2 cylinder, and through the CO_2 cylinder to the PSP lowering line. The attachment points are shown in Figure 64. Exhibit 656 Exhibit 657

Figure 64. Liferaft/PSP configurations.

1.4.6.53 The advantages of attaching the PSP lowering line to the neck of the CO_2 cylinder are found mostly in the PSP deployment phase of the ejection sequence. The advantages are: Exhibit 656

a. The CO_2 cylinder is stronger than the fabric SAC "Y" strap. The PSP lowering line would fail before the neck of the CO_2 cylinder would fail, thus eliminating the risk of separation observed in the ejection from ZE789.

b. While packed, the weight of the SAC is wrapped around the CO_2 cylinder and liferaft, rather than being exerted through it. The valve assembly is not under tension and no modification of the packing plan is required.

c. Assuming failure free operation, once in the sea the pilot will come to his liferaft first if following the PSP lowering line.

RESTRICTED – SERVICE INQUIRY

1.4.6.54 The former single attachment point for the liferaft was the purpose fitted becket on the liferaft floor. If that becket was to fail and cause damage to the liferaft, it is likely that the damage would have been confined to the liferaft floor rather than extending to the buoyancy chamber. Adding an attachment point to the CO_2 cylinder adds a second point for failure to occur, this time on the buoyancy chamber wall. The CO_2 cylinder is fitted into the ALIU which screws onto the valve assembly. Failure of the attachment of the CO_2 cylinder will almost certainly result in deflation of the buoyancy chamber.

1.4.6.55 It is not known whether or not the post-Mod 02266 configuration is strong enough to withstand the full envelope of water entries which an ejectee might be expected to survive. The MBA stated design entry speed is 9 m/sec. Four examples of entries into the sea at or below the MBA design entry speed resulted in survival of the ejectees and no failures of equipment; a validation of the MBA design entry speed. MBA consider entry speeds above 9 m/sec to be outside of the design envelope. Evidence exists[4] that entries into water at speeds greater than 9 m/sec can be survivable, and analysis by Centre for Aviation Medicine (CAM) indicates that safe separation from the ejection seat can be achieved with residual descent speeds of up to 18 m/sec. Exhibit 653 Exhibit 668

Summary

1.4.6.56 The likelihood of a liferaft valve failure occurring in the pre-Mod 02266 configuration of the PSP was demonstrably small; it did not occur. The post-Mod 02266 configuration of the PSP has provided means by which to exert forces which could initiate this failure. The likelihood of this failure occurring remains low, but it is more likely than it was prior to incorporation of Mod 02266.

1.4.6.57 The Panel **observed** that the significance of the liferaft valve assembly failure under tension due to loads exerted through the PSP lowering line cannot be assessed because the full range of survivable water entry speeds is not fully understood.

Conclusions

1.4.6.58 The Panel concluded that:

a. there is a risk to the integrity of the buoyancy chamber from the ALIU; and

b. the embodiment of Mod 02266 has introduced the risk that the liferaft valve will fail under tension.

Elements of the PSP design and configuration, therefore, introduce hazards that are **other factors**, in that they could aggravate a future accident.

Personnel Emergency Locator System (PELS)

1.4.6.59 Prior to 1 Feb 09, the search and rescue satellite system, COSPAS-SARSAT, monitored 121.5, 243, and 406 MHz frequencies to detect emergency beacons. Exhibit 418 Witness 58 Witness 105 Exhibit 293

1.4.6.60 In Oct 00 at the 25th General Session of COSPAS-SARSAT participants, agreement was reached to cease monitoring 121.5 and 243 Mhz[5]. The cessation was scheduled to take place on 1 Feb 2009 in order to give sufficient notice (8 yrs 4 mths) for beacon users to replace their 121.5 and 243 MHz beacons.

[4] Snyder R.G., Snow C.C. (September 1968), Fatal Injuries Resulting from Extreme Water Impact, Federal Aviation Administration Office of Aviation Medicine.

[5] There is no documented evidence why the monitoring ceased, however the proliferation of PLBs and the high false alarm rate, along with the ease to include GPS data within the 406 Mhz signal contributed to the decision.

1.4.6.61 MoD advertised that it would be procuring 406 MHz beacons to replace its 121.5 and 243 MHz beacons in the Official Journal of the European Union (OJEU) on 5 Nov 04. The project to replace the beacon was named Personnel Emergency Locator System (PELS).	Exhibit 607
1.4.6.62 The project was then delayed by 12 months due to withdrawal of funding in Mar 05. The delay meant that the Invitation to Tender (ITT) was not issued until 4 May 07, 2 yrs 6 mths after the OJEU advert was placed.	Exhibit 607
1.4.6.63 Signature Industries Limited (SIL) was selected as the preferred bidder on 5 Dec 07 and the project reached Main Gate on 8 Jan 08. The contract for delivery of PELS was awarded on 1 Sep 08 and was expected to deliver an Initial Operating Capability (IOC) by Jul 09.	Exhibit 607 Exhibit 448
1.4.6.64 COSPAS-SARSAT ceased monitoring 121.5 and 243 MHz beacons on 1 Feb 09. No 406 MHz beacons had been brought into service through the PELS project to replace the lost capability in time for the switch off. The in service 121.5 and 243 MHz beacons could still be detected by a ground based transmitter/receiver (TX/RX) network and SAR homing equipment, but satellite detection had ceased.	Exhibit 418 Witness 58 Witness 105
1.4.6.65 Top Level Budget (TLB) holders used local purchasing arrangements to procure FastFind and SARBE G2R Personal Locator Beacons (PLBs) but did not follow a coherent strategy via Duty Holders. These beacons operate on 406 MHz but are not integrated into aircrew equipment assemblies. The FastFind beacon can only be operated manually. The SARBE G2R has a saltwater activation facility, but is not effective unless the antenna is manually deployed. Neither beacon was sufficiently effective to provide the required capability but significantly increased the likelihood of aircrew being found.	Exhibit 418 Witness 58 Witness 105
1.4.6.66 PELS IOC was delivered on 8 Jul 09, but the beacons were recalled by SIL on 8 Aug 09. Accelerated Usage Trials (AUTs) continued, but were suspended in Oct 10 for modifications to be made.	Exhibit 607 Witness 58
1.4.6.67 A second set of AUTs took place over the period Jul – Sep 11. The results of the AUTs indicated that the PELS project was not ready for delivery and that the project was at risk of failure. The project was terminated on 10 Apr 12 by mutual agreement between SIL and MoD.	Exhibit 607

Analysis/Conclusions

1.4.6.68 The PELS project was initiated in good time to replace the 121.5 and 243 MHz beacons ahead of the COSPAS-SARSAT cessation of monitoring of those frequencies.

1.4.6.69 The 12 month delay put delivery of the PELS project before 1 Feb 09 at risk.

1.4.6.70 Without the 12 month delay, the contracted delivery timelines would have resulted in IOC having been delivered prior to 1 Feb 09.

1.4.6.71 PELS project activity continued until 10 Apr 12 but did not deliver the required beacon capability.

1.4.6.72 The FastFind and SARBE G2R provide partial mitigation for the capability lost on cessation of monitoring of 121.5 and 243 MHz, but neither beacon provides fully integrated automatic initiation.

Sea Survival, Aircrew Survival Training and UK SAR

Introduction

1.4.6.73 This sub-section is divided as follows:

a. ABBOT 2 RS Pilot

b. Cold Water Immersion

c. Regulation, Policy and Orders: Sea Survival

d. UK SAR: Changes to Detection and Recovery Capabilities

e. Survival Evade Resist Extract (SERE) Policy, Aircrew Training and RtL

f. Analysis

g. Conclusions

ABBOT 2 RS Pilot

1.4.6.74 ABBOT 2 RS Pilot sustained a [redacted] most likely as a result of windblast during ejection. He was found immersed in the sea, wearing his inflated Life Preserver Aircrew (LPA) and holding onto his liferaft. He had not disconnected himself from his parachute by operating the Quick Release Fastener (QRF) on the parachute harness and had not activated his FastFind beacon. He was recovered after 75 mins of immersion in 12° C sea water [redacted] He was wearing flying coverall, long sleeved green aircrew roll neck, aircrew white long drawers and desert issue service socks. Topical heating (blankets) was applied to his body by a paramedic during the 25 mins journey to hospital by helicopter. His core body temperature was checked on arrival at hospital and recorded as [redacted] Death as a result of hypothermia will occur when core body temperature has fallen from the normal temperature of 37° C to about 25° C.[6]

Exhibit 6
Exhibit 78
Exhibit 42
Exhibit 44
Exhibit 8
Exhibit 15
Exhibit 479

1.4.6.75 It was the extreme nature of ABBOT 2 RS Pilot's [redacted] coupled with the attitude regarding SAR operations in the near vicinity of a SAR base (RAF Lossiemouth) that led the Panel to investigate sea survival, aircrew survival training and UK SAR.

Cold Water Immersion

1.4.6.76 Cold water immersion survival can be divided in to four stages: initial, short term, long term and post. Post recovery is not considered in this report.

Witness 48
Exhibit 370

1.4.6.77 **Initial (Cold Shock Response).** The sudden lowering of skin temperature on immersion in cold water can produce a number of significant physiological responses which can adversely affect survival chances. Initial responses, which predominately affect circulation and breathing, are collectively known as cold shock. This response probably accounts for the majority of near drowning incidents and drowning deaths following accidental immersion in open water below 15° C. Circulatory changes can include: immediate vasoconstriction of the skin blood vessels, sudden rise in heart rate, dramatic

[6] Essentials of Sea Survival, Frank Golden MD PhD and Michael Tipton PhD, Human Kinetics 2002, Pg 35.

increase in blood pressure, abnormal cardiac rhythms and cardiac arrest. Respiratory changes in water below 15° C include: an initial gasp preceding uncontrollable rapid over breathing, a sense of breathing difficulty, reduction in maximum breath hold from typically one minute in air to less than 10 secs in cold water, and drowning can result from aspiration of small quantities (1/2 - 1 pint) of water. For lightly clothed individuals, initial responses appear to reach their peak in water between 10° C and 15° C. Understanding of cold shock improved significantly following investigations in the late 1980s and 1990s.[7]

1.4.6.78 **Short Term.** After the skin, the next tissues to be affected by falling temperatures are the nerves, muscles and joints in the limbs. In these areas, cold quickly has a debilitating affect on the conduction of nerve impulses, chemical reactions, and muscle mechanics. It is important to complete any essential survival actions requiring manual dexterity soon after immersion, including: boarding of liferaft and preparation of location aids.[8] Witness 48 Exhibit 370

1.4.6.79 **Long Term.** Long term survival consists of many different strands, however, those are pertinent on this occasion are: Witness 48 Exhibit 370

a. **Hypothermia.** Difficulty arises in deciding the cut-off sea temperature at which regulations come in to force for personnel at risk of immersion to don protective clothing. Most authorities opt for a temperature of 15° C, assuming that at that temperature a person of normal build and physical fitness, wearing normal clothing and a lifejacket, could survive for six to eight hours. Such an assumption is erroneous and although some may survive that long in favourable circumstances, many factors can reduce survival time. The rate of heat loss to water will vary significantly between individuals depending on: age, gender, fitness level, illness and injury. When brain temperature falls below 34° C, the period of useful consciousness is limited as consciousness gradually becomes impaired. Consciousness is eventually lost at about 30° C, and below 28° C the heart may suddenly and spontaneously arrest either through ventricular fibrillation or later in relaxation when the cardiac muscle itself becomes paralysed by cold.[9]

b. **Life Preserver.** Because life preserver buoyancy is mainly distributed over the front of the upper torso to facilitate self-righting, and the dependent legs act as a sea anchor, waves apply a turning moment to the body. The result is that within one or two waves, a totally relaxed or unconscious person will turn to float facing the on-coming waves. Some twin-lobed life jackets unintentionally direct water toward the mouth in the channel formed by the lobes. Small waves running against a current or tidal stream can produce a steep wave face that can be particularly troublesome in this respect. In larger breaking waves, the narrow crest of the wave may periodically wash entirely over the face of the wearer; this is referred to as "wave splash." By interfering with normal breathing, the repetitive splashing of waves on the face can quickly become intolerable, however a conscious person is able to act to orientate themselves with their back to the waves. It is likely that an unconscious casualty will drown before severe hypothermia develops.

