Defence
Safety Authority

Service Inquiry

Into the death of a Royal Air Force parachute instructor at RAF Weston on the Green

2 September 2021

Defence Safety Authority

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PART 1.1

Covering Note & Glossary

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PART 1.1 – COVERING NOTE

DSA/SI/04/21/WOTG

Jan 23

DG DSA

SERVICE INQUIRY INTO THE DEATH OF A ROYAL AIR FORCE PARACHUTE INSTRUCTOR DURING A FORCE DEVELOPMENT DAY AT RAF WESTON ON THE GREEN ON 2 SEP 2021

1. The Service Inquiry Panel assembled at MOD Boscombe Down, on the 13 Sep 2021 by order of the Director General of the Defence Safety Authority (DG DSA) for the purpose of investigating the accident involving Sgt Rachel Fisk Royal Air Force on 02 Sep 2021 and to make recommendations in order to prevent reoccurrence. The Panel has concluded its inquiries and submits the provisional report for the Convening Authority's consideration.

2. The following inquiry papers are enclosed:

Part 1 REPORT	Part 2 RECORD OF PROCEEDINGS
Part 1.1 Covering Note and Glossary	Part 2.1 Diary of Events
Part 1.2 Convening Orders & TORs	Part 2.2 List of Witnesses
Part 1.3 Narrative of Events	Part 2.3 Witness Statements
Part 1.3 Annex A Equipment and Ancillaries	Part 2.4 List of Attendees
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Part 1.5 Recommendations	Part 2.6 Exhibits
	Part 2.7 List of Annexes
	Part 2.8 Annexes
	Part 2.9 Schedule of Matters Not Germane to the Inquiry
	Part 2.10 Master Schedule

PRESIDENT

[Signature]

Commander [redacted]
Fleet Air Arm
Royal Navy

MEMBER 1

[Signature]

Captain [redacted]
Royal Logistic Corps
Army

MEMBER 2

[Signature]

Warrant Officer [redacted]
Parachute Jump Instructor
Royal Air Force

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GLOSSARY

AAD	Automated activation device
AATAW	Army Adventurous Training Air Wing
ABN	Army Briefing Note
ACDS	Assistant Chief of Defence Staff
ACE	Air Concentration Exercise
ACSO	Army Command Standing Order
ADE	Airborne Delivery Equipment
ADV	Advance
ADW	Airborne Delivery Wing
AFE	Airborne Forces Equipment
AFF	Accelerated freefall
AFFI	Accelerated freefall Instructor
AGAI	Army General and Administrative Instruction
agl	above ground level
AI	Advanced Instructor
ALARP	As Low as Reasonably Practicable
amsl	above mean sea level
AOC	Air Officer Commanding
AP	Air Publication
APA	Army Parachute Association
APDT	Adventurous Physical Development Training
ARITC	Army Recruiting and Initial Training Commands
AS	Aerospace Standard
ASIMS	Air Safety Information Management System
ASMP	Air Safety Management Plan
AT	Adventurous Training
ATG(A)	Adventurous Training Group (Army)
ATSB	Australian Transportation Safety Bureau
ATSR	Adventurous Training Safety Regulator
BOC	Base of Container
BPA	British Parachute Association (now British Skydiving)
BRd	Book of Reference Digital
BS	British Skydiving (formerly British Parachute Association)
BSOM	British Skydiving Operations Manual
BZN	RAF Brize Norton
CAA	Civilian Aviation Authority
CAERC	Compendium of Airborne Equipment Release Certificate
CAP	Civil Aviation Publication
CE	Conformitè Europëenne
CEB	Customer Executive Board
CH	Canopy Handling
CI	Chief Instructor
CoC	Chain of Command
Comdt	Commandant
Cpl	Corporal
CPR	Cardiopulmonary Resuscitation

CSI	Category Systems Instructor
CTS-AW	Central Training School – Assurance Wing
CYPRES	CYbernetic Parachute RElease System
DAAM	Danger Area Airspace Manager
DAIB	Defence Accident Investigation Branch
DAM	Defence Aerodrome Manual
DASOR	Defence Air Safety Occurrence Report
dB	Decibels
DCDSO	Deputy Chief of Defence Staff Officer
DCoP	Defence Code of Practice
DDH	Delivery Duty Holder
DG DSA	Director General of the Defence Safety Authority
DIN	Defence Instructional Notice
DLSR	Defence Land Safety Regulator
DoC	Duty of Care
DSA	Defence Safety Authority
DSAT	Defence Systems Approach to Training
DTC	Defence Trainer Capability
DURALS	Defence Unified Reporting and Lessons System
DZ	Drop Zone
EASA	European Union Aviation Safety Agency
EP	Emergency Procedure
E-TSO	European Technical Standard Order
EU	European Union
ExVal	External Validation
FAA	Federal Aviation Authority
FD	Force Development
FDI	Force Development Instructor
FE@R	Force Elements at Readiness
Flt Sgt	Flight Sergeant
Flt Lt	Flight Lieutenant
FS	Formation Skydiving
FSIMS	Functional Safety Information Management System
FSMP	Functional Safety Management Plan
GDAS	Graphical Data Analysis System
Gp	Group
GPS	Global Positioning System
HAHO	High Altitude High Opening
Hd	Head
HEMS	Helicopter Emergency Medical Services
HF	Human Factors
HoE	Head of Establishment
HQ	Headquarters
HSDV	High Speed Digital Video
H&S	Health and Safety

HSE	Health and Safety Executive
HS&EP	Health, Safety and Environmental Policy
HSWA	Health and Safety at Work etc Act 1974
IBN	Internal Briefing Note
JM	Jump Master
JMES	Joint Medical Employment Standard
JNCO	Junior Non-Commissioned Officer
JPA	Joint Personnel Administration
JSATSG	Joint Service Adventurous Training Steering Group
JSAT	Joint Service Adventurous Training
JSATFA	Joint Service Adventurous Training Form ALPHA
JSAT POM	Joint Service Adventurous Training Parachute Operations Manual
JSP	Joint Service Publication
JSPC(C)	Joint Service Parachute Centre (Cyprus)
JSPC(W)	Joint Service Parachute Centre (Weston)
LoDA	Line of Defence Assurance
LPS	Lightweight Parachute System
MAA	Military Aviation Authority
MARD	Main Assisted Reserve Deployment
mb	millibar
MED	Medical Employment Standard
MedCat	Medical Category
MedLims	Medical Limitations
MET	Meteorological Forecast
METAR	Meteorological Terminal Air Report
MFD	Medically Fully Deployable
MFFO	Military freefall Observers Course
Mil	Military
MLD	Medically Limited Deployable
MND	Medically Non-Deployable
MOD	Ministry of Defence
MOU	Memorandum of Understanding
MTS	Management of the Training System
NCPGB	Non-Combat Parachute Governance Board
NGB	National Governing Body
nm	Nautical Miles
NPAS	National Police Air Service
NSOR	Naval Safety Occurrence Report
OC	Officer Commanding
ODH	Operating Duty Holder
OEM	Original Equipment Manufacturer
PA	Party Assurance
PC	Police Constable

PCSI	Police Crime Scene Investigation
Pers Cap	Personnel Capability
PFS	Personal Functional Standards
PI	Point of Impact
PIA	Parachute Industry Association
PJI	Parachute Jump Instructor
POM	Parachute Operating Manual
PPE	Personal Protection Equipment
PS	Performance Statement
PTI	Physical Training Instructor
PTO	Parachute Training Organisation
PTS	Parachute Training School
QR	Queens Regulation
RA	Risk Assessment
RA1240	Regulatory Article 1240
RAF	Royal Air Force
RAF CAM	RAF Centre of Aviation Medicine
RAFFT	Royal Air Force Fitness Test
RAFSPA	Royal Air Force Sports Parachute Association
RAR	Robson Academy of Resilience
Rep	Representative
Res Wg	Resilience Wing
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences
RM	Royal Marines
RN	Royal Navy
RNTM	Royal Navy Temporary Memorandum
ROCC	Radio Operators Certificate of Competence
RPC	Reserve Pilot Chute
RRC	Robson Resilience Centre
SAE	Society of Automotive Engineers
SAT	Safety, Assurance and Training
SDH	Senior Duty Holder
SEMP	Safety and Environmental Management Plan
SEMS	Safety and Environmental Management System
Sgt	Sergeant
SHEF	Safety, Health, Environment and Fire
SI	Service Inquiry
SIM	Safety Information Manual
SME	Subject Matter Expert
SNCO	Senior Non-Commissioned Officer
SOADE	Special Operations Aerial Delivery Element
SOH	Stable on Heading
SOP	Standard Operating Procedures
SP	Service Personnel
SPTQA	Second Party Training Quality Audit
SQEP	Suitably Qualified and Experienced Person

Sqn Ldr	Squadron Leader
sS	single Service
SSW	Safe System of Work
SST	Safe Systems of Training
STIR	Safety, Training and Instructor Review
STW	Specialist Training Wing
SUA	Safe Usable Area
TA	Technical Authority
TAAV	Training Assurance Advisory Visit
TAF	Terminal Area Forecast
TDA	Training Delivery Authority
TESRR	Training, Education Skills, Recruiting and Resettlement
TI	Tandem Instructor
TLB	Top Level Budget
TLoD	Training Line of Development
TOR	Terms of Reference
TP	Training Provider
TR	Tracking
TRA	Training Requirement Authority
TS	Technical Standard
TSO	Technical Standard Order
TVP	Thames Valley Police
UKCA	United Kingdom Conformity Assessed
UKPS	United Kingdom Parachute Services
US	United States
USPA	United States Parachute Association
WOTG	RAF Weston on the Green

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PART 1.2

Convening Order & TORs

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Defence Safety Authority

Service Inquiry Convening Order

13 Sep 2021

SI President	Hd DAIB	DAIB Mentor
SI Members	DSA-HQ-Legad	DAIB Office Manager

Copy to:

PS/SofS	MA/CNS	Inspector Safety RAF
PS/Min(AF)	MA/CGS	DSA-DLSR-Hd
PS/Min(DPV)	PSO/CAS	Head DAIB
PS/Min(DP)	PSO/COMD UKStratCom	DDC Dir
PS/PUS	PSO/DComOps	DDC Head of News
DPSO/CDS	PSO/AOC 22 Gp	DDC PR News SO1 RAF
MA/VCDS	Dir HS&EP	Air-COSPers-Del CasBereave SO2

DSA DG/SI/04/21 – CONVENING ORDER FOR THE SERVICE INQUIRY INTO THE DEATH OF A ROYAL AIR FORCE PARACHUTE INSTRUCTOR DURING A FORCE DEVELOPMENT DAY AT RAF WESTON ON THE GREEN ON 2 SEP 2021

1. In accordance with Section 343 of Armed Forces Act 2006 and JSP 832 – Guide to Service Inquiries (Issue 1.0 Oct 08), the Director General, Defence Safety Authority (DG DSA) has elected to convene a Service Inquiry (SI).

2. The purpose of this SI is to investigate the circumstances surrounding the incident and to make recommendations in order to prevent recurrence.

3. The SI Panel will commence administrative briefing at 1200 on Monday 13 September 2021 at DAIB, B120 at MoD Boscombe Down, and will be formally convened by the DG at 1500.

4. The SI Panel comprises:

President: **Commander** [redacted]
Members: **Captain** [redacted]
Flight Sergeant [redacted]

5. The legal advisor to the SI is **Wg Cdr** [redacted] **RAF** (DSA-HQ-Leg[redacted]) and technical investigation/inquiry support is to be provided by the Defence Accident Investigation Branch (DAIB). The nominated mentors for this SI are **Captain (MAA)** [redacted] (DSA-DAIB-Land-Ops[redacted] and **Warrant Officer First Class** [redacted] (DSA-DAIB-Air-Eng[redacted].

6. The SI is to investigate and report on the facts relating to the matters specified in its Terms of Reference (TOR) and otherwise to comply with those TOR (at Annex

A). It is to record all evidence and express opinions as directed in the TOR. An Initial Report on the commencement of the investigation is to be submitted on 13 October 2021.

7. Attendance at the SI by advisors/observers, unless extended by the Convening Authority, is limited to the following:

Head DAIB – Unrestricted Attendance.
DAIB investigators in their capacity as advisors to the SI Panel – Unrestricted Attendance.
Human Factors Specialists in their capacity as advisors to the SI Panel – Unrestricted Attendance.

8. The SI Panel will initially undertake induction training at the DAIB facility at MOD Boscombe Down immediately after convening. Thereafter, permanent working accommodation, equipment and assistance suitable for the nature and duration of the SI will be requested at a location decided by the SI President in due course.

9. Reasonable costs will be borne by DG DSA under UIN [redacted].

[redacted]

[redacted]

Annex A To
DSA DG/SI/04/21 Convening Order
Dated 13 Sep 2021

TERMS OF REFERENCE FOR THE SERVICE INQUIRY INTO THE DEATH OF A ROYAL AIR FORCE PARACHUTING INSTRUCTOR DURING A FORCE DEVELOPMENT DAY AT RAF WESTON ON THE GREEN ON 2 SEP 2021

1. As the nominated Inquiry Panel for the subject SI, you are to:

a. Investigate and, if possible, determine the cause of the occurrence, together with any contributory, aggravating and other factors and observations.

b. Ascertain whether the personnel (Service and civilian) were acting in the course of their duties.

c. Examine what policies, orders and instructions were applicable and whether they were appropriate and complied with.

d. Establish the level of training, relevant competencies, qualifications and currency of the individuals involved in the incident.

e. Identify if the levels of planning and preparation met the activities' objectives.

f. Review the levels of authority and supervision covering the task during which the incident occurred.

g. Investigate and comment on relevant fatigue implications of an individual's activities prior to the matter under investigation.

h. Determine the state of serviceability of relevant equipment.

i. Determine any equipment deficiencies including any integration or compatibility issues.

j. Determine and comment on any broader organisational and/or resource factors.

k. Make appropriate recommendations to the DG DSA.

2. The investigation should not seek to attribute blame and you should use JSP 832 Guide to Service Inquiries and DSA 03.10 as guidance for the conduct of your inquiry. You are to report immediately to the DG DSA should you have cause to believe a criminal or Service Offence has been committed.

3. If at any stage the Panel discovers something that they perceive to be a continuing hazard presenting a risk to the safety of personnel or equipment, the President should alert DG DSA without delay to initiate remedial actions. Consideration should also be given to raising an Urgent Safety Advice note.

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PART 1.3

Narrative of Events

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Part 1.3 – Narrative of events

Unless stated, all times are local for the time of the accident (GMT plus 1 hour).