Regulation, Policy and Orders: Sea Survival

1.4.6.80 Regulation, policy and orders relating to sea survival include MRP RA, 1Gp Air Staff Orders (ASOs) and the RAF Lossiemouth FOB.

[7] Ibid Pg 61-63

[8] Ibid Pg 66-77.

[9] Ibid Pg 38, 107.

1.4.6.81 **MRP RA 2130 Safety and Survival Drills.** MRP RA 2130 Guidance Material states: Exhibit 186

*"**Survival Times**. Sea and land survival times are dependent on many factors and advice on appropriate clothing and procedures is given in Annexes B... This advice will be used by Aviation Duty Holders and Commanders when formulating their orders for the carriage and wearing of AEA and SE."*

1.4.6.82 Annex B provides estimated survival times for various aircrew clothing assemblies for a given water temperature (Figure 65).

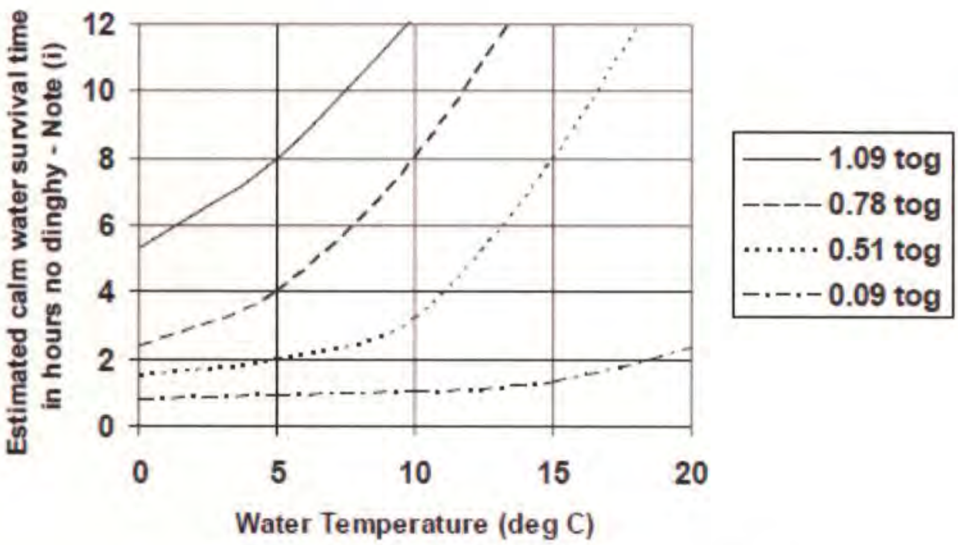


Figure 65. MRP RA 2130 Survival Graph

The accompanying notes state that *"At these temperatures individuals without immersion coveralls may die rapidly from cold shock before the onset of life-threatening hypothermia"* and that *"As these estimates are to be used for safety purposes, they are based on the shortest likely survival times for relatively thin individuals (approx 10th percentile mean skinfold thickness)"*.

Provenance of MRP RA 2130 Survival Times

1.4.6.83 The MRP RA 2130 survival graphs are derived from a mathematical model which was derived in 1987. The survival graph is based on the predicted time for the central arterial temperature of the survivor to fall to 34° C. This temperature is well above the level usually associated with terminal cardiac dysfunction, but represents a level of cooling at which the ability of the victim immersed in water to cope with even a moderate sea or co-operate in rescue measures, for example by firing flares, will be seriously in doubt. Exhibit 15

1Gp ASOs

Exhibit 187

1.4.6.84 1Gp ASO 2130 states:

"Immersion coveralls are to be worn by 1Gp aircrew for all sorties flying over or within 5nm of sea, when the sea surface temperature is 10°C or less."

RAF Lossiemouth Flying Order Book

1.4.6.85 The RAF Lossiemouth FOB states: Exhibit 144 Exhibit 285

"from 01 Nov to 30 Apr each year, unless otherwise authorised by the Stn Cdr, Lossiemouth crews are to wear immersion suits for all sorties."

Immersion Coverall Policy

1.4.6.86 **RN and JHC.** Policy varies across Defence as to which sea temperature limit is used for donning of immersion coveralls. Royal Navy and Joint Helicopter Command use a 15° C limit. Exceptionally, this rule may be waived provided that the estimated survival time is greater than the expected rescue time (although there are no current tools to measure this) or when the likelihood of heat stress is high. RN policy also requires Sqn COs to determine, using the information in MRP RA 2130, the appropriate clothing items to be worn in conjunction with the immersion coverall, having regard to local circumstances affecting survival or rescue times. Exhibit 286 Exhibit 287 Exhibit 687

1.4.6.87 **RAF Fast Jet (FJ) Immersion Coverall Policy.** RAF FJ immersion coverall policy requires the donning of immersion suits at or below 10° C. Evidence would suggest that RAF FJ immersion suit coverall policy was formulated before 1975 on differing concepts of operations from those of the RN, and the availability of rescue facilities. A regular complaint from RAF crews was the requirement to wear immersion coveralls in Spring when air temperatures had risen but sea temperatures were still lagging below 10° C. This led to a review of ejections in UK coastal waters, published in 1980. Following successful ejection, all but one individual managed to board a single seat liferaft. A wind tunnel experiment in moderately severe conditions demonstrated that no life threatening hypothermia occurred over six hours for personnel in a liferaft, which was roughly four times longer than the longest estimated time to rescue. The risk was identified as being one of cooling on water, rather than in water and the 10° C immersion coverall policy continued. Exhibit 288 Exhibit 289 Exhibit 290 Exhibit 307

UK SAR: Changes to Detection and Recovery Capabilities

1.4.6.88 **Recent Changes to UK SAR.** A number of recent changes to UK SAR capabilities have affected the likely detection and recovery times for downed aircrew. Exhibit 293 Exhibit 295 Witness 49 Exhibit 294 Witness 50 Exhibit 399

a. The withdrawal of COSPAS-SARSAT 121.5/243 MHz beacon detection in 2009 has increased the time taken to detect an emergency and to locate a casualty, particularly for incapacitated aircrew. Fast Jet aircrew do not have a credible automatic beacon that can be detected by satellite.

b. The SDSR deletion of a dedicated Maritime Patrol Aircraft; previously a Nimrod MR2 would be held at 2 hrs readiness.

c. The UK SAR Framework required SAR Flts to maintain one helicopter at 15 mins readiness and a second at 60 mins readiness. Currently, a single aircraft is maintained at 15 mins readiness. More recently, due to gapped rear crew posts across the RAF SAR Force, there will be occasions were RAF SAR helicopter will be unable to recover casualties from the water, vessels or from terrain on which the aircraft cannot land. In this instance, a SAR helicopter might be required to transit from an adjacent station, increasing the time to recover downed aircrew.

1.4.6.89 **SAR Helicopter Network.** The UK SAR helicopter network consists of 12 units comprising RN, RAF and Maritime and Coastguard Agency (MCA) assets. Figure 66 displays one hour flight time radius circles from each operating airfield. Capabilities of RN, RAF and MCA assets differ, particularly during night operations. For example, MCA do not have a Night Vision Device capability and therefore would not be able to respond to overland operations in remote areas in all but the best weather conditions. It is this publicised picture (Figure 66) that gives the impression that there is total coverage of UK coastal waters within a one hour response time in daylight hours. In reality the SAR assets could be in a different location (away from the centre of the ring) and could be unserviceable/manning shortfalls which could mean an asset from another location covering a larger area resulting in significantly increased recovery times.

Exhibit 294
Exhibit 297
Witness 5
Exhibit 296

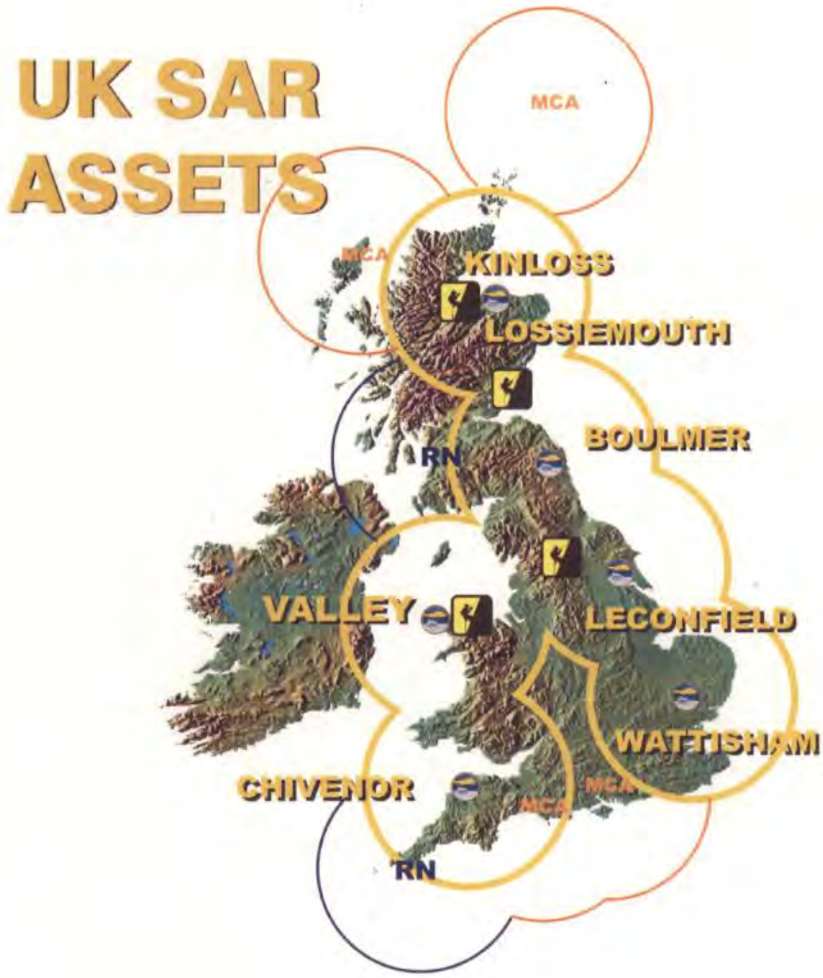


Figure 66. SAR Network.