Synopsis

1.3.1. On Thu 2 Sep 2021, the Joint Service Parachute Centre (Weston) (JSPC(W)) was conducting parachuting Force Development (FD) activity at Royal Air Force (RAF) Weston on the Green (WOTG) for eight members of the catering department from RAF Marham. During the fourth and final sortie[1] of the day, two tandem instructors with a student each were being filmed by three instructors conducting solo descents. Sergeant (Sgt) Rachel Fisk RAF was acting as a secondary camera operator working with one tandem instructor and student, along with another instructor in the primary camera operator role.[2] Shortly after the tandem instructor deployed their parachute the group lost sight of Sgt Fisk. She was found by a National Police Air Service (NPAS) helicopter a short distance northeast of WOTG in a field adjacent to the M40 motorway (Figure 1.3.1) Sgt Fisk was pronounced life extinct at the scene by the Helicopter Emergency Medical Services (HEMS) Doctor, after attempts to revive her by the emergency services were unsuccessful.

Witness 07
Witness 09
Witness 13
Witness 15
Exhibit 01
Exhibit 02

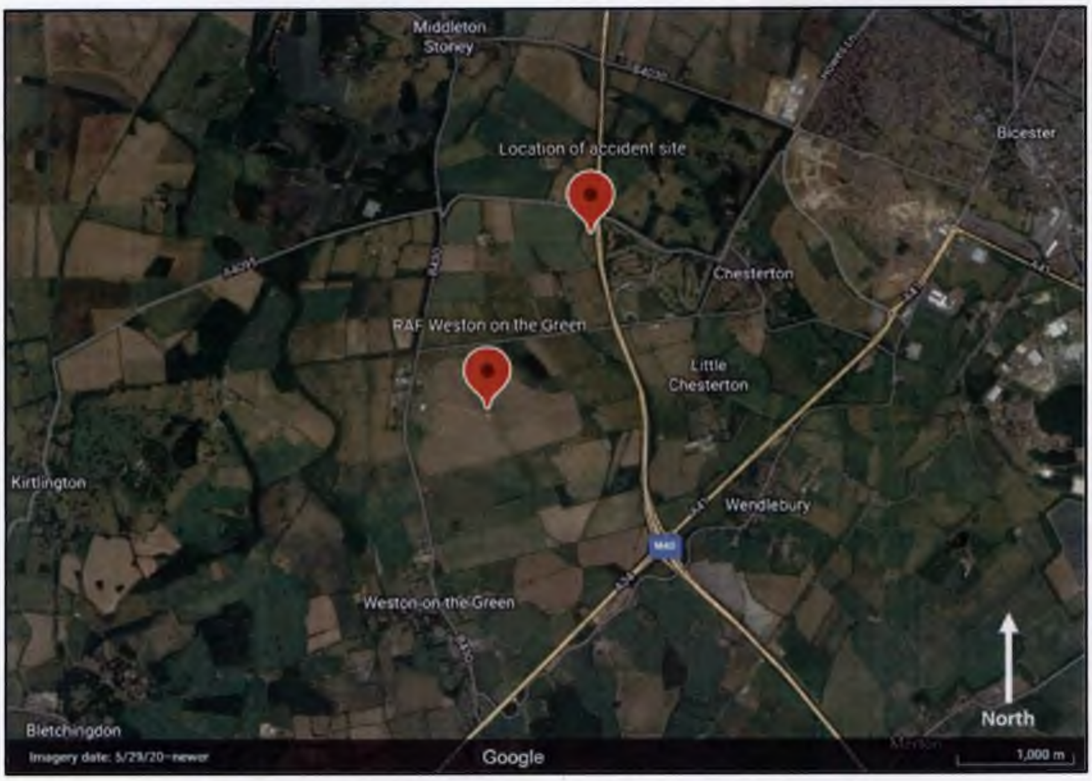

Figure 1.3.1 – RAF Weston on the Green location.

[1] A sortie is defined as an individual flight of an aircraft.
[2] An individual filming a skydiving activity.

Background

1.3.2. RAF WOTG was a World War One era airfield used for military and Joint Service Adventurous Training (JSAT) parachute activity. Located 10 miles north of Oxford, the site also hosted the Oxford Gliding Club.

1.3.3. The airfield and drop zone (DZ) were managed by JSPC(W), which was based at RAF WOTG under the command of the RAF Cranwell based Robson Academy of Resilience (RAR). The RAR was the training lead for RAF JSAT and specialist training[3] and was governed by No. 22 Group (Gp) RAF.[4] Outside of parachuting activities the wider parenting responsibilities for the site were conducted by RAF Brize Norton.[5] Exhibit 03 Exhibit 04

1.3.4. **RAF WOTG facilities**. The key airfield facilities that were at RAF WOTG are detailed below (Figure 1.3.2).

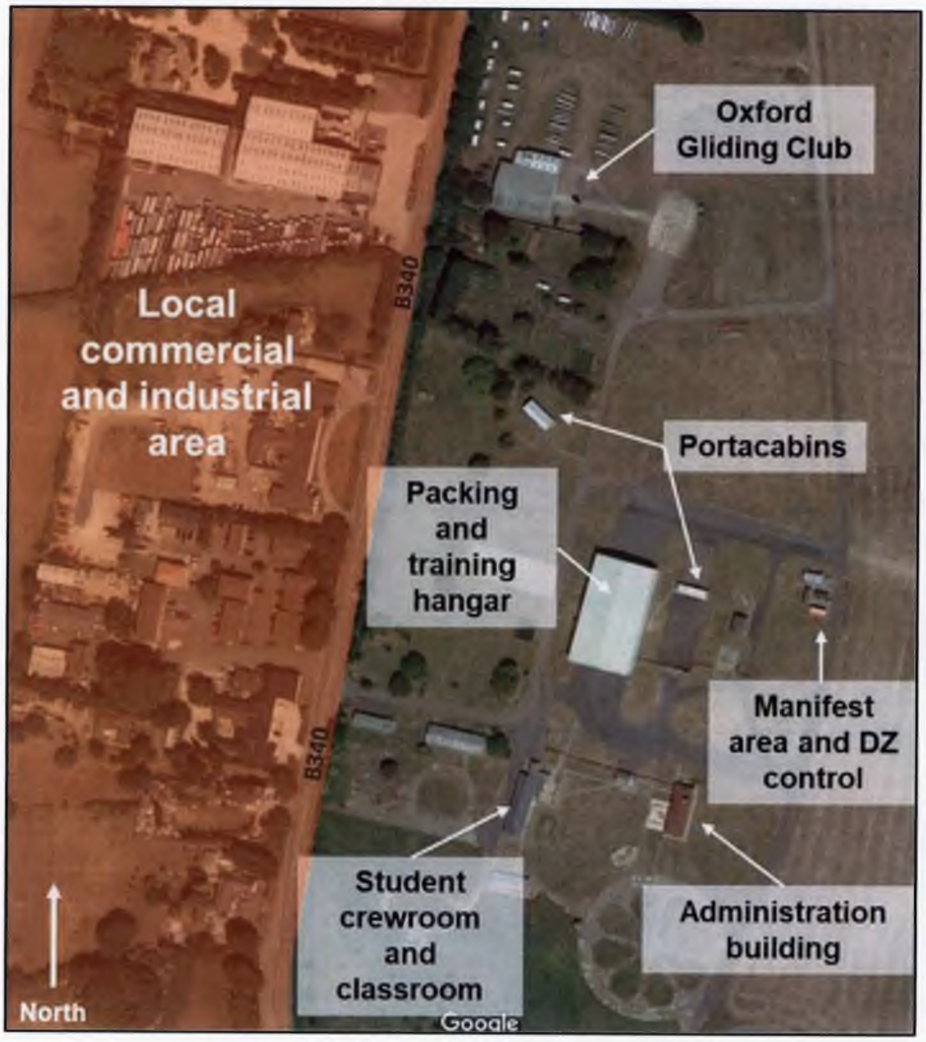

Figure 1.3.2 – RAF WOTG orientation.

[3] Specialist training includes survive, extract, resist and evade (SERE), Defence fire, and human factors.
[4] No. 22 Gp RAF was the training provider for the RAF.
[5] The provision of services such as motor transport, administration or health and safety support by another unit.

1.3.5. **Parachuting within the Ministry of Defence (MOD).** Parachuting was conducted within the MOD for the following purposes:

a. **Military parachuting.** Military parachuting activity was conducted to train personnel in operational techniques to produce Force Elements at Readiness (FE@R) for front-line operations.[6] This activity was governed by No. 2 Gp RAF as the Operating Duty Holder for all military parachuting within the MOD and regulated by the Military Aviation Authority (MAA). Exhibit 05 Exhibit 06 Exhibit 07

b. **Sports parachuting.** Sports parachuting was understood by the panel to be regulated by the Civil Aviation Authority (CAA) and British Skydiving which operated as the United Kingdom National Governing Body (NGB). Sports parachuting within the MOD was used for the following purposes: Exhibit 08 Exhibit 09 Exhibit 10

(1)**JSAT.** No. 22 Gp RAF was the lead sponsor for JSAT parachuting activity. There were three MOD sites that conducted JSAT parachuting, as certified by British Skydiving, as parachute training organisations (PTO):

(a) JSPC(W) at RAF WOTG under the command of the RAR. Exhibit 11

(b) The Army Adventurous Training Air Wing at Netheravon under the command of the Adventurous Training Group (Army) (ATG(A)). Exhibit 12

(c)The Joint Services Parachute Centre Cyprus at Dhekelia, which was also under the command of the ATG(A). Exhibit 12

(2)**JSAT expeditions.** Expeditions were led by instructors qualified through the JSAT Scheme in accordance with Joint Service Publication (JSP) 419, Adventurous Training in the UK Armed Forces. Exhibit 13

(3)**Display parachuting.** Display parachuting was governed by the single Services (sS).[7] Exhibit 14

(4)**In-service recreational sport parachuting.** Recreational sport parachuting was conducted through the sS parachute associations.[8] Exhibit 15 Exhibit 16 Exhibit 17

1.3.6. **JSAT.** The MOD operated a JSAT scheme for the following reasons, as defined in JSP 419: Exhibit 13

'Physical Development is a key component of Armed Forces military capability and it comprises the three pillars of Physical Training, Adventurous Training (AT) and Sport. AT makes a

[6] Military Capability is made up of force elements which are generated and combined by the Military Commands to enable the conduct of an operation or task. The Military Commands generate the force elements at the required level of readiness to deploy when needed. These are known as Force Elements at Readiness (FE@R).
[7] Royal Navy (RN), Army and RAF.
[8] Royal Navy Skydiving, Army Parachute Association (APA) and RAF Sports Parachute Association (RAFSPA).

significant contribution to military effectiveness, fighting spirit and personal development. AT is on-duty,[9] mandated, military training which, through exposure to challenges and controlled risk, enables Service Personnel (SP) to develop the fortitude, rigour, robustness, initiative and leadership necessary to deliver the resilience that military personnel require on operations and during other military tasks. In addition, AT builds teamwork, self-discipline, determination, coordination and courage. AT can also provide balance in the lives of SP who are subject to the pressures of military commitments and periods of high tempo operations, thus it provides an invaluable opportunity for decompression that plays an important part in Service life, which includes recruiting and retention.'

The JSAT scheme consisted of ten authorised activities, each of which had a sS sponsor and were associated with an NGB.[10] For JSAT parachuting, the RAF was the sponsor.

1.3.7. **RAF Force Development (FD).** The JSAT scheme was used as a vehicle to provide FD training opportunities within the RAF. Air Publication (AP) 3379, The Governance of Individual Training in the RAF stated: Exhibit 18

'RAF FD activities aim to improve operational effectiveness through individual and collective education and training activities. FD activities have been proven to increase preparedness and improve the performance of all personnel, enhancing the ability to carry out their duties, either in the workplace or whilst deployed on exercise or operations.'

1.3.8. **RAF Eagles Scheme.** The RAF Eagles Scheme provided through-life training which was complementary to formal courses through the use of blended FD activity. The Eagles Scheme used a professional FD instructor cadre, the majority of which were established to support phase one training delivery at the Robson Resilience Centres (RRCs) combined with suitably qualified and experienced personnel (SQEP), Service subject matter experts (SME) and contracted-in training.[11] Exhibit 19

1.3.9. **Exercise (Ex) EAGLES DARE.** Ex EAGLES DARE was an element of the Eagles Scheme that used parachuting as the means to provide FD. The scheme was funded for eight weeks a year and was run as five, single-day events over the period of a working week for up to eight students per day. Depending on the prevailing weather conditions, it could be achieved through individual static line or tandem parachuting descents. Exhibit 19

[9] Service personnel are considered as on-duty when conducting activity for which the MOD has accepted liability for duty of care purposes.
[10] Offshore sailing, sub aqua diving, canoeing/kayaking, caving, mountaineering, mountain biking, skiing, gliding, parachuting and paragliding.
[11] Phase one is the basic recruit training provided to all new entrants into the armed forces.