1.4.6.90 Necessary tasks sometimes prevent the provision of an aircraft at 15 mins readiness. These include aircraft already "on task", training and maintenance test flights. There are also unanticipated occurrences such as aircraft unserviceabilities, poor weather and crew unavailability. On these occasions, cover is maintained over the network by ensuring that the next nearest stations can provide cover. Measures to ensure that such cover is maintained can involve moving aircraft and crews between stns. Therefore, response times may differ significantly and it is not unusual for a helicopter to be tasked from adjoining units.

SERE Policy, Aircrew Training and RtL

1.4.6.91 **JSP 898 Part 3 Chapter 3 Generic SERE Training Policy.** JSP 898 Part 3 Chapter 3 is sponsored by the Permanent Joint Headquarters (PJHQ), Joint Force Command (JFC). The chapter defines *"the responsibilities for, and the content of, generic SERE training to meet operational requirements."* The document is focussed on training for operations, specifically the training of personnel Prone to Capture and Exploitation and does not capture considerations for UK peacetime training. JSP 898 also defines TOR and membership of the tri-Service SERE Working Group (WG), which meets every two years to *"develop the scale and content of training to match the operational requirement within the available budget, and in accordance with relevant Defence and single Service policies."* Exhibit 429

1.4.6.92 **JSP 911 SERE.** JSP 911 SERE is produced by the Defence SERE Training Organisation (DSTO) and provides a comprehensive manual which *"contains all the detail necessary to Survive, Evade, Resist and Extract in any environment, on land or sea".* Exhibit 428

1.4.6.93 **Air Cmd SERE.** The Air Cmd SERE staff consists of one SO2 post (SO2 RAF SERE). The post is part of the Physical Education branch of 22(Trg) Gp. The SO2 post is currently filled by a Flt Lt Survival Evasion Resistance Extraction Officer (SEREO) who arrived in Sep 12; the post had been gapped since late 2011. Although not mandated, each Front Line Command (FLC) SERE representative should chair an internal review (FLC SERE WG) of SERE requirements for their respective command ahead of the SERE WG. Witness 50 Exhibit 675

1.4.6.94 **DSTO.** The DSTO is a tri-Service organisation under the command of AOC 22 (Trg) Gp, RAF. The DSTO delivers operationally focused SERE training together with basic land and maritime survival training; it does not set policy, but provides SME advice on UK SERE doctrine and policy to Joint Capability. The formal mechanism for the Training Requirement Authorities within the FLCs to agree training requirements and the DSTO delivery mechanism is through a number of WGs including the FLC SERE WG and SERE WG. These WG culminate in a 1* chaired WG to *"hold the customer to account"* for training requirements and DSTO *"for the quality and quantity of trg to meet that requirement."* SO2 RAF SERE believes that a number of personnel have a misunderstanding that DSTO is responsible for reviewing SAR/SERE considerations and providing policy guidance to aircrew. DSTO will, on request, provide advice to help shape regulation, policy and orders for UK peacetime flying however they do not direct it, this lies with the MAA and Duty Holder chain. Exhibit 298 Witness 50 Exhibit 427 Exhibit 675

1.4.6.95 **Pre Operational Conversion Unit (OCU) Training.** 1Gp FJ aircrew are required to attend initial training at the DSTO prior to commencing training at the OCU. Aircrew are mandated to wear immersion coveralls for <u>all</u> sea survival training when the water temperature is at or below 15° C. The DSTO instructors are aware of the withdrawal of 121.5/243 MHz beacon satellite detection; current DSTO aircrew briefing slides delivered to courses were found to state that 121.5/243 MHz beacons in the UK could still be detected by satellites, although the instructor was aware of the change. Classroom based training (lecture and demonstration) is provided on the FastFind beacon. Exhibit 303 Exhibit 188 Exhibit 299 Exhibit 427 Exhibit 635

1.4.6.96 **Continuation Training**. MRP RA 2130 requires that FJ aircrew undergo dry dingy training at six month periodicity, pool drill training annually and sea drill training biennially. Aircrew wear immersion coveralls for all sea drills at RAF Lossiemouth, regardless of water temperature. Pool drill training is conducted at normal pool temperatures and aircrew do not wear immersion coveralls; typically swimming pool water temperatures are above 28° C. Combat Survival Waistcoats (CSW) containing FastFind beacons are not worn for pool or sea survival training, therefore aircrew do not practise wet drills with representative equipment or current survival aids. Exhibit 186 Exhibit 291 Exhibit 292 Exhibit 188

1.4.6.97 **1Gp Tornado.** The current HQ 1Gp Tornado staff expect to be informed of long term changes to UK SAR, which may affect the recovery of Tornado aircrew, through either the HQ 2 Gp SAR Force representative or the SO2 RAF SERE. A recent example being that the Tornado desk was informed of SAR helicopter rear crew manning shortfalls. As UK SAR capabilities is a pan Gp issue, the Tornado desk would consider that policy changes and guidance would be forthcoming from Air Cmd.

Witness 49

1.4.6.98 **Survival Time and SAR Readiness States.** Several orders including 1Gp ASO, 2Gp ASO, JHC FOB and Books of Reference 767 require aircrew supervisors to make immersion coverall and overland clothing decisions based on MRP RA 2130 survival times and the expected availability of SAR assets and recovery times. The RAF Lossiemouth FOB states that:

"D Flt maintains 2 Sea King helicopters at the following readiness states:

a. Between 0800 - 2200 local: RS 15.

b. Between 2200 - 0800 local: RS 45."

Exhibit 187
Exhibit 288
Exhibit 286
Exhibit 289
Exhibit 287
Exhibit 295
Exhibit 428
Witness 5

1.4.6.99 JSP 911 SERE details helicopter readiness states and states that *"a second helicopter is on 60 minutes readiness between 0800 and evening civil twilight (ECT)."*

1.4.6.100 The Panel **observed** that both the RAF Lossiemouth FOB and JSP 911 SERE are in error, only a single aircraft is normally maintained at 15 mins readiness and there is no guarantee that it will be available in that vicinity in the event of an incident.

1.4.6.101 **Aircrew Briefing.** Consideration of survival is omitted in TGRF sortie briefing materials. MRP RA 2305 Supervision of Flying – Aircrew Briefing Guidance Material requires that *"emergency/survival procedures"* must be briefed during sortie briefs. 1Gp ASO 2305 also details Aircrew Briefing and requires the authorising officer to ensure that the sortie has been briefed iaw MRP RA 2305 and Force SOPs. The TGRF Handbook requires that formation leaders use the Force Standard briefing sheet from the TGRF Pocketbook for all routine sorties wherever possible. The TGRF Pocketbook briefing aide memoire encompasses the briefing requirements detailed in MRP RA 2305 with the exception of survival procedures; briefing material relates to aircraft emergency handling and Combat Search and Rescue procedures.

Exhibit 139
Exhibit 141
Exhibit 167
Exhibit 168

1.4.6.102 **Oversight of Changes to Recovery Capabilities.** RAF Flight Safety, Air Cmd, believes that Defence does not have a log of the cumulative changes to UK SAR capabilities and how the RtL has been affected. It does not believe that a suitable organisation exists to review pan-Defence guidance such as MRP RA 2130 Survival Times and continually review and analyse capabilities. The risk holder, however, is the Operational Duty Holder (ODH) but only for the assets within his Area of Responsibility (AoR). There is no pan-defence oversight for any changes to RtL.

Witness 51

1.4.6.103 **121.5/243 MHz Mitigations.** Although FastFind beacons were purchased to mitigate the failure of the PELS project, there is no evidence that a wider review of downed aircrew recovery times has been conducted as a result of recent changes, such as the removal of 121.5/243 MHz satellite monitoring. The 1Gp Tornado platform desk were aware of the change, however they were unaware of what analysis was conducted at the time. The Directorate of Aviation Regulation & Safety (DARS) publicised the demise and provided some suggested mitigations: Filing a flight plan, reporting emergency beacons to an ATC agency, leaving a copy of your route maps, extensive use of en-route ATC services and attempting to communicate deviations from the planned route with an ATC agency or home unit.

Witness 49
Exhibit 430

Analysis

1.4.6.104 The Panel **observed** that the intent of JSP 898 Part 3 Chapter 3 Generic SERE Training Policy remains broadly correct, however, it does require a significant degree of updating. JSP 898 details Commander Joint Operations as the Training Requirements Authority for <u>all</u> SERE training rather than just operational SERE. The ownership and review process for updating JSP 898 Part 3 Chapter 3 is unclear. Exhibit 675

1.4.6.105 The Panel considers that the RAF has not always been an "intelligent customer" in reviewing aircrew survival training, capturing emerging requirements and articulating these for consideration at the various WGs for inclusion in the endorsed training delivered at DSTO and FL units. Exhibit 675

1.4.6.106 **Downed Aircrew Recovery Times.** There have been significant changes to UK SAR capabilities since the implementation of the RAF 10° C immersion coverall policy. There is no evidence that thorough reviews have been conducted of the RtL for downed aircrew following recent changes to SAR capabilities. Witness 50 Witness 49

1.4.6.107 **Duty Holder Consideration of RtL for Downed Aircrew.** Given that immersion coverall policy is based in part on likely recovery times, there does not appear to be a suitable pan defence Duty Holder facing construct to comprehensively analyse aircraft operations, assess survival and rescue issues, consider past and future changes to UK SAR, and influence individual platform survival policy. The current Air Cmd SERE staff organisational construct is lacking and there is an absence of a formal mechanism for interaction with platform desk/Duty Holders. Witness 50 Witness 49 Exhibit 290

1.4.6.108 **Supervisor Decision Making.** Several orders require aircrew supervisors to make overland and oversea clothing decisions based on the information in MRP RA 2130 and expected SAR recovery times, but there does not appear to be a comprehensive and timely mechanism to inform the supervisors' judgement on a day by day basis. There is no means for the supervisor to estimate the mean or maximum time it would take to identify an emergency and for a SAR asset to find them. There is not a "one stop shop" authoritative reference for supervisors to keep abreast of current UK SAR Capabilities and SERE considerations; the RAF Lossiemouth FOB and JSP 911 SERE detail recovery capabilities but need to be updated to reflect current readiness states. Exhibit 187 Exhibit 288 Exhibit 286 Exhibit 289 Exhibit 287 Exhibit 399 Exhibit 295

1.4.6.109 **Aircrew Briefing and Knowledge.** Survival issues are not routinely considered as part of the mission cycle, when compared to other platforms. TGRF briefing material does not include survival considerations. A survey of a broad range of TGRF crews demonstrated a variable knowledge of PLBs, with a lack of knowledge of wider SAR capabilities. This may have been partially informed by DSTO briefing slides which suggested that 121.5/243 MHz personal locator beacons in the UK could be detected by satellite. Witness 37 Witness 40 Witness 38 Witness 36 Witness 31 Exhibit 399 Witness 4

1.4.6.110 **Cold Water Immersion Training.** RAF FJ aircrew training does not match the likely scenarios that may be encountered following an ejection. Aircrew do not practise sea drills in water below 15° C without immersions coveralls (although they do practice in sea temps at 15° C or above); this may limit understanding of cold water immersion survival, including cold shock and short term responses, and the likely difficulties that would be encountered in a real survival situation. If aircrew had the opportunity to practise survival drills in representative conditions, they might of their own volition wear an immersion coverall at sea temperatures above 10° C. Exhibit 292

1.4.6.111 **Wave Splash.** The Panel **observed** that there is no evidence that trials have been conducted to assess wave splash with RAF life preservers. Exhibit 300

1.4.6.112 **FastFind Beacon Training.** No trials have been conducted to assess the feasibility of accessing and operating the FastFind beacon from Tornado GR4 Aircrew Equipment Assembly (AEA) while in water. The carriage of the FastFind beacon in the CSW presents additional, unnecessary challenges in its operation. The CSW is worn beneath the LPA, and it is considered that the FastFind beacon would be difficult to access while submersed in water; a survivor could need to unfasten their life preserver. In addition to the difficulty of access, unfastening the LPA introduces a risk of the survivor becoming separated from his/her life preserver. All of the provided survival equipment is attached to the LPA via a lanyard, so separation from the LPA would also present a total loss of the provided survival equipment including the life raft. In a sanitised pool environment it is difficult to see the potential for this to happen, however it is a very real risk in a high sea state. Furthermore, aircrew do not conduct training in the pool or sea equipped with the CSW and FastFind beacons. The 22(Trg) Gp SEREO has stated that the CSW/beacon solution is *"...completely inappropriate in air equipment integration...."* Exhibit 300 Exhibit 292 Exhibit 301 Witness 50 Exhibit 302

1.4.6.113 On only one occasion have McMurdo Fastfind Max G PLBs been activated during a crash involving UK fast jets. Two Fastfind Max G PLBs were activated following the Tornado ZG792 accident. The crash happened during a gap between Low Earth-Orbiting (LEO) satellite passes, and the next LEO pass did not occur until after the two crew members had been rescued. Exhibit 458

1.4.6.114 LEO satellites can produce independently derived Doppler positions and the separate GPS position embedded within the beacon's transmitted data-burst on 406 MHz. On this occasion only a Geostationary (GEO) satellite detected bursts from the PLBs. The pilot's beacon was detected a couple of times and a 'coarse' GPS-derived position calculated from the data-burst's embedded GPS data. This position was approximately 10 nm in error, but within the "coarse" criteria maximum of 15 nm. The WSO's beacon was detected only once, when he was elevated during the winching process, and that data-burst did not produce a position.

1.4.6.115 **ABBOT 2 Expectation of Recovery Time.** Given the local nature of the sortie and close proximity of a SAR unit, the majority of aircrew would expect an expeditious recovery. ABBOT 2 RS Pilot's understanding of likely recovery times may have been partially informed by RAF Lossiemouth FOB ,which incorrectly states that two aircraft are maintained at 15 mins readiness. Witness 5 Exhibit 295

1.4.6.116 **ABBOT 2 RS Pilot Dress State.** ABBOT 2 RS Pilot's dress state complied with Regulation, Policy and Orders, which did not require him to wear an immersion coverall. Outside of the mandated period 1 Nov to 30 Apr, it is a rare occurrence for the sea temperature to drop below 10° C. Due to local policy and expectation of a fast recovery, it is by exception that immersion coveralls are worn for a sortie to Tain AWR from RAF Lossiemouth, when sea temperatures are above 10° C. Exhibit 304

1.4.6.117 **Survival Actions of ABBOT 2 RS Pilot.** Once in the water, ABBOT 2 RS Pilot was unable to complete his survival drills and was incapacitated. In this circumstance, an automatic PLB was vital. The accident occurred approx 25 nm from a SAR unit and the casualty remained in 12° C sea water for 75 mins; if the accident had occurred in a remote location an automatic 406 MHz beacon would have been required to facilitate rescue in a timely manner. Witness 18

1.4.6.118 **MRP RA 2130 Survival Graphs vs ABBOT 2 RS Pilot.** ABBOT 2 RS Pilot's clothing provided an immersed insulation of 0.13 tog. MRP RA 2130 predicts a survival time (34° C core body temperature) of 1.2 hrs based on a 10th percentile mean skinfold thickness. [redacted] Exhibit 15 Exhibit 305 Exhibit 306

1.4.6.119 **MRP RA 2130 Survival Graphs Review.** [redacted] The level of understanding amongst specialists in cold water immersion survival has improved significantly due to new research since the last modification to the MRP RA 2130 survival graph. Given that it is mandated that supervisors use the survival graphs to inform clothing decisions, it is important that the MRP RA 2130 survival graph and policy is reviewed periodically and updated as necessary. Exhibit 307 Exhibit 15 Witness 48 Exhibit 187 Exhibit 288 Exhibit 286 Exhibit 289 Exhibit 287

Conclusions

1.4.6.120 The Panel found that:

a. There is no effective Defence level organisation or forum to assess and inform the chain of command/Duty Holders of the latest information regarding survival and rescue. As a result, the risk being carried by RAF Duty Holders is not well understood and the measures being taken in mitigation are sub optimal.

b. There is no mechanism/ consolidated information to facilitate supervisors' decision-making on both overland and oversea clothing states compared against likely recovery times which take into account heat stress within the cockpit.

c. Sea survival regulation and RAF survival policy and orders are out of date.

d. RAF FJ aircrew do not train in scenarios which reflect those they are required to operate in. Specifically, they have:

(1) no opportunity to train without immersion suits in water temperatures below 15°C.

(2) no opportunity to train in water with the AEA they are required to wear in flight. Specifically, they train without the CSW and FastFind beacon.

(3) Poor knowledge of the capabilities of PLBs and wider SAR capabilities, in TGRF aircrew.

e. Integration of the FastFind beacon in to Tornado AEA is sub-optimal.

f. No realistic trials have been done to assess wave splash with RAF LPAs.

1.4.6.121 The Panel concluded that survival/platform organisation, survival policy, survival training and survival equipment integration is an **other factor** as it could aggravate another accident.

[10] The medical staffs at the hospital deal with hypothermic casualties on a routine basis and are well practised in measuring core body temperature.

Electronic Planning (Deconfliction) Aids

Introduction

1.4.6.122 This section of the report details the procurement history of electronic planning (deconfliction) aids. Electronic planning (deconfliction) aids can be used to highlight potential conflictions during mission planning, thereby allowing aircrew to take action to avoid or deconflict with other airspace users. This sub-section is divided as follows: Exhibit 318 Exhibit 63

a. Requirement

b. Automated Low Flying Enquiry and Notification System (ALFENS)

c. Military Flying Management Information System (MFMIS)

d. Centralised Aviation Data Service (CADS)

e. Defence Aircraft Collision Avoidance Service (DACAS)

f. Analysis

g. Conclusions

Requirement

1.4.6.123 Following a review of the UK Low Flying System (UKLFS) in the late 1980s, a redesigned night low flying system was introduced to improve deconfliction. It was intended that a computerised system of track deconfliction would be introduced to substantially increase flexibility of the system; this requirement was incorporated in to the Automated Low Flying Enquiry and Notification System (ALFENS). The requirement for an electronic planning (deconfliction) aid has remained through to the present day. The DACAS enhancement option, authored by Cap Air and Littoral Manoeuvre (Cap ALM) in 2011, noted that DACAS would provide a *"deconfliction service, allowing all aircrew to 'plan to avoid' other aircraft, mitigating the Risk to Life of aircraft collision…this would reduce the likelihood of collisions and their consequent loss of aircraft and life"*. Exhibit 63 Exhibit 319

ALFENS

1.4.6.124 **Concept.** The original ALFENS concept was an automated system to assist the Tactical Booking Cell at West Drayton, who managed the UKLFS and AWR bookings. Following increased use of the UKLFS throughout the 1980s and mid air collisions in 1987/88, the ALFENS project was broadened to include night deconfliction. The deconfliction concept was one of a networked mission planning system that would calculate a lozenge around a user's route and highlight conflictions with other users' routes. The contract for ALFENS was let in Nov 91 to Logica. Witness 23 Exhibit 320 Exhibit 318 Exhibit 63

1.4.6.125 **Project Failure.** Logica was scheduled to achieve final acceptance of ALFENS in Apr 94. By Apr 93, it became clear that the complexities associated with the project had not been well understood by Logica until several months into the programme. A progress report a year later noted that the project would not deliver the required functionality. Witness 23 Exhibit 320 Exhibit 318

1.4.6.126 **M-ALFENS**. It was decided to accept the parts of the ALFENS system that did work; this led to Messaging-ALFENS (M-ALFENS). Servers were installed at West Drayton Witness 23 Exhibit 494 and M-ALFENS was used to distribute Notice to Airmen (NOTAM) and warnings. M-ALFENS entered service circa 1998 but did not include conflict alert functionality.