Key personalities during the accident

1.3.10. **Introduction.** The following key personalities were involved:

a. **Sgt Fisk.** Sgt Fisk was a physical training instructor (PTI) and military parachute jump instructor (PJI). She had served for 10 years in the RAF conducting various roles as a PTI and more latterly as a PJI. Following a period in the Airborne Delivery Wing (ADW) at RAF Brize Norton, where she delivered ab-initio military parachuting training, she joined JSPC(W) at RAF WOTG in Jul 2020 and was a qualified British Skydiving 'C' licensed skydiver.[12] Exhibit 20 Exhibit 21

b. **Officer Commanding (OC) JSPC(W).** The OC was an RAF officer at the rank of flight lieutenant and was employed as a personnel training officer. They were a qualified parachute jump officer who, after a short tour at the Parachute Training School (PTS), ADW at RAF Brize Norton, joined JSPC(W) in Sep 2020 during the COVID pandemic. The OC held a British Skydiving 'A' licence. On 2 Sep 2021 the OC was carrying out solo descents for their own currency. Exhibit 29

c. **Chief Instructor (CI) JSPC(W).** The CI was an RAF senior non-commissioned officer (SNCO) at the rank of flight sergeant who joined JSPC(W) during the COVID pandemic in Jul 2020. As WOTG was licenced as a British Skydiving PTO, the CI was responsible for ensuring that the conditions laid down in the British Skydiving Operations Manual (BSOM) were observed. The CI had been parachuting since 2006 and was a qualified British Skydiving 'D' licensed skydiver who also held all of the relevant British Skydiving ratings required for their role. The CI was operating as the DZ controller on 2 Sep 2021, which involved the safe supervision of the parachute landing area including airspace management and the monitoring of the parachute descents from the ground. Witness 09 Exhibit 30

d. **PJI 1.** PJI 1 was an RAF SNCO at the rank of sergeant who was a qualified British Skydiving 'C' licensed skydiver who was operating as a camera operator for the descents on 2 Sep 2021. They were also the jump master (JM) for the accident sortie.[13] Witness 14

e. **PJI 2.** PJI 2 was an RAF SNCO at the rank of sergeant who was a qualified British Skydiving 'C' licensed skydiver who was operating as a tandem instructor during the event. Witness 12

f. **PJI 3.** PJI 3 was an RAF junior non-commissioned officer (JNCO) at the rank of corporal who was a qualified British Skydiving 'C' licensed skydiver who was operating as a camera operator during the event. Witness 15

[12] British Skydiving initial licence awarded on qualifying is 'A', skydivers will then progress through 'B', 'C' and 'D' licence after a designated number of descents and completion of the required elements of the grading system as published within the British Skydiving Operations Manual.
[13] The person responsible for the safe conduct of the parachuting activity from within the aircraft.

g. **PJI 4.** PJI 4 was an RAF SNCO at the rank of sergeant who was a British Skydiving 'C' licensed skydiver who was operating as a tandem instructor during the event. Witness 13

h. **Jump pilot.** The jump pilot held a CAA pilot's licence and was a British Skydiving approved pilot and pilot examiner, they were contracted to JSPC(W) as the pilot-in-command on 2 Sep 2021. Exhibit 31 Exhibit 32

i. **British Skydiving rigger JSPC(W).** The rigger was a qualified British Skydiving advanced packer and rigger contracted to inspect and maintain all JSPC(W) parachute systems. Witness 11

The week of the event

1.3.11. All JSPC(W) staff were programmed to facilitate FD for individual units as part of Ex EAGLES DARE during the week of the accident. Whilst other units had been programmed throughout the week, the RAF Marham catering unit were the only group to complete any parachuting activity due to poor weather over the previous three days. Exhibit 33

1.3.12. **Events of the day up to live parachuting activity.** At approximately 08:30 on 2 Sep 2021, eight students from RAF Marham's catering department arrived at RAF WOTG from RAF Halton, where they had stayed overnight. On arrival they met Sgt Fisk who was the lead instructor for that day.[14] Prior to conducting the parachute descents, their day consisted of the following briefings and activities which concluded at approximately 14:00: Witness 16 Witness 19

a. Introduction brief.

b. Team building exercises.

c. Parachute training.

d. Practical training on the correct parachuting positions to be adopted.

e. Wider knowledge of parachutes in use within the military.

f. Resilience (Headspace) brief.[15]

1.3.13. **Personal equipment preparation.** At approximately 10:00 during a gap in the training programme Sgt Fisk collected her personal parachute systems from the equipment store and carried out serviceability checks. This included turning on the automated activation device (AAD)[16] for each of the two systems allocated to her and placing the equipment on the hooks provided within the main parachute packing area (Figure 1.3.3). Exhibit 34

[14] The lead instructor was responsible for the days course administration and the conduct of the staff parachuting brief.
[15] A brief on mental resilience.
[16] The AAD is an electronic microprocessor computer and cutter fitted within the parachute system that automatically deploys the reserve parachute when the set parameters are met.

Figure 1.3.3 – JSPC(W) Packing hangar staff equipment hooks.

1.3.14. A detailed description of the equipment used by Sgt Fisk on the day is at Annex A. The equipment and clothing reported to have been worn by Sgt Fisk during the accident was as follows:

Exhibit 35

a. **Clothing.** Jedi Airwear trousers and camera jacket, gloves, helmet and personal footwear.

b. **Parachute Systems.** JSPC(W) Local ID Staff 08. Sunpath Odyssey Container.

Exhibit 37

(1)Main Canopy. Performance Designs Sabre 2, size 150.

(2)Reserve Canopy. Performance Designs Optimum, size 160.

(3)Automatic Activation Device (AAD). AirTec CYPRES 2.

(4)MARD device. United Parachute Technologies Skyhook.

c. **Parachute ancillaries.** Larsen & Brusgaard ALFA visual altimeter and ECHO audible altimeter. Exhibit 36

d. **GoPro™ Hero7 Black Camera.** Helmet mounted GoPro™ video camera.

1.3.15. **Meteorology.** Due to the weather being forecast as overcast for most of the day, Sgt Fisk informed the students shortly after arrival that they may not be able to complete the activity. At midday the CI decided to push the staff parachuting brief back to 14:00 due to continuing poor conditions. As the lead instructor, Sgt Fisk led the brief, with the CI required to make the final decision on whether the parachuting activity could take place. On completion of the brief the CI went outside to look at the conditions and decided that they were suitable to complete tandem descents. The students were therefore informed that the activity would take place.

Exhibit 38
Exhibit 39
Witness 09
Witness 19

1.3.16. The Dropping Zone forecast for WOTG at 15:00 was issued by the Brize Norton Met Office at 04:40 on 2 Sep 2021:

Exhibit 39

a. Wind direction from 050°.

b. Wind speed 12 knots gusting 17 knots.

c. Temperature 19°C.

d. Cloud cover 5-7 Oktas between 3,000ft and 4,500ft, with temporary periods of 3-4 Oktas.[17]

1.3.17. **Aircraft used for parachute activity.** The aircraft used throughout the day of the incident was a Cessna 208B Caravan, registration number N208AD (Figure 1.3.4), which was configured for parachuting activity (Figure 1.3.5). The aircraft was flown by a British Skydiving qualified jump pilot.[18]

Exhibit 40

Figure 1.3.4 – Cessna 208B Caravan external.

[17] Okta is a unit used to express the extent of cloud cover; one okta is equal to one eighth of the sky.
[18] A pilot qualified by British Skydiving to conduct parachuting activity.

Figure 1.3.5 – Cessna 208B Caravan internal.

1.3.18. **Parachute descents prior to the accident.** Four sorties in total were conducted on the day, each following the same pattern, with five instructors (two tandem instructors and three others who were acting as camera operators using helmet mounted GoPro™ cameras).[19] Each tandem instructor had a student attached to their harness, referred to as a tandem pair. With the exception of sortie two, the OC JSPC(W) was also on board the aircraft conducting solo training descents.

Exhibit 23
Witness 13
Witness 15

1.3.19. Before each sortie, the required parachuting pre-flight checks were conducted and signed for on the aircraft manifest by the designated instructors before boarding the aircraft. Once the aircraft was at the correct release point the parachutists exited in three groups at an approximate height of 11,500ft above ground level (agl) in the following order:

Exhibit 23

a. The OC JSPC(W), followed by;

b. PJI 2 (tandem pair) with PJI 1 as the camera operator, followed by;

c. PJI 3 training as a camera operator with PJI 4 (tandem pair) and Sgt Fisk as secondary camera operator.

1.3.20. After descent three Sgt Fisk elected to use her second parachute system which had been stored in the packing area with all pre-descent checks completed. When asked by a student as to why she had decided to change parachute systems she explained that her original parachute had some twists in the rigging lines which she would sort out later. The CI was informed by Sgt Fisk of her decision to change equipment and all pre-flight manifest checks were completed before boarding the aircraft for the fourth and final descent of the day.

Witness 09
Witness 19
Exhibit 328

[19] Including Sgt Fisk.

1.3.21. **Sortie four.** All checks were completed as per the previous descents, with the parachutists' planned exit order sequence as described at Para 1.3.19.

Exhibit 41
Exhibit 42
Exhibit 43
Witness 13
Witness 15

a. Sgt Fisk boarded the aircraft along with the seven other parachutists, which departed from the northeast runway at approximately 17:09 on a heading of 047º. At 17:21 the aircraft reached the exit altitude of approximately 11,900ft agl.

b. On reaching the exit altitude, the aircraft commenced the jump run on a bearing of 043º, passing directly over WOTG DZ. At approximately 0.5km upwind of the DZ the pilot turned on the green light to indicate to the JM that they were cleared to exit the aircraft.[20]

c. PJI 1 who was acting as the JM conducted a visual check to confirm line of sight between the aircraft and the DZ (Figure 1.3.6). A layer of cloud was evident between the aircraft and the ground as captured on their GoPro™ footage; however, RAF WOTG main hangar was visible through the gaps, allowing the JM to commence the despatch sequence.

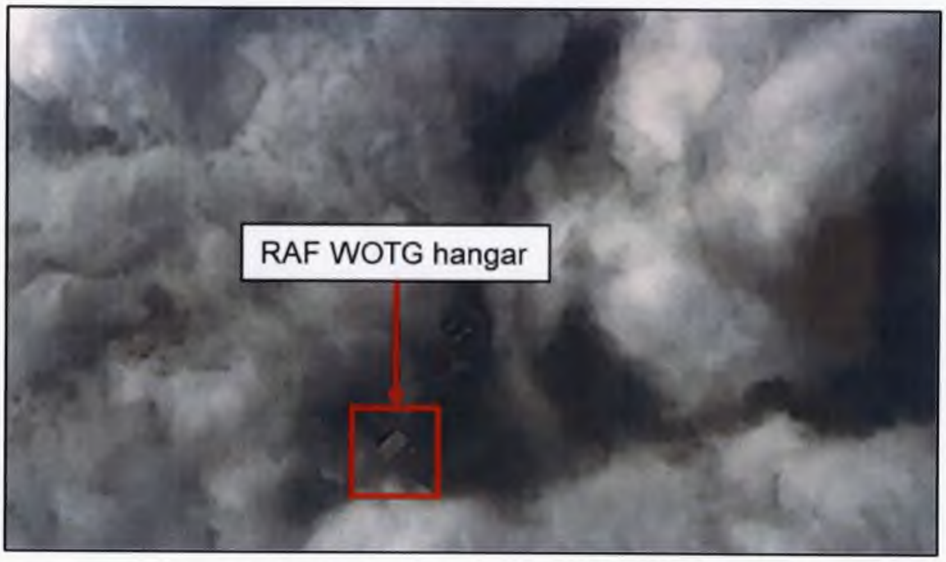

Figure 1.3.6 – GoPro™ image captured from PJI 1 (JM) visual spot for sortie four.

d. Sgt Fisk was the last parachutist to exit the aircraft, leaving at roughly 17:22.

e. On exiting the aircraft, PJI 3 was intended to be the primary camera operator but was unable to position correctly to capture the descent. Therefore, Sgt Fisk manoeuvred in front of the tandem pair to video the freefall with her position captured on PJI 3's footage (Figure 1.3.7).

[20] Green Light: signal to JM that the DZ controller has given clearance to start exiting the aircraft.

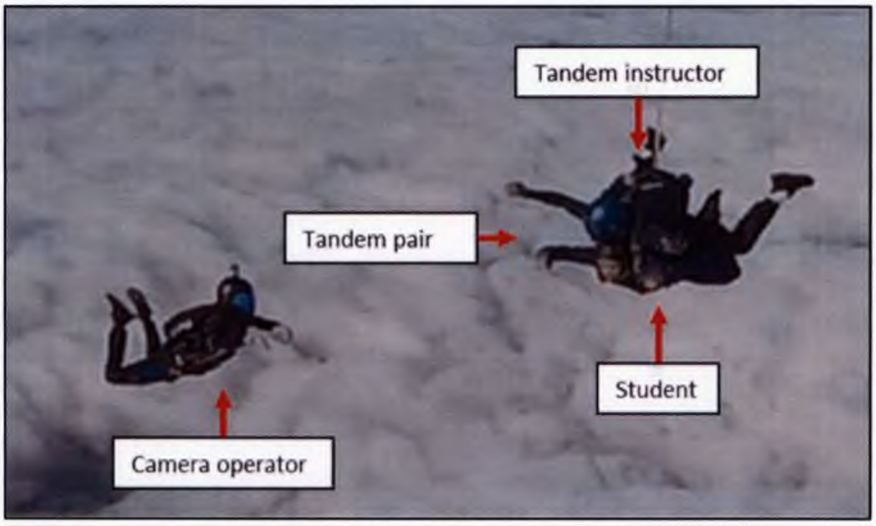

Figure 1.3.7 – Sgt Fisk, in position as the camera operator.

f. Sgt Fisk filmed the tandem pair throughout the freefall, and on approaching 5,000ft agl PJI 4 indicated their intention to deploy their main canopy. Post PJI 4's main canopy deployment, Sgt Fisk and PJI 3 increased their separation from each other to allow for a safe deployment of their own main canopies.

g. Sgt Fisk's GoPro™ camera footage showed that once PJI 4 had deployed their canopy she continued her freefall descent. Shortly afterwards she passed through a thin layer of cloud before a small amount of body movement was evident as the DZ came into view.

h. Between 1,515ft and 984ft agl some further movement could be seen before the yellow cable of the main canopy cutaway system came into view, shortly followed by the metal reserve release cable. (Figure 1.3.8).

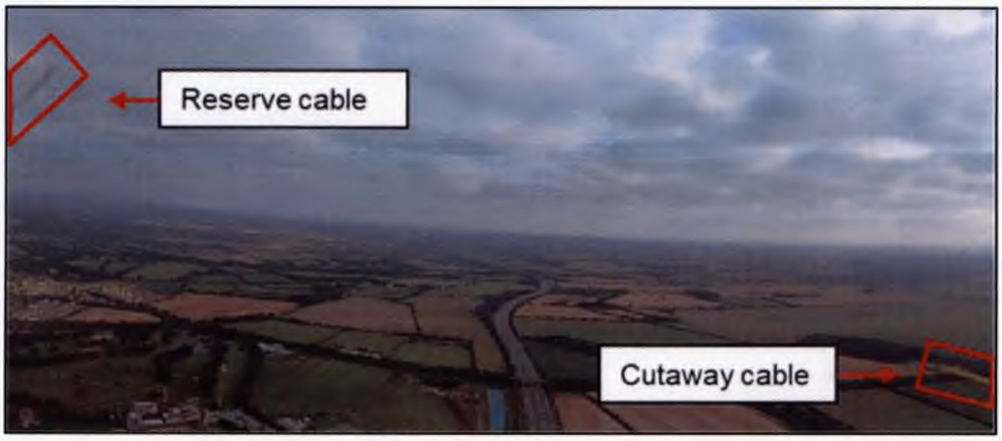

Figure 1.3.8 – Cutaway and reserve cables, 05.289sec before impact.

i. The camera panned twice towards the sky and captured a reserve pilot chute that appeared entangled within the bridle assembly (Figure 1.3.9). The reserve parachute free-bag containing the reserve canopy was not seen in the video. Immediately before impact with the ground the pilot chute came back into view in the same configuration (Figure 1.3.10).

Figure 1.3.9 – Reserve Pilot Chute entanglement 2.136sec before impact.

Figure 1.3.10 – Reserve Pilot Chute entanglement 0.034sec before impact.

j. On impact with the ground the GoPro™ camera detached from Sgt Fisk's helmet and came to rest in the undergrowth.

1.3.22. **DZ control.** The CI was responsible for managing the safe conduct of parachuting activity from the DZ control position. During the final descent of the day the CI, along with other instructors and staff, did not observe Sgt Fisk's

Witness 09

parachute canopy when expected. The CI checked the manifest to confirm the number of instructors that were expected to have made the descent and established with the pilot that all personnel had left the aircraft. The CI also checked with the other instructors as they landed on the DZ that they had witnessed Sgt Fisk leave the aircraft and whether they had any visual sight of her whilst they were under canopy.