MFMIS

1.4.6.127 **Requirement.** West Drayton was due to close in 2007/8, so there was a need to either move the servers or replace M-ALFENS with a new system. This led to the Military Flying Management Information System (MFMIS) project, contracted to EDS, which was to be delivered in two phases with an anticipated ISD of 2004. The first phase of the project was to provide similar functionality to M-ALFENS with the second phase providing deconfliction functionality. Witness 23 Exhibit 321 Exhibit 494

1.4.6.128 **Project Failure.** The MFMIS project suffered similar problems to ALFENS; the networked deconfliction part of the system failed to deliver and it was decided to cancel the MFMIS project in late 2007. The MoD therefore contracted National Air Traffic Services (NATS) for a version of their Extended Aeronautical Message Handling System (EAMS). With the imminent closure of West Drayton, NATS was able to deliver Military-EAMS (Mil-EAMS) within six months. However, Mil-EAMS did not provide conflict alert functionality. Witness 23 Exhibit 321

CADS

1.4.6.129 **Trial and Contract.** The Army Air Corps (AAC) contracted BAES in 2010 for a year long trial of Centralised Aviation Data Service (CADS) to see if it could be used to reduce the potential for mid air collision during the planning process. Up until then the AAC relied on fax, telephone and email to deconflict. Following the trial the AAC soon embraced CADS. BAES were awarded a year long contract in Aug 11 to provide CADS to all JHC units using Low Flying Area 1A (Salisbury Plain Training Area). At the time, CADS was not adopted by other FLC's as the DACAS project, was due to deliver an electronic planning (deconfliction) aid in Aug 12. The DACAS project suffered redundancies and shortfalls in key skills areas and was therefore delayed. A new contract was subsequently let to extend CADS to Aug 2013. Exhibit 322 Exhibit 323 Exhibit 324

1.4.6.130 **Effectiveness.** It is difficult to accurately quantify the effect of CADS on airproxs although one Duty Holder commented in Mar 12 that since the introduction of CADS there has not been an airprox reported locally. JHC has also commented that *"during its service CADS had identified potential risks and they have been avoided; that said only JHC and elements of Brize* [RAF Brize Norton] *have access, our civil partners do not."* Exhibit 325 Exhibit 322

DACAS

1.4.6.131 **DACAS Concept.** Cap ALM developed the DACAS concept in 2011. It was envisaged that DACAS would be a Defence wide tool, although initially it was to be used by JHC and Air Cmd for helicopter deconfliction. Following liaison with No 1 Aeronautical Information Documents Unit (AIDU), Cap ALM understood that a DACAS solution could be sourced in-house given AIDU's role, which includes managing airspace IT systems. OC No 1 AIDU stated that *"it was verbally briefed as a simple web based system."* Exhibit 326 Exhibit 324 Exhibit 323 Exhibit 325 Exhibit 327

1.4.6.132 **Project Failure.** DACAS was approved in Planning Round 12, at a ten year cost of £2.53m, with an ISD scheduled for Aug 12. OC No 1 AIDU stated that *"it soon became apparent that the limited system requirements provided to AIDU were not coherent with those required by the users…JHC and AIR…requirements were actually far in excess of AIDU's ability to deliver."* AIDU did not have the necessary project management expertise and, following redundancies, it became clear that they would be unable to deliver a DACAS solution. Exhibit 327 Exhibit 324 Exhibit 400

Analysis

1.4.6.133 Since the electronic planning (deconfliction) aid requirement was identified in the late 1980s, a successful long term solution has not been delivered.

1.4.6.134 The complexity of delivering a networked electronic planning (deconfliction) aid, that satisfies user requirements, should not be underestimated. ALFENS, MFMIS and DACAS projects have not delivered deconfliction or conflict alert functionality.

1.4.6.135 It is considered that No 1 AIDU were not best placed to deliver DACAS. No 1 AIDU lacked the project management training to effectively manage a project of the size and complexity of DACAS. Exhibit 324

1.4.6.136 Electronic planning (deconfliction) aids have the potential to reduce mil-mil airprox and mid air collision when combined with robust SOPs (crews have to adhere to them). Electronic planning (deconfliction) aids should not be viewed as a panacea, as aircrew often need to reroute or alter their mission profile once airborne. Exhibit 322 Exhibit 325 Exhibit 372 Exhibit 501

Conclusions

1.4.6.137 The Panel considered that:

a. Defence's electronic planning (deconfliction) aid requirement has not been satisfied, an electronic (deconfliction) aid was not available to ASTON and ABBOT;

b. an electronic planning (deconfliction) aid could have highlighted ASTON's planned route and First Run Attack (FRA) to ABBOT, prompting further action by ABBOT.

Therefore the inability of the procurement process to provide an electronic planning (deconfliction) aid is a **contributory factor**.

Medical Policy and Care of ASTON 1 WSO

1.4.6.138 This sub-section is divided as follows:

a. Background to Events (repeat of paras 1.4.1.107 – 1.4.1.115)

b. ASTON 1 WSO's Symptoms (repeat of paras 1.4.1.116 to 1.4.1.118)

c. Regulation, Policy and Procedures

d. Treatment, Assessment and Recording

e. Aviation Medicine Training

f. Flying Executive Records

g. Analysis

h. CAA and G-BYXR and G-CKHT Accident Case Study

i. Conclusions

Background to Events

1.4.6.139 The ASTON 1 WSO presented to the SMO on 25 Apr 12 stating that he had reached *"a crisis point"* and *"could not face going flying"* due to the anxiety he felt when flying at Medium Level (ML). He had already declared his intent to seek medical help to his Sqn OC, who had arranged the appointment with the SMO. The SMO diagnosed a phobic anxiety disorder. The symptoms of vertigo (dizziness), fear of falling, sweaty palms, dry mouth, abdominal discomfort and feeling disabled until the aircraft returns to Low Level (LL) and a history of anxiety had now also become symptomatic whilst on the ground. Having gained permission from the patient, the SMO consulted with the Sqn OC. The Sqn OC then consulted the Stn Cdr and, on medical advice from the SMO that the WSO remained fit to fly, the Executive agreed that he was fit to continue flying. The WSO was given an absence from duties of two days on 25 Apr by annotation of his medical notes. The WSO was referred to the local Department of Community Mental Health (DCMH) for treatment.	Exhibit 463 Exhibit 464 Witness 7 Witness 11 Witness 27 Exhibit 480 Exhibit 21
1.4.6.140 The SMO conducted the initial assessment and a physical examination of the WSO and on 14 May he was deployed on an Out of Area (OOA) posting. Before departure he conducted a "hand over" of his practise to the Civilian Medical Practitioner (CMP) in the Medical Centre, and the Deputy SMO. This included passing on a list of *"priority patients"* and a verbal description of the diagnosis, prognosis and treatment. The WSO was on the list and a description of the treatment and prognosis was given to the CMP. The description included the facts that the WSO was fit to fly and that the Station Executive were aware of, and happy with, the decision for him to remain flying. The SMO felt that the WSO's presentation was "*a moderate presentation*" rather than being "*at the severe end of the spectrum.*" Immediately after the "handover" of patients, the CMP went on two weeks leave and did not see the SMO again until he returned from his OOA posting. The SMO accessed medical records on 3 May and read the Community Psychiatric Nurse's (CPN) assessment of the patient from his first appointment; no further action was taken. After the SMO accessed the documents on 3 May, the RAF Lossiemouth Station Medical Centre took no further part in treating or managing the WSO for anxiety.	Exhibit 465 Witness 28 Witness 27 Exhibit 478 Exhibit 21
1.4.6.141 The WSO did not fly for three weeks after his initial presentation to the SMO. His next flight took place on 16 May 12. The WSO had no recorded absences from duties (declared unfit to fly) apart from the initial two day period prescribed by the SMO. The Sqn OC briefed the WSO that he would "*...work out whether or not you're fit to fly with the SMO. As soon as we get the green light from the SMO you can fly again...*". His course of action included directing the WSO to "*...go and do your first treatment at the psychiatrist over at Kinloss prior to...physically flying for the first time...*". The WSO declared at a review with the CPN and a consultant on 24 May 12 that he had had *"a 2 week period of grounding and following this had returned to flying"*. This was not documented in his flying records. At this review, the CPN noted that the WSO should remain in flying duties and recommendations on his Joint Medical Employment Standard (JMES) would be made as appropriate. OC XV(R) did not receive feedback from the CPN or SMO/CMP prior to the WSO resuming flying duties, he received feedback from the WSO.	Exhibit 22 Witness 7 Exhibit 464 Witness 28
1.4.6.142 The WSO recommenced flying on 16 May after a plan was formulated by the Flying Executive that he would avoid ML flight, which he had identified as the trigger mechanism for his anxiety. Additionally, he would only fly with staff instructor pilots, and not students. This was initiated by the WSO as he felt he should not be flying with students. This change in instructional status and control of flight regime was not regarded as a limitation by OC XV(R), but "*...an attempt to keep the sorties to a certain profile...*"	Exhibit 464 Exhibit 22 Exhibit 21
1.4.6.143 The WSO did not attempt to hide his condition; instead he explained it to the instructors on the Sqn at a communal meeting (without students present) and discussed it with colleagues on Stn and elsewhere. On 8 Jun, at an informal function at another stn, the WSO described to a previous SMO he knew that he had an irrational fear of ejector seats that "*...could either kill me or save me...*" and that *"...he didn't really want to fly again..."*	Witness 7 Witness 29 Witness 30 Witness 33 Witness 40

Discussing his condition with another doctor at the same event he informed him "*...that he wasn't comfortable flying, he didn't feel... in control..*" "*...and it hadn't happened to him before, and he couldn't explain why it was happening at that time, but he had decided not to continue flying...*" The two doctors did not raise any concerns as they both thought the WSO was no longer flying. Witness 34 Witness 36 Exhibit 477

1.4.6.144 On 27 Jun, ten weeks after initial presentation and having conducted 14 flights with staff pilots from XV(R) Sqn (22 hrs 40 mins flying, of which none was known to have included ML flight), the WSO resumed flying with student pilots. There was no medical review associated with this change in role nor any stipulated incremental sortie plan to resumption of instructional duties. He continued to see the CPN and the Consultant Psychiatrist who noted the change in training roles, recommended no requirement for medication and that the patient should not be downgraded. This is normal practise for DCMH recommendations. There was an understanding between the WSO, the CPN and the Consultant that the WSO remained in the early stages of managing the anxiety. He was assessed as *"mildly anxious"* but it was noted that his anxiety was *"deep rooted"*. Exhibit 22 Exhibit 21 Witness 7

1.4.6.145 During the preceding phase of flying with staff pilots, the WSO had informed them individually of his condition (if they had not been at the communal meeting where he declared his anxiety) and he made sure they were content with him to continue as their WSO. He informed them that his anxiety was brought about by flying at ML, and also described "*...suffering a bit with knife edge*[11]*...*" where he felt he was "*...a bit nervous when at medium level...*" The sorties were then planned to remain at LL. On resumption of instructional duties, the WSO did not inform the students of his condition prior to flying with them; they were generally aware of the situation from *"crew-room rumour."* Witness 16 Witness 13

1.4.6.146 The CPN and Consultant both conducted separate reviews with the WSO on 28 Jun, five days before the accident. The WSO gave conflicting information about his levels of anxiety to them, but both reports noted it was still present, albeit less severe than at his initial presentation. There were no inquiries about ML flight or the WSO's exposure to it. Exhibit 21 Exhibit 464 Exhibit 22

1.4.6.147 On 31 May, just over four weeks before the accident, he informed the pilot he was going to fly with that he felt a *"tunnelling effect when he looked out"* during low workload sections of the sortie and that he was very anxious before flying. On 18 Jun, he requested if the pilot who was conducting the planning for the sortie could *"avoid medium level"* if possible. On 26 Jun he stated to a pilot he was flying with that he preferred *"local sorties"* that remained at LL. The day before the accident, when speaking to the instructor who was setting the scenario for the flight for the day of the accident, the WSO had asked him to *"try and keep it at a low level"* which he duly planned to do. Interviews with Sqn pilots and electronic flight records show that the WSO was not exposed to ML flight or flight higher than 2-3000 ft AGL between 25 Apr (initial presentation) and 3 Jul 12 (the day of the accident). Witness 31 Witness 16 Witness 2 Witness 34 Exhibit 233

ASTON 1 WSO's Symptoms

1.4.6.148 The symptoms experienced by the ASTON 1 WSO at initial presentation to the SMO were vertigo, dizziness, fear of falling, sweaty palms, dry mouth and abdominal discomfort. These symptoms had begun to get worse and had arisen in an anticipatory fashion before flying (and during mundane flying related tasks such as reviewing the flying Exhibit 21 Exhibit 464 Exhibit 480

[11] Usually associated with high altitude flights, and during periods of low stimulation, some pilots have been known to suffer from various "out-of-body" experiences, where they "sense" that they are on the wing looking back in at themselves flying the aircraft. Under similar conditions, some pilots have also reported feeling that the aircraft is precariously balanced on a knife edge and extremely sensitive to small control inputs, or sometimes being "held" or restrained somehow, such that the controls become ineffective.

programme (Flypro)). He admitted he had chosen to fly the Tornado GR4 rather than the Tornado F3 due to the *"ML issue"* in flying training. The SMO diagnosed these symptoms as mild and recommended he remain fit to fly.

1.4.6.149 Symptoms described to the CPN by the ASTON 1 WSO were vertigo, anticipatory anxiety of ML flight and anxiety about his ability to fulfil his role should he be unable to control his anxiety at ML. Feelings of panic and disorientation when looking out of the aircraft at ML with significant anxious arousal resulted in him not looking out of the aircraft. Hyperventilation, increased heart rate, paraesthesia, holding onto the sides of the aircraft and feeling disabled until returning to LL. He also experienced disturbed sleep through anxiety with resulting fatigue the next day. The CPN diagnosed these symptoms as *"a straightforward anxiety case"* and recommended he remain fit to fly.

Exhibit 21
Exhibit 464
Exhibit 480

1.4.6.150 Symptoms initially described to the Consultant by ASTON 1 WSO were of an anxiety and phobia related to flying at ML. He had been experiencing anxiety since his early training as a WSO. Sweating, palpitations and paraesthesia had reached panic levels with fear of losing control. These symptoms have been present since early flying training. Whilst the symptoms tended to occur at ML they were also now affecting him when flying at LL. The symptoms were worse at periods of low work intensity during flight. He described feelings of anxiety when thinking about flying even when not in work, and on walking out to the aircraft. He began anticipating the symptoms and felt relief when a possible exposure to flying related events were cancelled, such as a recent cancellation of a sea survival drill. He had a worry of acute anxiety/panic attack whilst flying and the possible serious consequences when instructing students. There was also an anxiety of the impact of the illness on his career. The Consultant Psychiatrist diagnosed the patient as moderate and recommended he remain fit to fly.

Exhibit 21
Exhibit 464
Exhibit 480

Regulation, Policy and Procedures

1.4.6.151 **Policy.** In order to ensure that personnel are fit to perform their Service Duties, trade and branch fitness standards are set, against which an individual's fitness can be clearly and accurately assessed. Where an individual's fitness falls short of the required standard, their employment may need to be restricted. This protects the individual and/or their colleagues whilst retaining the skills the individual may still be able to offer within the Service. In this way sickness absence and medical invalidation are both minimised. All Medical Officers (MOs) act as occupational physicians when judgements regarding fitness for duties are made. The role of the MO is to ensure that the JMES accurately reflects the limitations under which the individual can be employed.

Exhibit 466
Exhibit 489
Exhibit 490

1.4.6.152 **Standards.** Medical fitness of service personnel is expressed by a Joint Medical Employment Standard (JMES) which indicates any restrictions in employment that may be placed on an individual. For aircrew these are annotated within the medical section of their logbook after their Periodic Medical Examination which occurs annually.

1.4.6.153 JMES codes are as follows:

Exhibit 466

	JMES Code	Description	P Category	Notes
Air	A1	Fit for flying duties without restriction	P2	Only for aircrew
	A2	Fit for flying duties but has sub-optimal hearing or eyesight	P2	Only for aircrew
	A3	Fit for limited flying duties	P2, P3, P7	Only for aircrew

A4	Fit to be flown in a passenger aircraft	P2, P3, P4, P7, P0, P8	
A5	Unfit to be taken into the air	P3, P4, P7, P0, P8	
A6	Air assessment not currently required		Not to be used for RAF Personnel

Table 8. JMES Codes.

1.4.6.154 A JMES indicates whether an individual is fit for duty or is non-effective, and may be "permanent" or "temporary". These are defined as: Exhibit 466 Exhibit 489 Exhibit 490

a. **Permanent JMES**. No medical reason to expect any change in the individual's condition for the foreseeable future (minimum 18 months) or until a time defined by the Medical Board.

b. **Temporary JMES (effective).** A temporary and transitional JMES to reflect the individual's employability prior to restoration of a former permanent JMES or the award of a new permanent JMES. A temporary employment standard is one which, in the opinion of the medical board, will require review within 18 months. A temporary JMES uses a "T" suffix to differentiate it from a permanent JMES.

c. **Temporary JMES (non-effective).** The award of a temporary non-effective JMES is appropriate when an individual is likely to be unfit for all forms of duty for a prolonged period of time. A temporary non-effective JMES can be awarded for a maximum period of 18 months from the date the individual became unfit for duty.

1.4.6.155 **Process of Assessment.** When aircrew present to a MO with a medical condition, the assessment process falls broadly into two categories: Effective (fit for work) or Non-Effective (unfit for work). Within the Effective category there is the subset of Limited Duty (fit for work, but with limited duty restrictions, such as unfit flying duties). Being unfit to fly carries an absence from flying (colloquially known as "grounding") but this does not explicitly require absence from the workplace (unless recommended, e.g. contagion, bed rest). A flow diagram (Figure 67) of consultation disposal explains possible outcomes: Exhibit 467

Exhibit 468

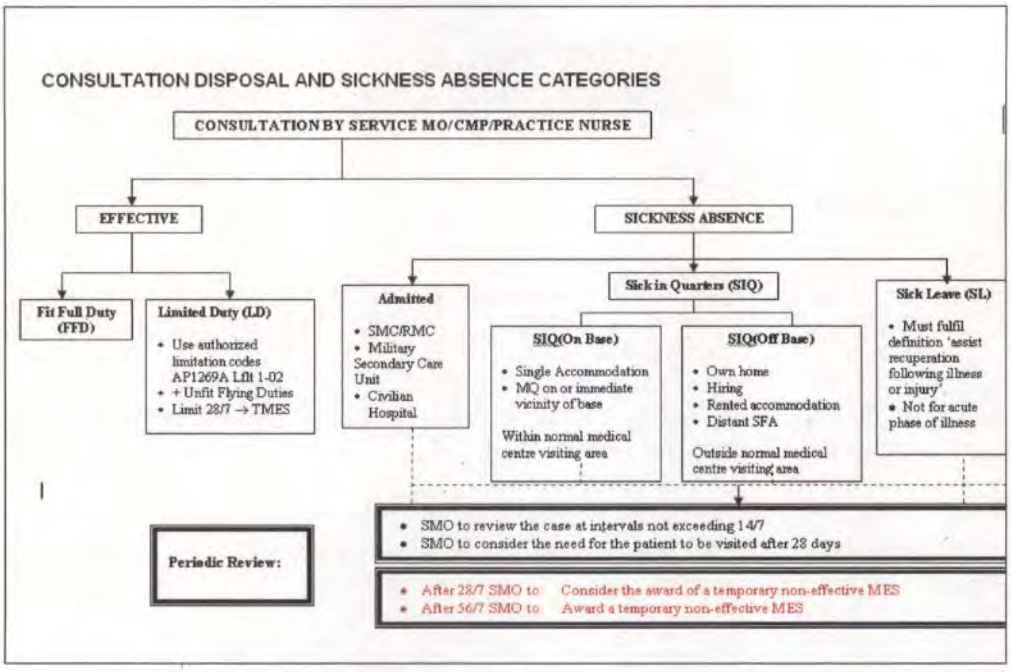
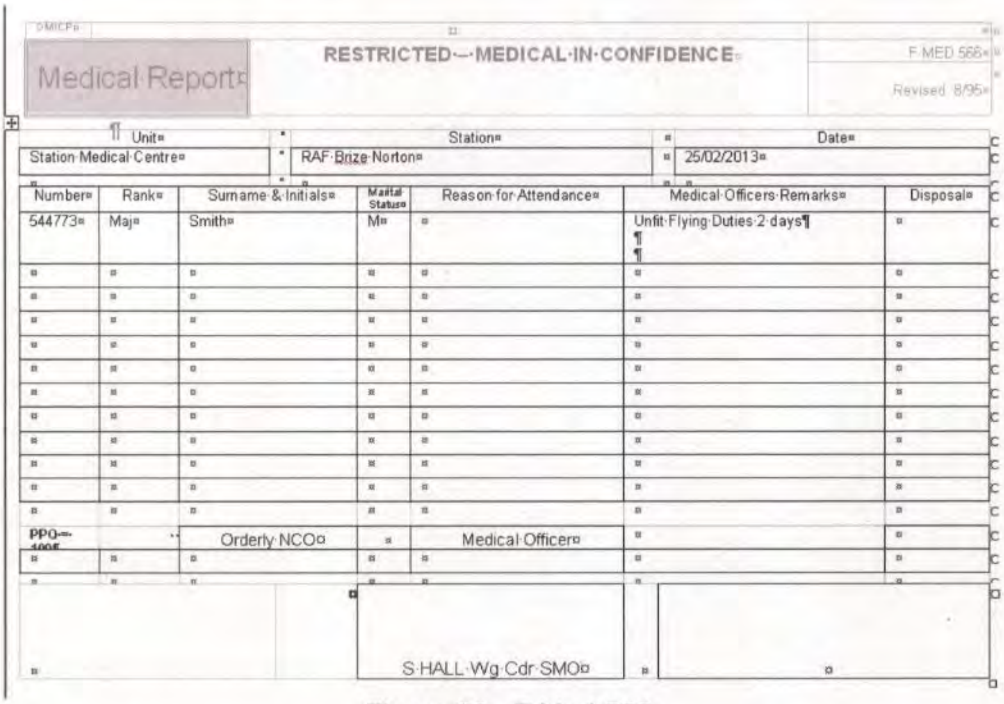


Figure 67. Consultation Disposal and Sickness Categories.

1.4.6.156 If the patient is assessed as Effective, Fit for Duty the MO is to record the consultation within the patient's medical documentation on the Defence Medical Information Capability Programme (DMICP) and there will be no further action taken (this is a rare occurrence as aircrew are generally astute about their own medical fitness to fly and it is unlikely an SMO will direct aircrew to return to flying duties against their wishes). If the patient is assessed as either Effective, Limited Duty or Non-Effective then the consultation will be recorded on the DMICP and a Form Medical (F Med) 566. A copy of the F Med 566 is given to the patient. Exhibit 469


DMICP

Medical Report

RESTRICTED – MEDICAL IN CONFIDENCE

F MED 566

Revised 8/95

Unit	Station	Date
Station Medical Centre	RAF Brize Norton	25/02/2013

Number	Rank	Surname & Initials	Marital Status	Reason for Attendance	Medical Officers Remarks	Disposal
544773	Maj	Smith	M		Unfit Flying Duties 2 days	
PPO-1005		Orderly NCO		Medical Officer		

S HALL Wg Cdr SMO

Figure 68. F Med 566.