1.3.23. In anticipation that Sgt Fisk had landed off the parachute landing area in an adjacent field, several attempts were made to contact her via mobile phone. With no ability to track her whereabouts and with no response to these calls, the JCPC(W) Emergency Response Plan was initiated with the emergency services being called at 17:41. Witness 07 Witness 09 Exhibit 02

1.3.24. **Ground search by JSPC(W) personnel.** Two JSPC(W) staff members in a Service vehicle along with the contracted Event Fire Solutions fire and rescue vehicle conducted an immediate search of the up-wind fields and surrounding areas in an attempt to locate Sgt Fisk.[21] Witness 12 Witness 14

1.3.25. **Airborne search of WOTG DZ.** On despatching the final sortie of parachutists, the Cessna 208B departed from RAF WOTG to reposition at Hinton airfield. Whilst the aircraft was en route, the CI requested that the aircraft return to search the local area. The aircraft conducted an initial search along the run-in direction for approximately five minutes before landing at RAF WOTG to pick up PJI 4. On landing, PJI 4 boarded the aircraft to assist with the visual search, but after approximately another ten minutes of searching and with no evidence of Sgt Fisk's location the aircraft was unable to continue due to limited fuel. Witness 09 Witness 13 Exhibit 31 Exhibit 32

1.3.26. **Emergency services**. On receipt of the emergency call from RAF WOTG the Police initiated a search with ground units and tasked the regional NPAS helicopter to the scene. A passenger in a taxi on the M40 made a 999 call at 17:30 to report a visual sighting of a person falling from the sky close to the motorway which helped focus the search area. Exhibit 02

1.3.27. The NPAS helicopter located Sgt Fisk in a field close to the M40 at 18:08. The helicopter landed nearby to drop off two crew members before lifting to clear the scene and capture imagery of the area from above. The air team were quickly joined by ground units, with cardiopulmonary resuscitation (CPR) commencing shortly afterwards. Sgt Fisk was pronounced life extinct at 19:00. Exhibit 01 Exhibit 02

1.3.28. **Cause of death**. A post-mortem indicated the cause of death as multiple injuries consistent with a sudden deceleration (ie, a body moving at speed suddenly coming to rest). Exhibit 51

[21] The contracted fire, rescue and medical cover for WOTG.

Post-accident events

1.3.29. **Investigation activity.** Thames Valley Police (TVP) led the immediate investigation on the evening of 2 Sep 2021 and into the following day with British Skydiving in attendance. The Defence Accident Investigation Branch (DAIB), the Health and Safety Executive (HSE), and the RAF regional liaison officer were also in attendance on 3 Sep 2021.[22] Witness 07

1.3.30. **Accident analysis.** Based on this narrative, the panel will explain in section one of Part 1.4 how Sgt Fisk had been unable to deploy her main pilot chute and canopy, and, therefore, completed her emergency procedure to deploy the reserve canopy. Through detailed analysis, it will explain how the turbulent wake above her was extremely likely to have created the conditions required for the reserve pilot chute to become malformed as shown above. The panel will discuss how this malformation would have reduced the pull force available to deploy the reserve canopy.[23] The panel was able to establish that the inability of the reserve canopy to deploy ultimately led to Sgt Fisk's death. Subsequent sections in the report will look at the safe systems of work in place within the organisation and the other parachuting disciplines[24] conducted within Defence.

1.3.31. Before reading the Part 1.4 it is important to read Annex A to Part 1.3 in order to understand the equipment used during the accident.

Annex:

Parachute equipment and ancillaries.

[22] The RAF regional liaison officer liaises with the civilian emergency services and local authorities to provide a conduit between the military, civilian agencies and other government departments as required.
[23] Turbulent wake is a body of chaotic air produced above a falling object such as a parachutist.
[24] Sports, display and FE@R.

Parachute equipment and ancillaries

1.3.A.1. **Introduction.** The aim of this Annex is to provide supporting information to the main Service Inquiry (SI) report, in order to help the reader to understand the purpose and functions of the various items of equipment used during the accident. Unless stated all images have been produced by the SI panel.

1.3.A.2. The list below identifies all the parachute equipment and ancillaries worn by Sgt Fisk during the WOTG accident on 2 Sep 2021 (Figure 1.3.A.1 and Figure 1.3.A.2).

a. Sun Path Products, Inc. (Sun Path), Javelin Odyssey parachute system.

b. Performance Designs, main and reserve canopies.

c. United Parachute Technologies – Main Assisted Reserve Deployment (MARD), Skyhook.

d. CYbernetic Parachute RElease System 2 (CYPRES 2), automatic activation device (AAD).

e. Larsen & Brusgaard, ALFA altimeter and ECHO audible altimeter.

f. Cookie – G4 helmet.

g. Jedi Airwear – camera jacket and trousers.

h. GoPro™ Hero7 Black (GoPro™).

i. Parachute packing pull ups.

Figure 1.3.A.1 – Equipment and ancillaries, front view.

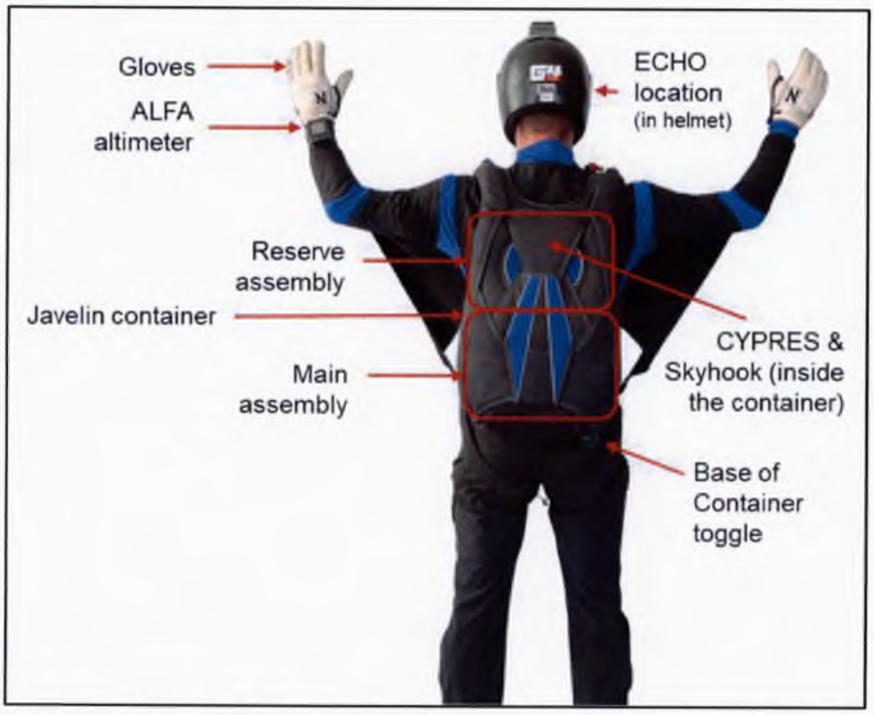

Figure 1.3.A.2 – Equipment and ancillaries, rear view.

Sun Path Javelin Odyssey parachute system

1.3.A.3. **Javelin harness and container system.**[25] The Javelin harness and container system was manufactured by Sun Path Products, Inc. and was made up of the following components (Figure 1.3.A.3): Exhibit 98

a. Harness and container assembly.

b. Main risers.

c. Main deployment bag.

d. Main pilot chute.

e. Reserve pilot chute. Reserve free-bag and bridle, with United Parachute Technologies Skyhook fitted.

f. Cutaway handle.

g. Reserve ripcord with Marine Eye.

Figure 1.3.A.3 – Sun Path Javelin odyssey container component parts.[26]

1.3.A.4. **Harness and container.**[27] The Javelin parachute system was available in various sizes to accommodate the size of the parachutist, including the main and reserve canopies. For example, a parachute systems size was identified by a designator such as J1KS B15, this refers to the two size measurements, detailed below:

a. J1KS refers to the container size, which dictates the size of main and reserve canopies that can be fitted in accordance with the manufacturer's canopy compatibility guidelines (Figure 1.3.A.4). As an

[25] https://www.sunpath.com/rig/javelin-odyssey/

[26] Image - created by SI panel using Sun Path images, SI images and Wikipedia.org.

[27] Harness and container system (JA-101) owner's manual

example, a J1KS container could be fitted with a maximum of a 160sqft low bulk reserve canopy and 170sqft low bulk main canopy.

b. B15 refers to the harness, which is split into two measurements:

(1) The 'B' identified the size of the yoke,[28] which was a manufacturer's set measurement from the top of the reserve container to the three rings (over the shoulder).

(2) The '15' identified the measurement of the main harness lift web (in inches), which was to fit the length of the user's torso.

Container Model	F-111 Reserve Canopy	Low Bulk Reserve Canopy	Zero Porosity Main Canopy	Hybrid F-111/ZP Main Canopy	Low Bulk Main Canopy	Crossbrace Main Canopy	Main Pilot Chute Diameter (F-111)
RSK	106 - 120	113 - 126	83 - 99		107	68 - 75	28
RSK.5	106 - 120	113 - 126	100 - 107		120	80 - 88	28
RSK-1	106 - 120	113 - 126	109 - 120	135	135	88 - 96	28
NJK	113 - 120	126	109 - 120	135	135	96 - 103	28
DNKY	126	143	109 - 120	135	135	96 - 103	28
TJNK	126 - 135	143	135	150	150	108 - 120	28
TJNK.5	126 - 135	143	150	170	170	120	33
OJK	143 - 150	160	135	150	150	120	28
J1KS	143 - 150	160	150	170	170	135	33
J1KL	143 - 150	160	170	190	190		33
J2K	160 - 170	176	150	170	170	135	33
J3K	160 - 170	176	170	190	190		33

Model	F.111 Reserve Canopy	Low Bulk Reserve canopy	Zero Porosity Main Canopy	Hybrid F-111/ZP Main Canopy	Low Bulk Main Canopy	Crossbrace Main Canopy	Main Pilot Chute Diameter (F-111)
J1KS	143-150	160	150	170	170	135	33

Figure 1.3.A.4 – Sun Path container compatibility chart.[29]

1.3.A.5. **Harness and container technical information.** The harness and container were manufactured to the Federal Aviation Authority (FAA) Technical Standard Order (TSO) C23d, which in turn used the test standards set out in the Society of Automotive Engineers (SAE) Aviation Standard (AS) 8015 Rev B. Systems tested under FAA TSO C23d and SAE AS-8015b had conducted a minimum of 68 live drop tests, which included a strength test for weight and speed up to the maximum operating limits of the system multiplied by a factor of 1.2. Testing included the following components:

a. Harness.

b. Stowage container (pack).

c. Risers, canopies (including suspension lines).

d. Deployment devices.

e. Pilot chutes.

f. Actuation devices (ripcord and/or reserve static line).

[28] Sun Path measurement range A to D.
[29] Image – Screenshot from Sun Path.

1.3.A.6. The materials used in the production of a harness and container are identified in the Parachute Rigger Handbook.[30] The container was primarily constructed out of Cordura®[31] with the harness made from various types of webbing[32] that have breaking strengths of up to 7,500 lbs.

1.3.A.7. **Harness and container maintenance.** The six-monthly (180 days) maintenance and inspection of the harness and container was directed by the Federal Aviation Authority (FAA) and conducted by a national governing body approved rigger.[33] All parachute systems maintained under British Skydiving regulations require a six-monthly inspection in accordance with British Skydiving Form 112. British Skydiving documentation and the Parachute Rigger Handbook provides guidance on the essential inspection requirements and associated repairs.

Exhibit 101
Exhibit 102
Exhibit 99
Exhibit 100

Deployment of the main canopy

1.3.A.8. **Main pilot chute deployment.** There are various methods to deploy a main canopy. The parachute system used in the accident was deployed by a Base of Container (BOC) toggle attached to the main pilot chute;[34] a small auxiliary parachute used to deploy the main or reserve parachute (Figure 1.3.A.5). The main pilot chute was packed into a Spandex®[35] pocket at the bottom of the container (Figure 1.3.A.6). To deploy the main canopy the parachutist's right hand is swept back taking hold of the BOC toggle (Figure 1.3.A.7), they then extract the pilot chute from the pocket (Figure 1.3.A.8) and throw it 90 degrees to their body, thereby releasing the pilot chute into the airflow once the arm is at full extension. The pilot chute then inflates creating drag as the parachutist continues to fall, this action removes the main container closure pin (Figure 1.3.A.9) and extracts the main canopy deployment bag allowing the main canopy to be released into the airflow (Figure 1.3.A.10).

[30] FAA regulations and policies – handbooks and manuals, https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/prh_change1.pdf.
[31] Cordura® is a synthetic fibre-based fabric.
[32] Parachute Rigger Handbook refers to webbing as Type – No. (Type-8, for example)
[33] British Skydiving was the NGB for the parachute systems in the UK.
[34] BOC toggle is a handle in which the parachutist can take hold of, in order to deploy the main pilot chute, i.e. a hackie sack.
[35] Spandex® is a synthetic (polyether-polyurea copolymer) fibric, known for its elasticity.

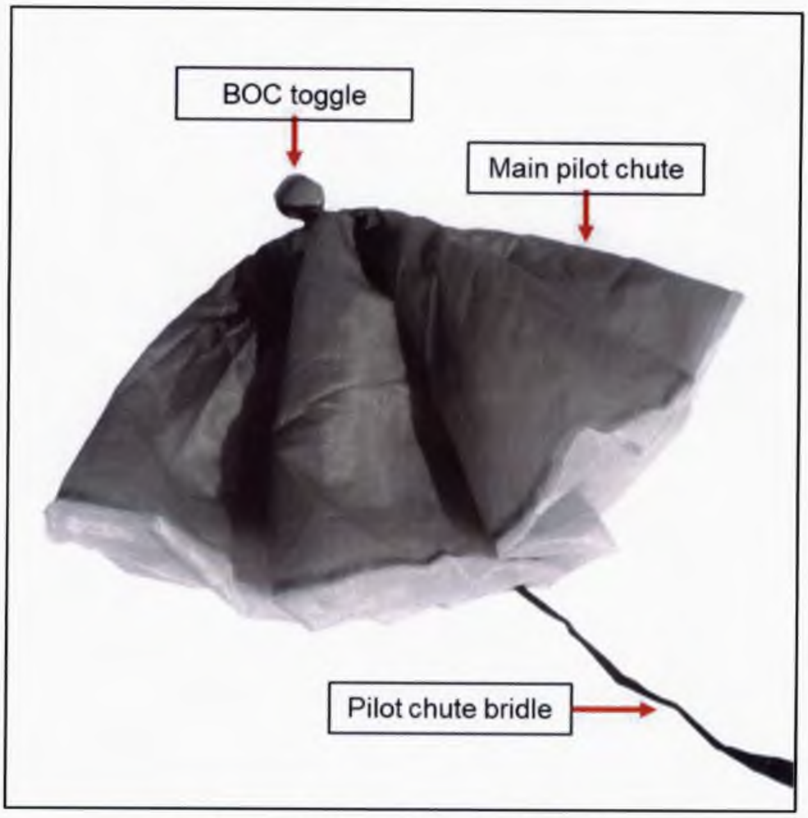

Figure 1.3.A.5 – Main pilot chute.[36]

Figure 1.3.A.6 – BOC Spandex® pocket and toggle.