1.4.6.157 The F Med 566 is a document that is printed from the DMICP system which holds no specific medical information; that information is retained on the Medical in Exhibit 467 Exhibit 489

Confidence system of DMICP. The F Med 566 is to be presented to the Line Manager by the patient in order to inform them that the service person can only perform limited duties (for example; declared unfit for flying) or is subject to a sickness absence. The majority of illnesses that are presented to MOs do not result in any alteration to the patient's JMES as the award of a temporary or non-effective JMES is appropriate when an individual is likely to be <u>unfit for some or all forms of duty respectively for more than 28 days.</u> It would also not be appropriate to award a transitional JMES in the example of a cold or temporary non-effectiveness/fitness to fly as this would place an unnecessary burden on the system and the F Med 566 process is sufficient in these cases to dispose a short absence from duty.

1.4.6.158 The term Limited Duty denotes that the individual is to perform limited duties only. The limitations are to be stated by the MO or Practise Nurse who is to use, where possible, the authorised limitation notes specified in AP1269A, Lflt 1-02. These limitations should provide sufficient flexibility to define the limited duty. Additionally, the limitation "Unfit Flying Duties" may also be used. Exhibit 467

Leaflet 1-02 AUTHORISED MES LIMITATIONS AND COMPUTER CODE NUMBERS

1. Authorised limitations and their computer code numbers are detailed below:

JPA Restriction Code	Restriction
(a)	(b)
50	Restricted employability because of anthropometric limitations
52	Aircrew assessed to have hearing standard of H2
53	Must wear approved corrective flying spectacles when flying
54	Must wear approved visual correction when flying (authorised to wear contact lenses)
55	Must carry approved corrective flying spectacles when flying
60	Unfit solo pilot - must fly with a pilot suitably qualified on type
63	Unfit solo (aircrew category will be specified in Med Docs)
65	Unfit ejection seat aircraft
70	Unfit specific aircraft (type(s) to be specified in Med Docs) (See note 1)
71	Fit (detail to be specified in Med Docs) flying duties only
72	**Obsolete**
73	Unfit aircrew respirators
74	Unfit (conditions of flight to be specified in Med Docs) (See note 1)
75	**Obsolete**
100	Unfit guard duties
102	Unfit marching

Exhibit 471

Figure 69. Authorised MES Limitations and Computer Code Numbers.

1.4.6.159 The extant code relating to flying fitness is 071 which carries an amplifying description. The unused code of 074 (Unfit (conditions of flight to be specified in Med Docs) (See Note1)) has been superseded by 071; code 074 does not have this facility for amplifying remarks which are used to describe specific conditions of flight. Exhibit 471

1.4.6.160 **Temporary JMES.** Any patient who is likely to be unfit for elements of their duties for more than four weeks, regardless of whether a specialist opinion has yet been Exhibit 472 Exhibit 473

[12] PULHEEMS is a system of grading physical and mental fitness. It is not a fitness test, it is a test of suitability for a purpose. It is an abbreviation for the factors: Physique, Upper Limbs, Lower Limbs, Hearing (left), Hearing (right), Eyesight (left), Eyesight (right), Mental function, Stability (emotional).

[13] **Should** is the permissive verb used in the Acceptable Means of Compliance to allow a Regulated Entity the opportunity to consider alternative approaches in meeting the regulation; noting that any alternative approach must be approved by the MAA.

gained, is to be awarded a temporary JMES immediately. The MO is then responsible for filling out an F Med 23 (which is kept on DMICP) with a supporting narrative including the following: Exhibit 489 Exhibit 676

a. The date the new MES becomes effective

b. A PULHHEEMS[12] profile and MES

c. The type of MES (T – Temp or P – Perm)

d. The duration of the employment standard

e. The diagnosis

f. The list of limitations and codes awarded along with any relevant permanent limitations previously awarded.

g. A statement that the patient has physically presented to the MO and that the MES awarded is correct.

1.4.6.161 MRP RA 2135 states *"Aircrew **should**[13] report any period of grounding to their Authorizing Officer."*

1.4.6.162 **F Med 23.** An example of an F Med 23 is below (Figure 70). This would be attached to the consultation notes in the F Med 4 (DMICP). Exhibit 474

Service No.	Rank/Rating	Branch/Trade	Date of entry
4000000	WG CDR	RAF - OFFICER	
Surname	BROWN	Command	
Forename(s)	BRIAN	Ship/Unit/Station	RAF HIGH WYCOMBE
Date of Birth	01/04/1980	Type of enlistment /commission	ROYAL AIR FORCE
Place of Board	RAF High Wycombe	Normal date of termination of full time service	1 Feb 2028
Authority for Board	PAP 2007	Ceased Duty On	
Date of Board	6 May 2011		

Principal condition(s) affecting the medical employment standard leading to the Medical Board		**Other condition(s) affecting the medical employment standard at the time of the Medical Board**	
ANXIETY DISORDER (F40)			
Date(s) of origin	Place(s) of origin	Date(s) of origin	Place(s) of origin
25 Feb 2013	RAF HIGH WYCOMBE		

FINDINGS OF THE BOARD

P	U	L	H	H	E	E	M	S	Employment Standard, including any specific

3 R	2	2	1	1	3	3	2	3 R
					1	1		
Period of validity of PES					6 MONTHS			

restrictions on employability and future plans
A3 L1 M1 E3 Limitations: 071 – Fit day VMC flying only 110 – Unfit Service Outside Base Areas

Wg Cdr Brown presented on 25 Apr 2012 complaining of anxiety type symptoms when flying in cloud. On questioning this appears to have started a few years ago and has gradually become worse. He now tries to actively avoid situations where he might have to do this type of flying. His Sqn OC describes him as a very capable operator and had no concerns about his ability. The patient describes typical somatic symptoms of anxiety including palpitations, sweating, and nausea. He has been referred for an urgent opinion at the local DCMH and in the meantime he needs to be awarded a lowered JMES to reflect this current situation and ensure that he stays in the UK to continue with treatment, if required.

Therefore iaw AP 1269A Lflt 2-03 Para 2 I award a JMES of A3 L1 M1 E3 MLD wef 6 Mar 2013 for a period of 6 months.

Figure 70. Example F Med 23.

1.4.6.163 **Review process.** The RAF Manual of Medical Administration, AP1269, states that aircrew who undergo medical treatment or drug therapy which renders them unfit for full flying duty, or aircrew who have a period of sickness absence, are to undergo consultation with the MO before resuming flying. It is at this point that an F Med 566 would be raised and delivered to the patient's Line Manager by the patient, confirming fitness to return to full flying duties. Exhibit 467 Exhibit 473

1.4.6.164 MRP RA 2135 states: *"When grounded, aircrew must ascertain whether they require review by a MAME[14], before returning to flying duties; if this is required they are responsible for ensuring that such a review is obtained."*

1.4.6.165 **Referral Process.** There is a standard process for referral of military personnel to the Department of Community Mental Health (DCMH) that would cover their catchment area. There is conflicting advice in AP1269 L6-03 Annex A and AP1269A L5-12 regarding referral of aircrew presenting with psychiatric disturbance associated with flying. AP1269 advises aircrew to be referred to the Tri Service Aviation Psychiatric Clinic at DCMH RAF Brize Norton for specialist aviation psychiatric advice rather than their catchment DCMH, and AP1269A advises that any RAF consultants may be approached about aspects of aviation psychiatry with the option for onward referral to DCMH, RAF Brize Norton. Exhibit 475 Exhibit 476 Exhibit 490

1.4.6.166 AP1269A states that in the absence of either a military psychiatrist or a psychiatric opinion from a civilian consultant psychiatrist, that if there are concerns regarding the risk of safe task performance, the Station MO is to change the patient's MES accordingly and review it on a regular basis while awaiting a psychological assessment.

1.4.6.167 Clinical concerns of aircrew within the advisory documentation state that disturbances of mental state may be associated with an unacceptable impairment of judgement in the execution of safety critical tasks. In cases that have been discussed with

[14] All MOs and CMPs who undertake periodic medical examinations of military aircrew and/or Air Traffic Controllers, and secondary care specialist giving advice on aircrew, must attend the RAF Initial Medical Officers Aviation Medicine Training Course. This will result in being appointed a Military Aviation Medical Examiner (MAME).

an aviation experienced RAF consultant psychiatrist, it may be possible to recommend temporary restrictions to the type of flying (for example, "unfit operational flying" (Code 071)). The psychiatric specialist is to determine their MES. Before returning to flying duties, all such cases are to be referred to a RAF consultant psychiatrist for further assessment.

1.4.6.168 **Anxiety Disorders**. Anxiety disorders include generalised anxiety, specific phobias and panic disorder. Problems associated with stressful circumstances may be more appropriately classified as an adjustment disorder, which can be a lesser presentation of anxiety. Symptoms and signs of an adjustment disorder can include palpitations, tremor, shortness of breath, chest pain, dizziness, fatigue, weakness, headaches and paraesthesia (pins and needles). In panic disorder there is a risk of sudden incapacitation. Exhibit 476

1.4.6.169 Both anxiety or adjustment disorders may elicit an appropriate limitation in their working duties. This may be appropriate for individuals with phobic disorders (to avoid the circumstances of the phobia initially) and also in the case of adjustment disorder when minor degrees of anxiety symptomatology arise in association with difficult psychological circumstances. In these cases judgement and cognitive performance might be impaired.

1.4.6.170 Many cases of adjustment disorder will be managed by the Community Mental Health Nurse and do not merit any change to the MES. Cases not responding immediately where there is a hazard to safety critical tasks (for example aircrew) are to be awarded a limitation on their JMES with specified restrictions.

Treatment, Assessment and Recording Observations

1.4.6.171 Civilian locum Consultant psychiatrists can provide SMOs with advice on individual patients concerning fitness to fly, mental state and suitability for performing current duties. There is nothing within published advisory documentation that states a requirement for consultants to have specific aviation experience. Decisions on these matters still rest with the SMO in conjunction with the opinion of the specialist. Exhibit 476 Exhibit 486 Exhibit 490

1.4.6.172 CPN's are able to provide a wide range of interventionist and counselling services including anxiety/stress management, panic disorder and other anxiety disorder management and phobic desensitization. There is nothing within published advisory documentation that states a requirement for CPNs to have specific aviation experience.

1.4.6.173 RAF Consultant psychiatrists have Aviation Medicine experience (either Initial Medical Officers Aviation Medicine training or Diploma in Aviation Medicine (DAvMed)), and the RAF consultant at DCMH Brize Norton provides specialist aviation psychiatric advice.

1.4.6.174 **Medical assessment, referral and treatment of ASTON 1 WSO.** ASTON 1 WSO initially approached OC XV(R), informing him of the situation and discussing the next steps. OC XV(R) consulted the SMO to arrange an appointment and received immediate feedback on the diagnosis after the appointment took place. At this point the WSO was verbally declared temporarily non-effective with two days absence from flying duties but with the prognosis that the WSO would be fit to fly *"when he is ready"*. There was no F Med 566 issued. OC XV(R) informed the Stn Cdr of the situation and, on gaining medical advice of diagnosis from the SMO, they both agreed that the WSO was fit to fly under the limitations of avoiding ML flight and on the proviso he was only to fly with staff instructors rather than students. The SMO made a judgement that, due to the patient being a WSO, it was less dangerous to resume flying than if the patient had been a pilot. There was no comment regarding the WSO flying in a training aircraft with dual controls. Exhibit 21 Exhibit 464 Exhibit 480 Witness 7 Witness 27 Witness 11

1.4.6.175 The SMO sent a referral letter to the DCMH and had a telephone call with the CPN to request that the WSO was seen as expeditiously as possible. The initial Exhibit 480 consultation with the CPN occurred five days after initial presentation to the SMO on 30 Apr. The referral letter stated, *"I am keen to keep him flying as I feel that would be the best way to manage him for the longer term*".

1.4.6.176 The initial consultation, referral letter and CPN consultation report were all recorded on DMICP, which is the central point of data management of all patient medical documentation. This is the means by which all medical-in-confidence information can be accessed by clinical staff (whether they be the SMO, DSMO, CPN, or Consultant). Confidential information (such as psychiatric assessments) should not be accessed by medical staff unless there is a legitimate reason for access. Any access is recorded to the Caldicott Guardian (the primary safeguard position for medical in confidence information management). Exhibit 480 Exhibit 21 Exhibit 488

1.4.6.177 The CPN who treated the patient was an RAF Flt Sgt with 20 years experience in the UK military, although has no specific aviation knowledge, experience[15] or training. There is no such training available to CPNs. Witness 88

1.4.6.178 The Consultant Psychiatrist was a civilian Locum Consultant who had served 28 years in a foreign military as a psychiatrist, but had no specific aviation or military aviation training or experience. He is extremely experienced in psychiatry, anxiety disorders and their treatment. The military he was a part of, had adopted UK armed forces medical processes and procedures, making him conversant with similar forms and practices. The UK military aviation medicine training is available to external applicants on an availability basis. Witness 66

1.4.6.179 The WSO had a total of five consultations with the CPN and two consultations with the Consultant Psychiatrist. During his assessment and consultations, a skeleton "Care Plan" was formulated which would manage his treatment and recovery. This included the Cognitive Behaviour Therapy (CBT) and assessment during a simulator sortie. The WSO did not complete the simulator assessment. The Care Plan included the clinical treatment of the WSO's condition, but did not stipulate the occupational requirements, such as flying regimes or flying limitations. Exhibit 21 Exhibit 464 Witness 88 Witness 66

1.4.6.180 **Resumption of Instructional Duties.** ASTON 1 WSO resumed instructional duties on 27 Jun having flown 14 sorties with staff pilots since his period of non-flying. He attended a consultation with the CPN on 22 Jun, but did not discuss any change in status. At the consultation the CPN noted that *"He is still clearly in the early stages and he acknowledges that he continues to 'body scan' for sensations that could indicate the onset of panic."* There was no stipulated assessment within the Care Plan to resume instructional duties, either by the Medical or Flying Executive. Exhibit 21 Exhibit 22

1.4.6.181 **Understanding of Information Flow.** There is a process of information flow amongst clinicians that centres around the data management facility of medical in confidence information – DMICP. Historically, notes were sent to MOs in physical form and the audit trail was recorded by circulation sheets bearing signatures to show who had seen the information. The process at the time of the accident was to note any consultation, referral, diagnosis, medication, recommendation and any supporting information on DMICP and it was best practice for MOs to review the documentation. Witness 28 Witness 27

1.4.6.182 This best practice was usually predicated on agreed review dates, medication

[15] The CPNs conduct aeromedical evacuation training. This five week course (and requalification course) looks at the basic effects of altitude on the body or medical conditions. There is a small element of psychiatry within this course. The CPN will have acted as an escort for psychiatric patients and will have seen aircrew in the past. This will have given them a basic knowledge and experience of aircrew.

assessment, end of absence of leave, disposal or an informal medical board, but relied on MOs accessing DMICP to review external consultant treatment (in this case CPN and Consultant notes). There is now no longer a specific trigger for MOs to read notes from referred clinicians, compared to the previous system of physical notes, if the external agencies do not feel there is a necessity to directly call them, or if there is not a review appointment made.

1.4.6.183 The Flying Executive (DDH and OC XV(R)) would receive information (once approved by the patient to be shared with them) via the MO and the patient. They would not receive any additional information if the MO believed patient management remained the same. The requirement for medical input would occur if a structured/agreed Flying Executive management review was mandated with the necessity for a medical review or MES upgrade.

1.4.6.184 The CPN would receive information from DMICP (MO consultation notes, referral letter and Consultant notes) and the patient.

1.4.6.185 The Consultant would receive information from the CPN (verbally), DMICP (MO consultation notes, CPN consultation notes and referral notes) and the patient.

1.4.6.186 The feedback from external clinical care/treatment to the Flying Executive is via the stn MOs, as they are the occupational physicians with the greatest knowledge of the specialisation (in the absence of RAF aviation specialist psychiatrists). Stn MOs can have different levels of occupational experience depending on how much aviation medicine (AvMed) training they have received.

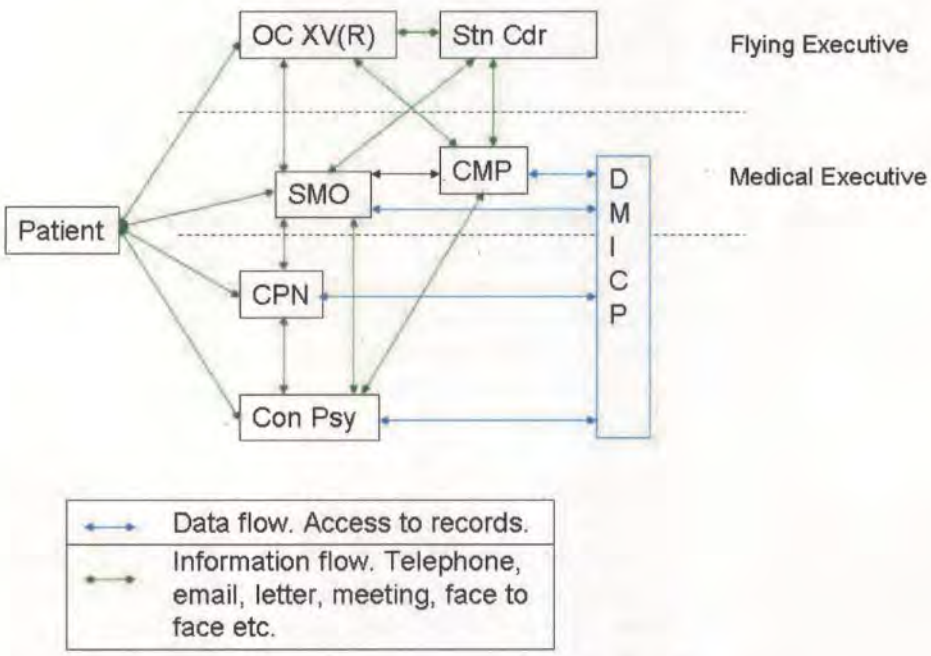


Figure 71. Diagram to show information flow.

1.4.6.187 **DMICP Tasking Process**. The DMICP system is enabled to send a "tasking" note to other users in order to inform them that there is documentation that requires some action or acknowledgement. This is an electronic means of informing units outside of a practise that there has been some change to medical documentation, or there is something that the "tasked" agency should see. This process is regularly used within "primary care"

Exhibit 482
Exhibit 484
Exhibit 485

(Unit Medical Health Centres) when doctors refer patients to specialists and are awaiting reports back on treatment or diagnosis, although there is no Surgeon General policy in place to mandate it.

1.4.6.188 DMICP training takes place at the Defence Medical Services Training Group (DMSTG). It is here that tri-service medical personnel attend training courses on DMICP, where "tasking" is taught within other processes such as "managing your admin list and referrals". A training manager within DMSTG stated that there is some information on the DMICP portal on the process, however as it is not a mandated practice and *"it is very dependant on where you work as to the policy".*

1.4.6.189 Unless medical personnel are on a Phase 2 or Phase 3 training course at the DMSTG (which are part of career progression qualification), then the only way medical personnel can get DMICP training is by bidding for an external course via the Defence Information Note (DIN) process. There are four courses offered on the DIN: User, Health Care Professional, System Admin and Pharmacy, all of which cover the DMICP tasking process. DMICP courses have been suspended since Sep 12 due to IT problems.

1.4.6.190 RAF Lossiemouth Health Centre has been using the "tasking" process for over two years, and use it frequently with referrals to the Department of Community Mental Health at Kinloss Barracks. However, the Lossiemouth Practice Manager stated that "*no Secondary Health Care* [referring to DCMH] *uses the tasking process*". He stated that "*several staff* [here] *have said they are aware of the facility but seldom use it and it appears we have a varied degree of training received at DMSTG Keogh Barracks.*" DCMH Kinloss fall under Primary Health care and were previously reminded by the SMO and CMP to use the process at the raising of a Significant Event Report.

1.4.6.191 The CPN stated that he had not had any specific DMICP training, instead he *"picked it up 'piecemeal' when visited by HQNI IT staff who would give us informal advice"* and that *"we did use taskings, but not as a matter of course. It was only really used if there was a change of management or if the MO was required to action anything."*

Aviation Medicine Training

1.4.6.192 All MOs and CMPs who undertake periodic medical examinations of military aircrew and/or air traffic controllers, and secondary care specialist giving advice on aircrew, must attend the RAF Initial Medical Officers Aviation Medicine Training Course. This will result in being appointed a Military Aviation Medical Examiner (MAME). CMPs, RN or Army MOs holding the DAvMed are also recognised as MAME. RAF MOs and CMPs are expected to maintain MAME status. For RAF MOs, the Initial Medical Officers Aviation Medicine Training is considered essential pre-employment training. Exhibit 486 Exhibit 487 Exhibit 674

1.4.6.193 AP1269 states that SMOs on flying stns normally hold the DAvMed qualification. It is obtained through a six month full-time course followed by an examination and is awarded by the Faculty of Occupational Medicine of the Royal College of Physicians. The Diploma examination may also be taken as an external candidate by MOs with the appropriate experience. Specialist MOs are also encouraged to obtain the qualification.

1.4.6.194 MOs may be appointed as Flight Medical Officers (FMOs). Pre-appointment qualifications are:

a. DAvMed.

b. Completion of the Operational Aviation Medicine Course.