[36] Image – https://en.wikipedia.org/wiki/File:Pilot_chute.png

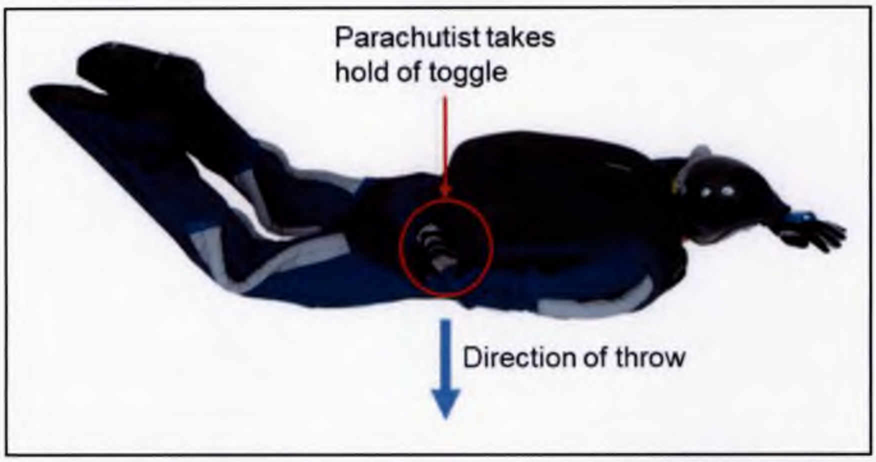

Figure 1.3.A.7 – Main pilot chute deployment position.[37]

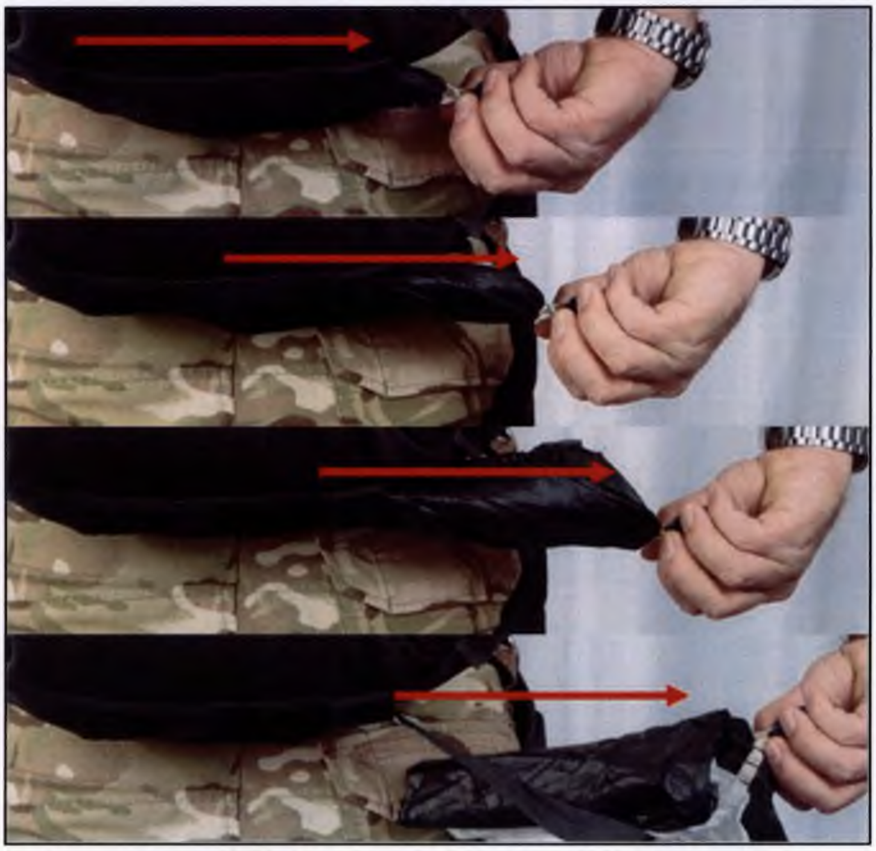

Figure 1.3.A.8 – Main pilot chute deployment.

[37] Image – RAF AP 101A-1110-1C3.

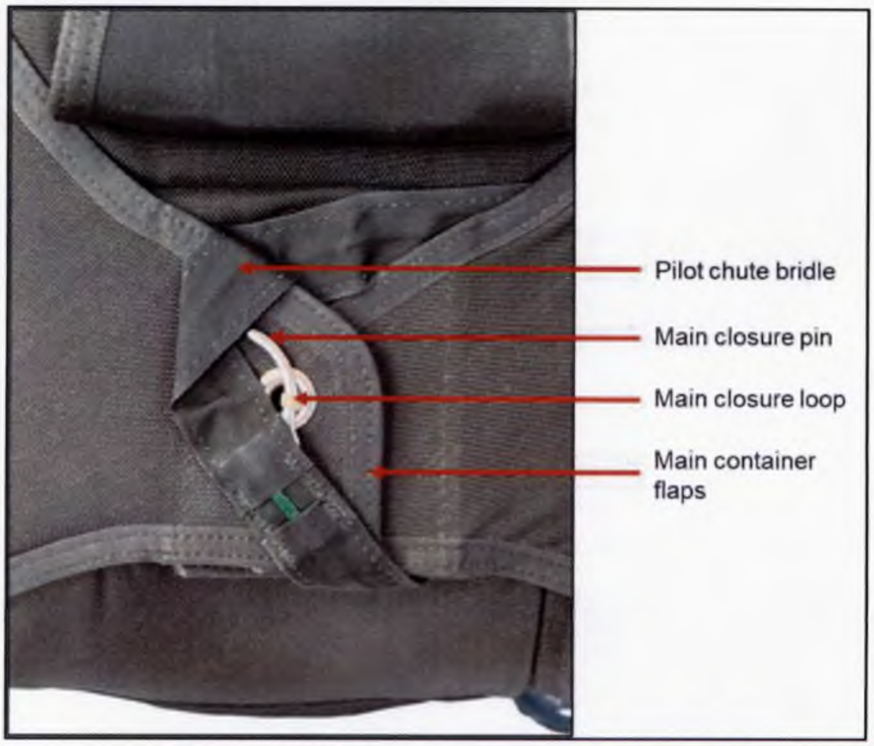

Figure 1.3.A.9 – Main container closure flaps and pin.

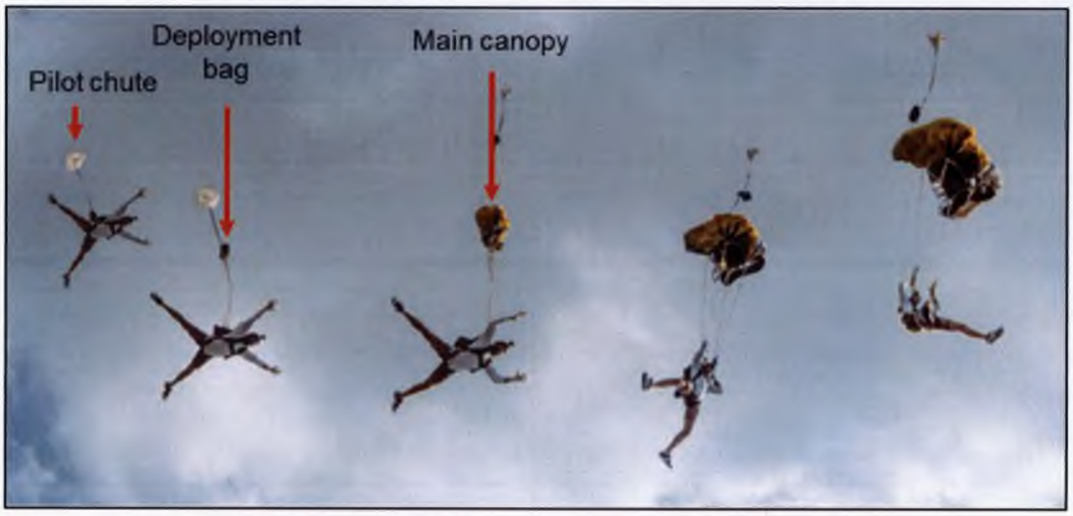

Figure 1.3.A.10 – Main canopy deployment.[38]

1.3.A.9. **Risers.** The main canopy was attached to the harness and container assembly by the canopy risers. For the Javelin container, a three-ring (3-ring) release system (Figure 1.3.A.11) was designed to bear the suspended load (i.e. the parachutist) under the canopy and reduce the force on the riser retaining loop, held in place by the cutaway cable. The 3-ring release system allowed a parachutist to release the main canopy in a single action with minimal force (Figure 1.3.A.12) by operating a cutaway handle. In comparison, the reserve risers (referred to as lift webs) formed part of the main harness assembly and could not be released. The reserve risers were positioned under the main canopy risers and the riser covers.

[38] Image - https://www.skydivemag.com/new/four-critical-altitudes/

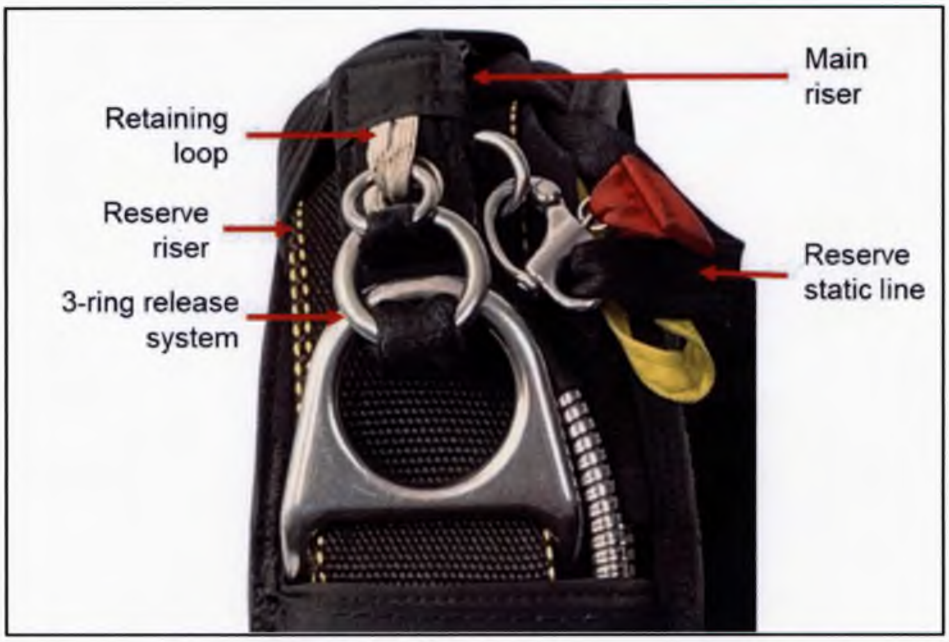

Figure 1.3.A.11 – 3-ring release system.

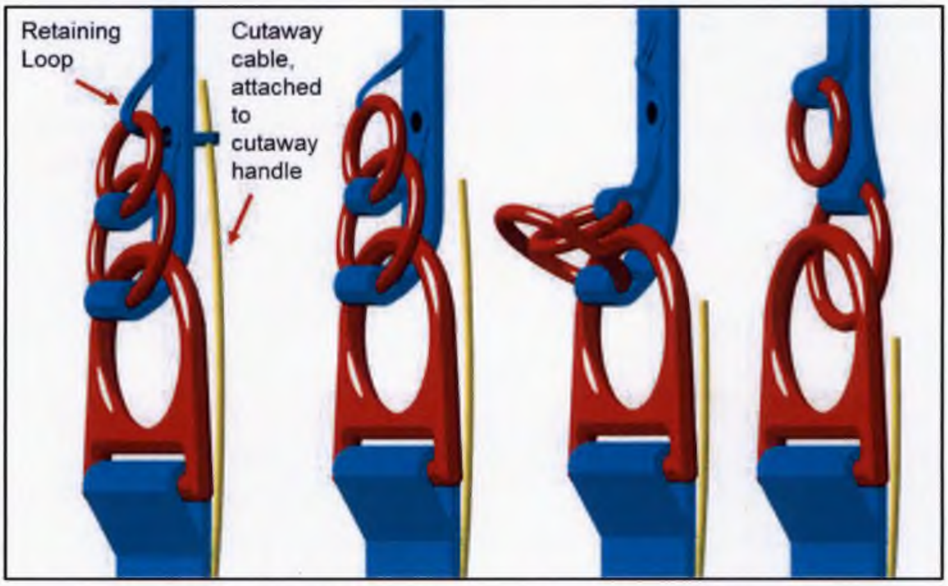

Figure 1.3.A.12 – 3-ring release operation.[39]

1.3.A.10. **Cutaway handle.** The cutaway handle comprised of a Cordura® handle with two LOLON®-F coated wire cables (Figure 1.3.A.13) and was fitted within a Velcro® pocket on the main harness lift web.[40] The two cables were contained within the parachute system's protective housing.

[39] Image – https://en.wikipedia.org/wiki/3-ring_release_system.
[40] Lolon-F is a highly flexible plastic coating for metal cables.

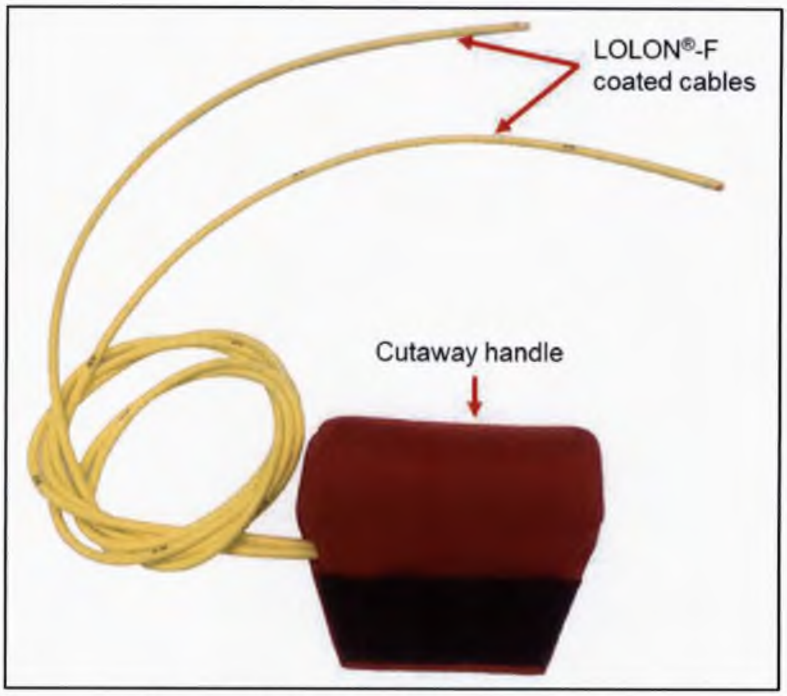

Figure 1.3.A.13 – Cutaway handle.

1.3.A.11. **Reserve ripcord with marine eye.** The reserve ripcord was a stainless steel D handle and steel cable (Figure 1.3.A.14) which was fitted to the harness within a Velcro® pocket on the main lift web. The cable was contained within the parachute system's housing to the back of the reserve container where the reserve pin was fed through the marine eye to secure the reserve pilot chute and container flaps (Figure 1.3.A.15).

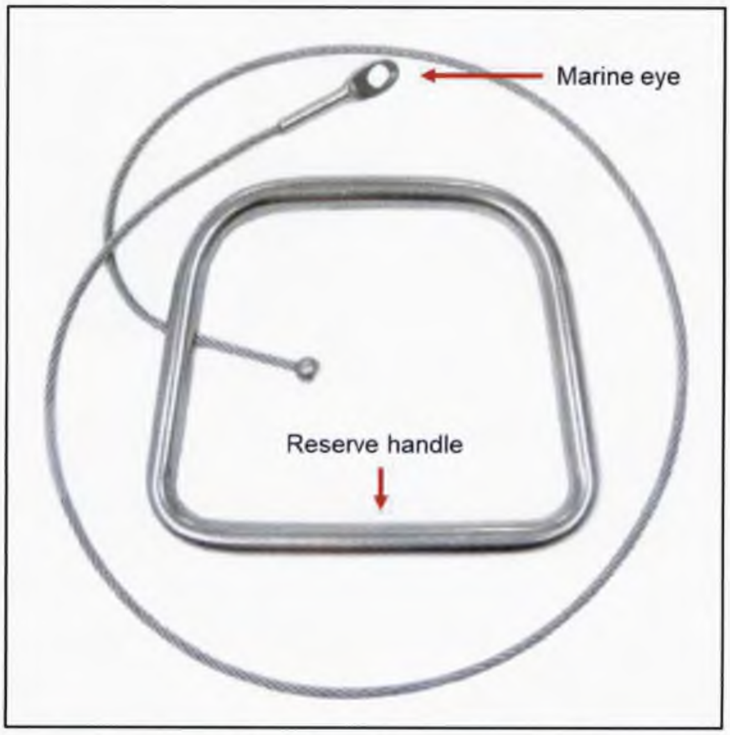

Figure 1.3.A.14 – Reserve ripcord.

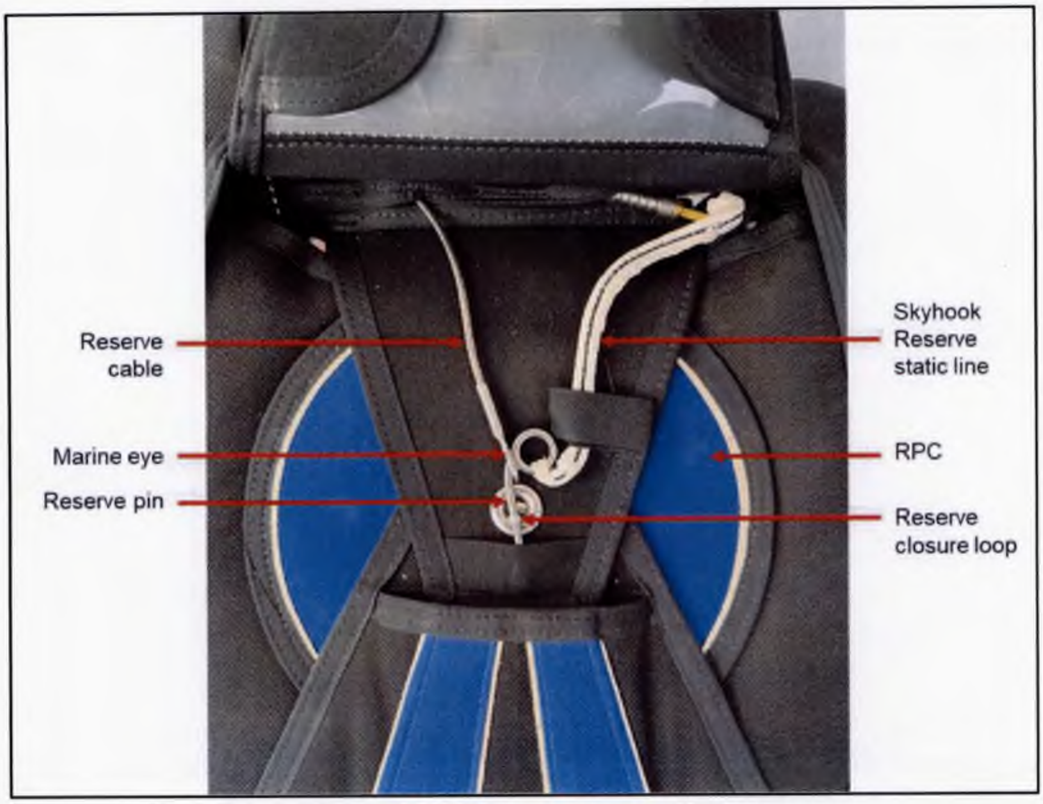

Figure 1.3.A.15 – Reserve configuration.

1.3.A.12. **Cutaway and reserve handle deployment.** Known as the 'malfunction drill' or 'emergency procedure' this was the same action for all parachute malfunctions, comprising five actions: Exhibit 103

a. **Look.** Parachutist looks for the location of the cutaway and reserve handles (Figure 1.3.A.16).

Figure 1.3.A.16 – Look.

b. **Locate.** Parachutist takes control of the cutaway handle in the right hand and the reserve handle in the left hand (Figure 1.3.A.17).

Figure 1.3.A.17 – Locate.

c. **Cutaway.** Parachutist cuts the main canopy away by peeling the handle out of the Velcro® pocket and extending the arm in line with their body (Figure 1.3.A.18).[41]

Figure 1.3.A.18 – Cutaway.

d. **Pull reserve.** The parachutist releases the reserve canopy by extracting the handle out of the Velcro® pocket and extending their arm in line with their body (Figure 1.3.A.19).

[41] Velcro ® is a hook and loop fastener, consisting of two liner fabric strips which are attached to the opposing surfaces to be fastened.

Figure 1.3.A.19 – Pull reserve.

e. **Arch.** After both handles have been operated the parachutist returns to a neutral position to aid the deployment of the reserve parachute (Figure 1.3.A.20).

Figure 1.3.A.20 – Arch.

1.3.A.13. **Reserve pilot chute (RPC).** The RPC (Figure 1.3.A.21) is the primary deployment method for the reserve canopy. Sun Path's RPC was constructed using rip-stop nylon (top section) and mesh (bottom section) material, surrounding a cylindrical metal spring. Rigging documentation suggested that the springs currently in use had between 20 to 30lbs of tension[42] and were retained under compression within the reserve container by the reserve pin (Figure 1.3.A.15). The RPC was released via the removal of the reserve pin during the operation of either the cutaway handle,[43] reserve handle, or by the automatic activation device (AAD), if fitted.

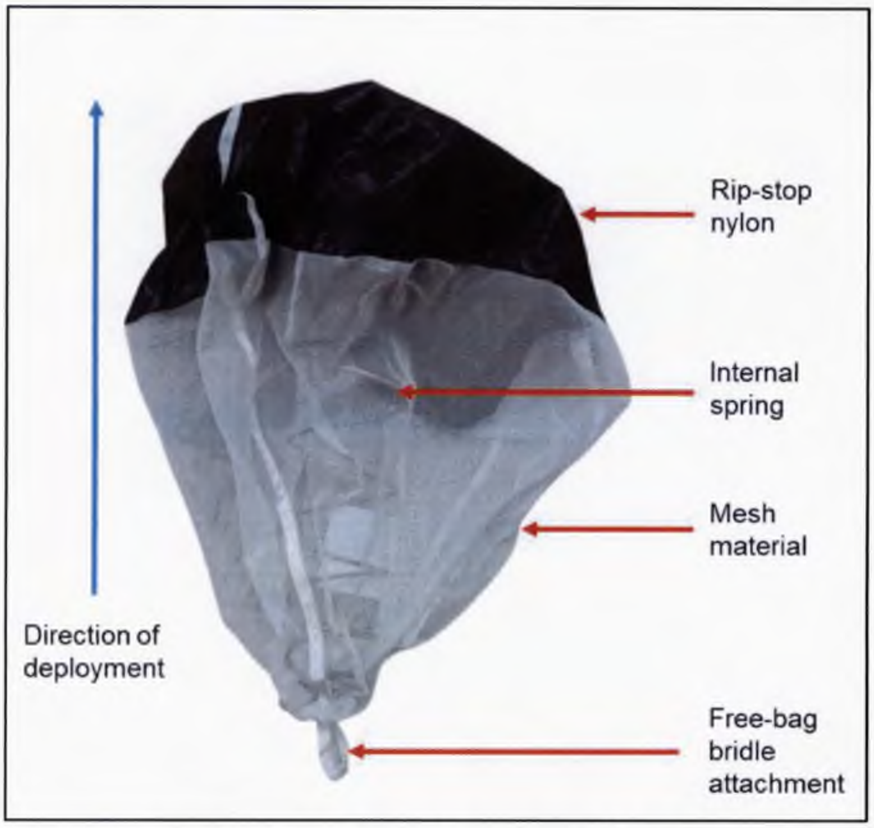

Figure 1.3.A.21 – Reserve pilot chute.

1.3.A.14. **Reserve free-bag and bridle.[44]** The reserve free-bag and bridle assembly (Figure 1.3.A.22) were supplied in accordance with the container size; and the manufacturer's compatibility table, which provided direction on the permitted reserve canopy size that could be fitted. The free-bag was U-shaped in its design, which allowed the reserve closure loop to be fed through a grommet with additional space for the compressed RPC to be positioned, once packed within the container. With the exception of the final two line stows,[45] the reserve canopy rigging lines are held within a pocket on the outside of the free-bag. The last two line stows are secured by the line stow 'bungee' which holds the mouth of the free-bag closed retaining the reserve canopy inside the free-bag (Figure 1.3.A.23). A bridle with an approximate length of 3.5m and width of 5cm connects the free-bag to the RPC, it was constructed from a polyester webbing Exhibit 98

[42] Source: Rigger's handbook. Also suggested tension can be as high as 40 to 45lbs.
[43] Main canopy deployed; reserve pin is pull by the reserve static line.
[44] The reserve free-bag housed the reserve canopy in order to be packed within the parachute container, on reserve deployment the free-bag was designed to separate from the reserve canopy.
[45] A stow refers to a loop of rigging lines secured with an elastic bungee.

material with a breadth designed to increase the drag forces to aid reserve deployment. The parachute system involved in the accident was fitted with a Skyhook (details in Para 1.3.A.20) which is positioned approximately 2m from the free-bag and 1.5m from the RPC in accordance with the manufacturer's guidelines.[46]

Figure 1.3.A.22 – Free-bag and bridle (Skyhook fitted).[47]

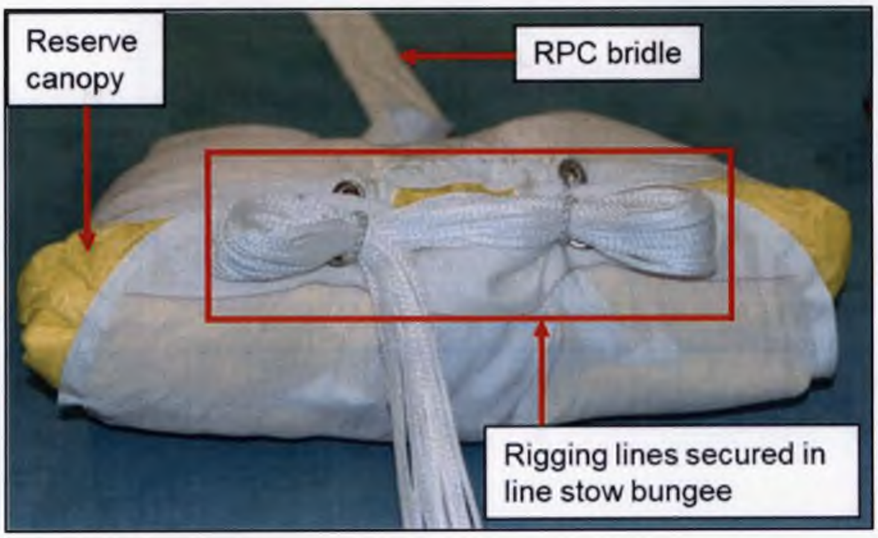

Figure 1.3.A.23 – Reserve line secured by line stow 'bungees'.[48]

[46] Skyhook position on bridle to prevent the RPC interacting with the reserve canopy when deployed under a main canopy malfunction scenario.
[47] Image – Sun Path owner's manual.
[48] Image – https://www.skydive-specialists.com/reserve-repack.

1.3.A.15. **RPC and free-bag deployment.** On operation of a reserve handle or post an AAD activation, the reserve closure loop would become free, allowing the reserve container retaining flaps to open, which in turn released the RPC into the airflow. The RPC acted as a drag device to extract the free-bag from its container as the parachutist falls away. As the reserve rigging lines get to full line extension (under tension) the final two rigging line stows would be removed from the bungee allowing the free-bag to open. The reserve canopy would then be extracted from the free-bag, which separates from the reserve canopy to ensure an unhindered deployment (Figure 1.3.A.24).

Figure 1.3.A.24 – RPC and reserve deployment.[49]

Performance Design canopies

1.3.A.16. **Main and reserve canopies.**[50] The main and reserve canopies were manufactured by Performance Designs in the USA, Figure 1.3.A.25 and Figure 1.3.A.26 show the design and main features of this style of ram-air canopy. Both main and reserve canopies were constructed using a cellular configuration with the leading edge of the canopy open to the airflow, forming intakes and allowing the cells to be ram-air inflated as the canopy moves forward. When ram-air inflated, a pressurised, semi-rigid wing was created with upper surfaces, lower surfaces and an aerofoil section. Canopies were connected to the harness by rigging lines attached to the load carry ribs, ensuring even distribution of the load along the chord of the canopy whilst in flight, thus keeping the canopy in a correct aerofoil shape. The parachutist controlled the canopy using left and right steering toggles which were connected to the control lines attached to its trailing edge.

[49] Image – screen shots of video - https://youtu.be/iBNf-HsD3Ms.
[50] www.performancedesigns.com/products/.

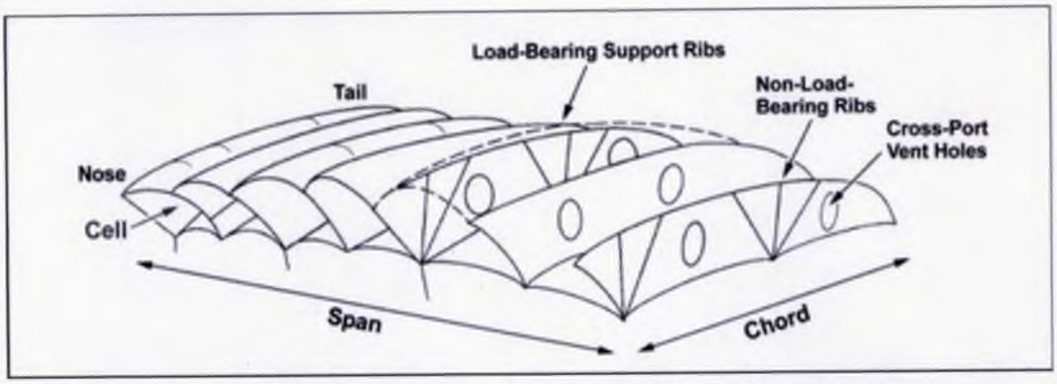

Figure 1.3.A.25 – Ram-air canopy internal design.[51]

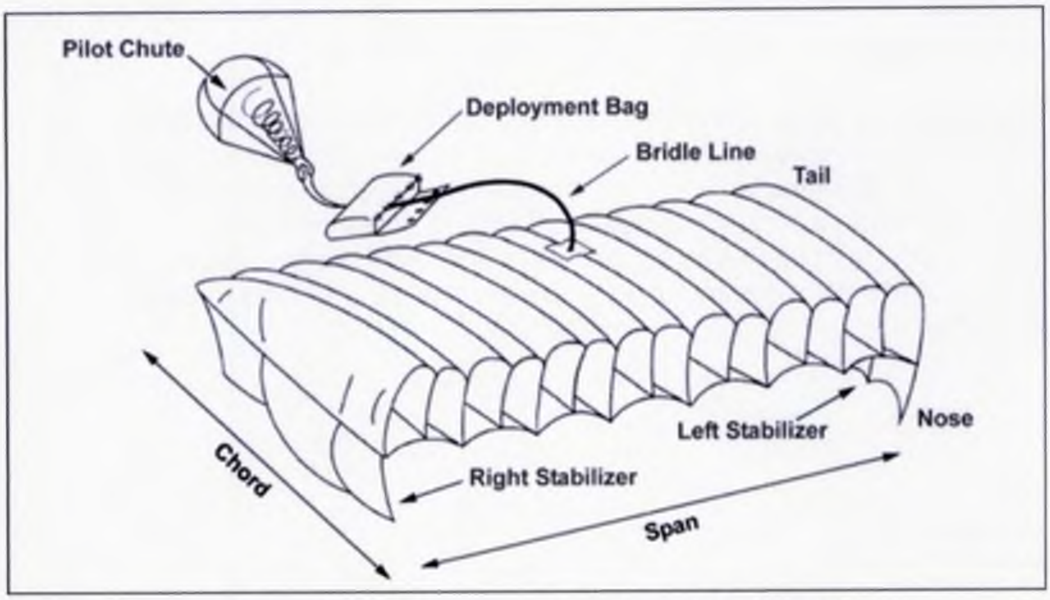

Figure 1.3.A.26 – Ram-air external design.[52]

1.3.A.17. Performance Design manufactured nine different main and two reserve canopies, all of which were designed to fly using the same aerodynamic principles, but had subtle differences in shape, size, material and construction. The details of the two parachute designs used in the accident are detailed below. Exhibit 104 Exhibit 105

a. **Main canopy.** The Sabre 2 (Figure 1.3.A.27 (left)) canopy was produced in a size range of 97 - 260sqft, Sgt Fisk's main canopy was 150sqft. It's design was a semi-elliptical '9 cell' canopy, constructed using zero porosity fabric and had been tested in accordance with FAA TSO C23d.

b. **Reserve canopy.** The Optimum (Figure 1.3.A.27 (right)) canopy was produced in a size range of 99 - 253sqft, Sgt Fisk's reserve canopy was a 160sqft '7 cell' canopy made from a 30 denier low-permeability low-bulk fabric and had been tested in accordance with FAA TSO C23d.

[51] Image – www.rumell.net.
[52] Image – www.rumell.net.

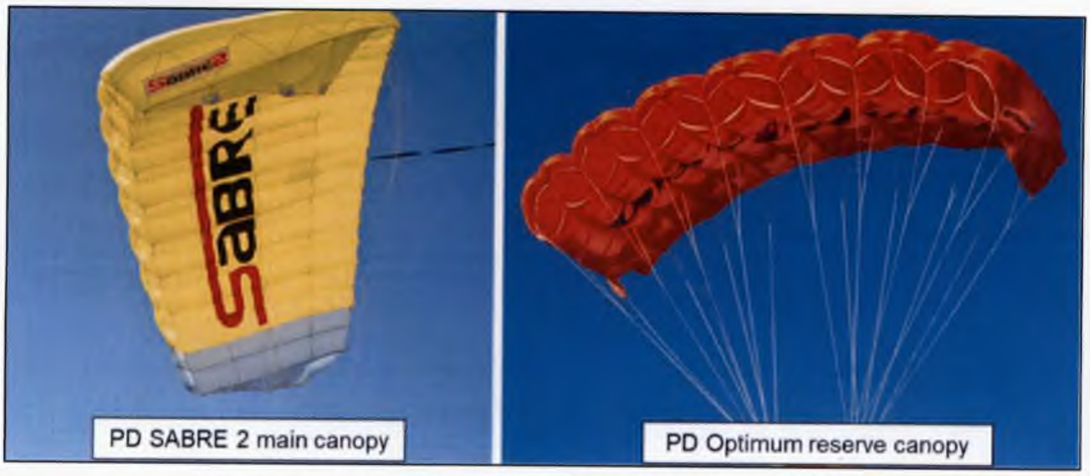

Figure 1.3.A.27 – Main and reserve canopies.[53]

1.3.A.18. **Rigging lines.** Main and reserve canopy rigging lines were identified as A, B, C and D lines (Figure 1.3.A.28), which were attached to the load bearing ribs of the canopy. [54] The lines were comprised of a nylon weave called Spectra Microline 725® which had a tensile strength of 330kg. In addition to the load bearing rigging lines, canopies had a set of control lines which were attached to the tail of the canopy to allow the parachutist to steer the canopy via a left and right control toggle.

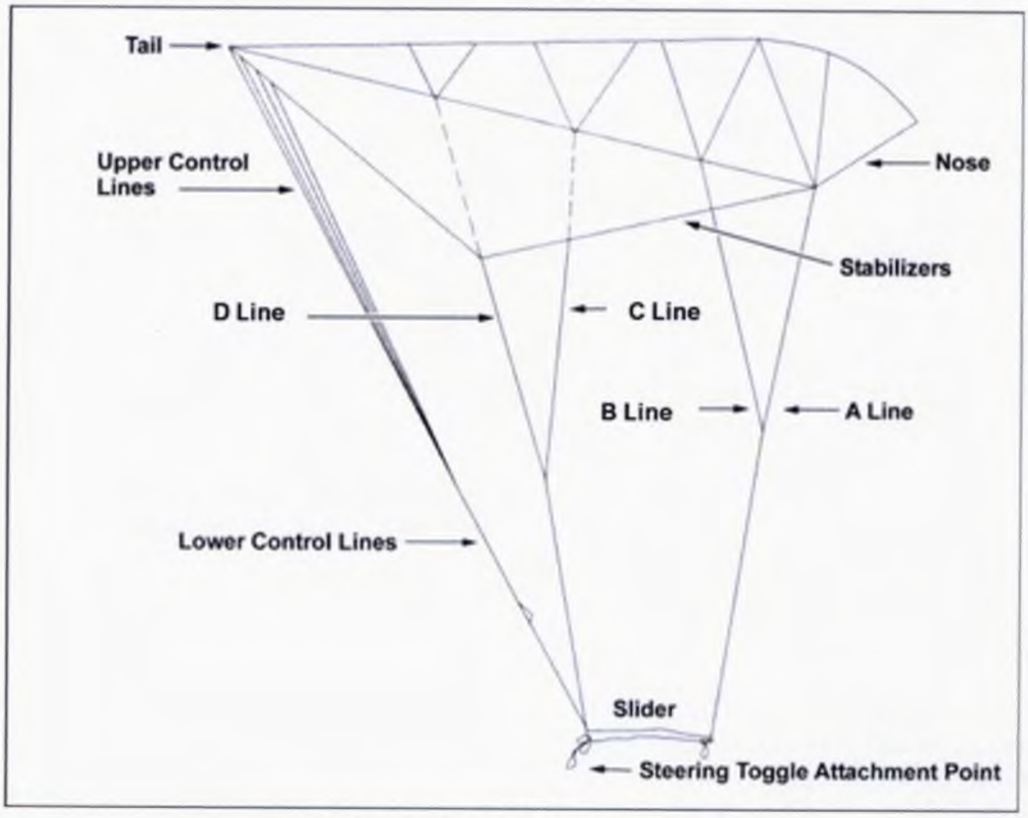

Figure 1.3.A.28 – Rigging lines.[55]

[53] Images – https://www.performancedesigns.com/products/.
[54] 32 lines for a 7 cell canopy and 40 lines for a 9 cell.
[55] Image – www.rumell.net.

1.3.A.19. **Slider.** Main and reserve canopy assemblies were fitted with a slider which was designed to control the opening speed of the deploying canopy. The primary difference between the main and reserve slider was that the reserve parachutes had a section in the middle of its slider removed; this was to allow air to flow through the slider for a quicker canopy deployment. The main canopy involved in the accident was fitted with a collapsible slider, which allowed the user to reduce the slider's surface area post canopy deployment, aiding the flying characteristics of the main canopy. The slider was collapsed by pulling on two drawstrings (Figure 1.3.A.29). Once collapsed, the slider could be retained behind the parachutist's head at the top of the container. Exhibit 105

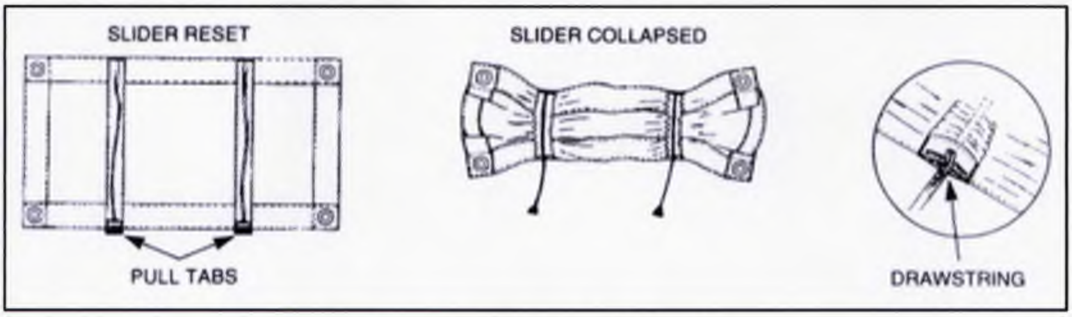

Figure 1.3.A.29 – Slider.[56]

United Parachute Technologies – Skyhook reserve static line (RSL), Main Assisted Reserve Deployment (MARD)

1.3.A.20. **Skyhook reserve static line.[57]** The Skyhook RSL is a MARD – a MARD is designed to use a deployed main canopy as the primary deployment method for the reserve canopy – manufactured by United Parachute Technologies and comprised of five parts (Figure 1.3.A.30). Exhibit 107 Exhibit 98

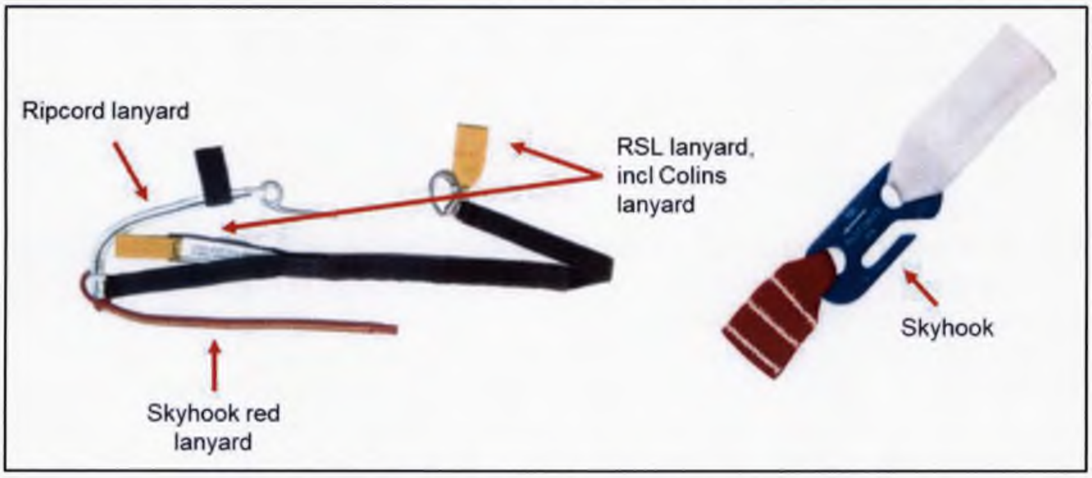

Figure 1.3.A.30[58] – Skyhook RSL components.[59]

[56] Image – Performance Designs main canopy user manual.
[57] United Parachute Technologies – www.uptvector.com/skyhook-overview/.
[58] Image – www.skydivegearsolutions.eu.
[59] RSL & Colins lanyard not an exact representation of current lanyards.

1.3.A.21. The Skyhook RSL could be fitted to any parachute system on the approval and issue of a licence by United Parachute Technologies. The Javelin container involved in the accident had a Skyhook fitted (Figure 1.3.A.31). The Skyhook was designed to work in all malfunction scenarios.[60] Where a main canopy had been deployed but had a malfunction, the Skyhook uses the malfunctioning canopy as the primary drag force to speed up the deployment process of the reserve canopy. In this instance the RPC is redundant.

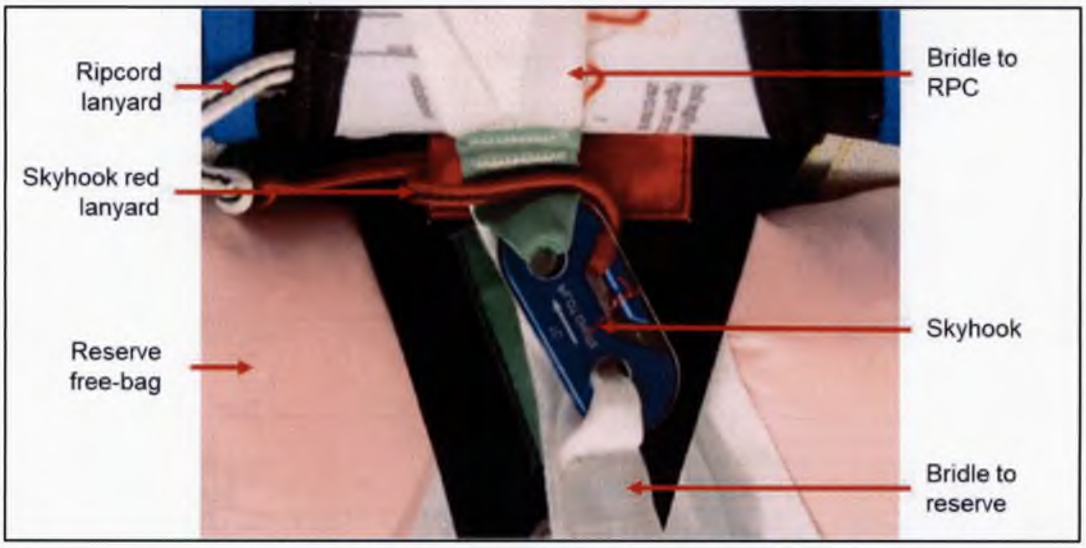

Figure 1.3.A.31 – Skyhook connection.

1.3.A.22. **Skyhook operation.** The Skyhook was designed to operate differently dependent upon the malfunction; both processes are detailed below.

a. **Main canopy malfunction.** On operating the cutaway handle the parachutist would fall away from the main canopy, which becomes the pilot chute for the reserve deployment. The drag causes the Skyhook RSL attached to the riser to become taught and when at full line stretch, removes the reserve pin. The drag continues to assist the extraction of the reserve free-bag via the Skyhook lanyard connection to the bridle, until the reserve canopy has been deployed (Figure 1.3.A.32).

b. **Non main canopy malfunction.** In the event of a malfunction with no main canopy deployed, the parachutist must operate the reserve handle. The reserve pin is removed by the reserve cable, allowing the reserve container to open and the RPC to deploy. As the parachutist falls away the RPC inflates acting as an 'anchor' to extract the free-bag from the container. In this scenario the Skyhook is not required and disconnects when the bridle becomes taught (Figure 1.3.A.33). Once released, the remaining bridle continues to deploy before removing the free-bag from the reserve container.

[60] High speed malfunction defined as any malfunction where the main canopy has not deployed, low speed defined as a malfunction when a main canopy has been deployed.

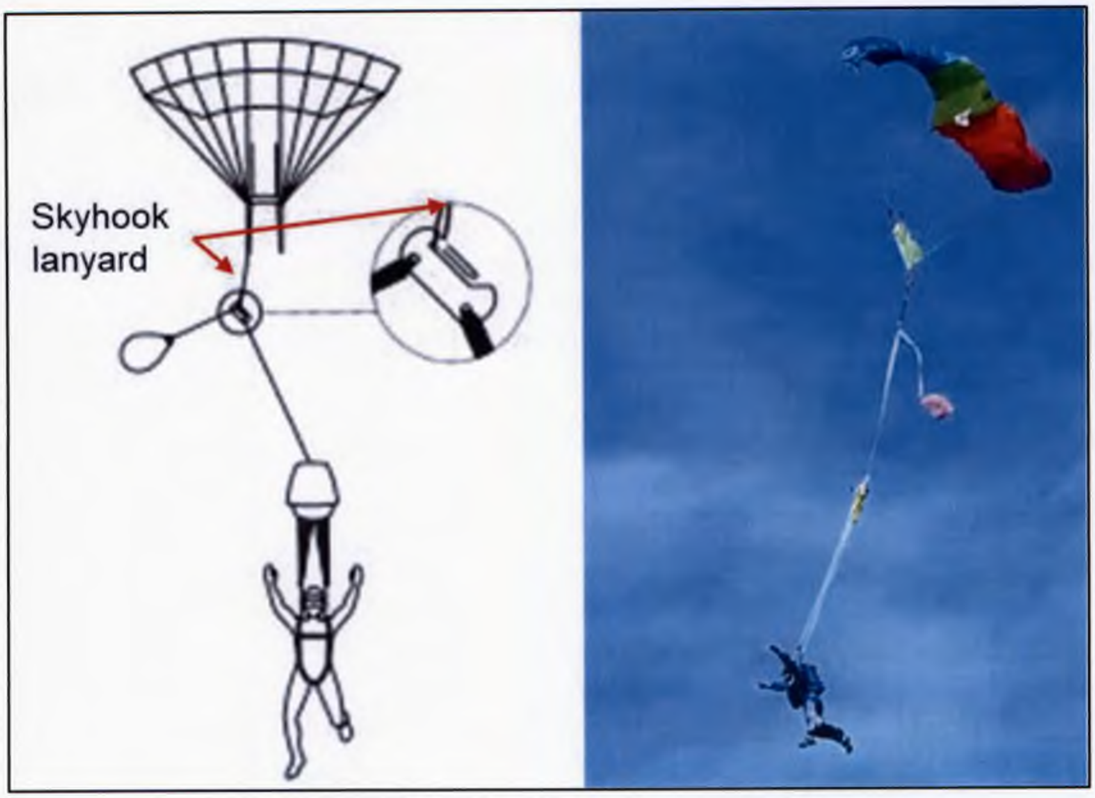

Figure 1.3.A.32 – Skyhook operation.[61]

Figure 1.3.A.33 – Skyhook operation for non-main canopy malfunction.[62]

[61] Image – www.uptvector.com.
[62] Image – www.uptvector.com.

AirTec Cybernetic Parachute Reserve System (CYPRES) 2 AAD[63]

1.3.A.23. **CYPRES 2 AAD.** The CYPRES 2 AAD was manufactured by AirTec GmbH Safety Systems and was designed to automatically deploy the reserve parachute assembly. While in use the CYPRES 2 continuously checked the air pressure whilst on the ground and adjusted to any fluctuations in pressure due to changing environmental conditions. The CYPRES 2 was designed to operate independently of the main and reserve parachute cutaway and deployment systems by cutting the reserve container closure loop to release the reserve parachute assembly should the parachutist exceed the set parameters (see Table 1.3.A.1). Exhibit 106

1.3.A.24. The main functions of the CYPRES 2 AAD unit included:

a. Number of descents.

b. Automatic reserve activation.

c. Descent data (altitude/speed) on activation.

1.3.A.25. The CYPRES 2 AAD consisted of a control, processing and release unit (Figure 1.3.A.34).

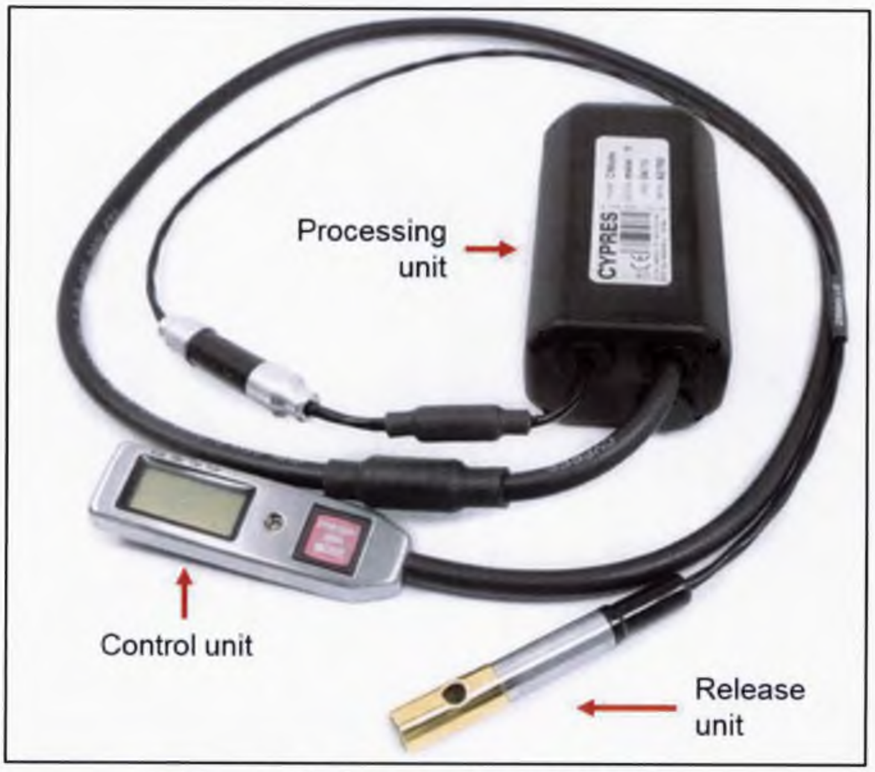

Figure 1.3.A.34 – CYPRES 2 AAD.[64]

[63] AirTech - www.cypres.aero/.
[64] Image – www.meelot.com.

1.3.A.26. **Control unit.** The control unit was a visual display for the user providing the ability to input and monitor settings for parachute descents. The CYPRES 2 'C-mode' model allowed the user to change between four modes.[65] The mode that the CYPRES was set to was identified by a digit beneath the mode title (Figure 1.3.A.35).

Figure 1.3.A.35 – CYPRES 2 AAD control unit.[66]

1.3.A.27. **Processing unit.** This unit contained a factory-programmed microprocessor that was capable of real-time calculations of the parachutist's altitude and rate of descent based on barometric pressure. Through the continued monitoring of the data the CYPRES 2 AAD was able to determine whether a parachutist would exceed the set criteria of a freefall rate of 78mph (35m/s), below a set safe altitude.[67] Should this be identified, the processing unit would trigger the release unit to initiate the reserve container opening sequence.

1.3.A.28. **Release unit.** Also known as the cutter, the release unit was configured to incorporate the reserve container closure loop (Figure 1.3.A.36) and therefore works independently of the reserve parachute's primary reserve deployment system (reserve handle), as it does not pull the reserve pin but cuts the closure loop instead.[68]

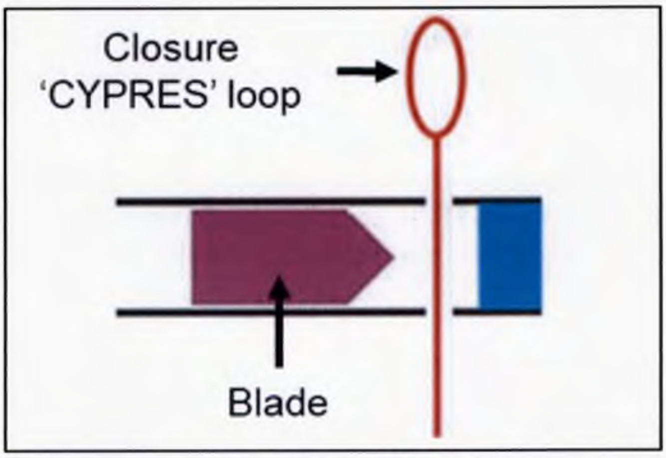

Figure 1.3.A.36 – Closure loop position.

[65] CYPRES 2 C-mode model programmes include Expert, Student, Tandem and Speed.
[66] Image – www.cypres.aero
[67] 78mph (35m/s) is approximately 70% of freefall speed.
[68] The reserve container closure loop supplied by the manufacturer was referred to as the 'CYPRES loop' and was the only closure loop permitted to be used with the CYPRES AAD

1.3.A.29. In the event of an activation, at an approximate height of 750ft agl[69] (dependent on freefall speed) an explosive material causes the blade to move approximately 5mm (Figure 1.3.A.37), cutting the closure loop and therefore releasing the RPC.[70]

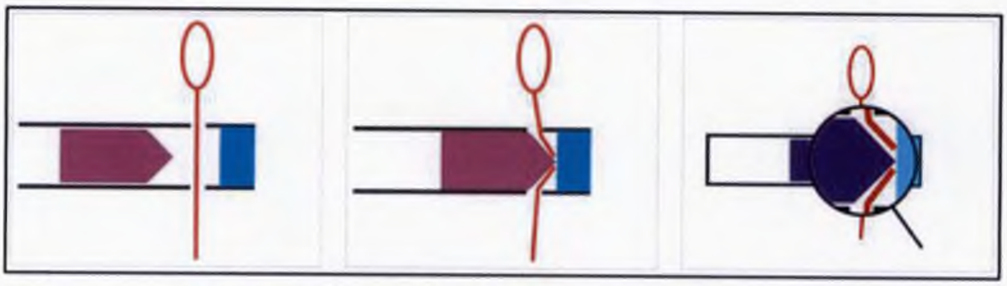

Figure 1.3.A.37 – CYPRES 2 cutter operation.[71]

1.3.A.30. **CYPRES 2 technical information.** The standard settings for a C-mode unit set in EXPERT mode are as follows:

Operating period	14hrs from switch on
Activation altitude	750 – 130 feet
Activation speed	approx. >78mph

Table 1.3.A.1 – CYPRES 2 operating parameters.

1.3.A.31. In the event of a main canopy cutaway, the EXPERT mode would operate down to approximately 130ft agl, at this height the CYPRES 2 would disarm the device, as activation is deemed no longer useful.

1.3.A.32. **Closure (CYPRES) loop and disc system.** The CYPRES loop was manufactured from a woven nylon with a diameter of 1.8mm, with a breaking strain in excess of 185kg (408lbs). The material's tubular construction allowed the nylon to be inserted into itself creating the closure loop's eye, with the opposite end secured by the CYPRES disc. This disc also held the CYPRES loop in position within the parachute reserve container to minimise the possibility of the loop tearing.

1.3.A.33. **CYPRES 2 maintenance information.** All CYPRES 2 units with a date of manufacture post Jan 2017 had a 15.5 year life. Maintenance could be performed on a voluntary basis at the five and ten year point from the date of manufacture.

1.3.A.34. Dependent on the parachute container design, the three component units were located in various positions. The CYPRES 2 was fitted to the Javelin container in accordance with the manufacturer's guidelines (Figure 1.3.A.38 and 1.3.A.35. Figure 1.3.A.39).

[69] 750ft agl above the elevation of the flight cycle start point.
[70] The AAD calculated the freefall speed and calculated whether it was required to fire above the set value.
[71] Image - www.cypres.aero/about/technology/cutter-demonstration/.

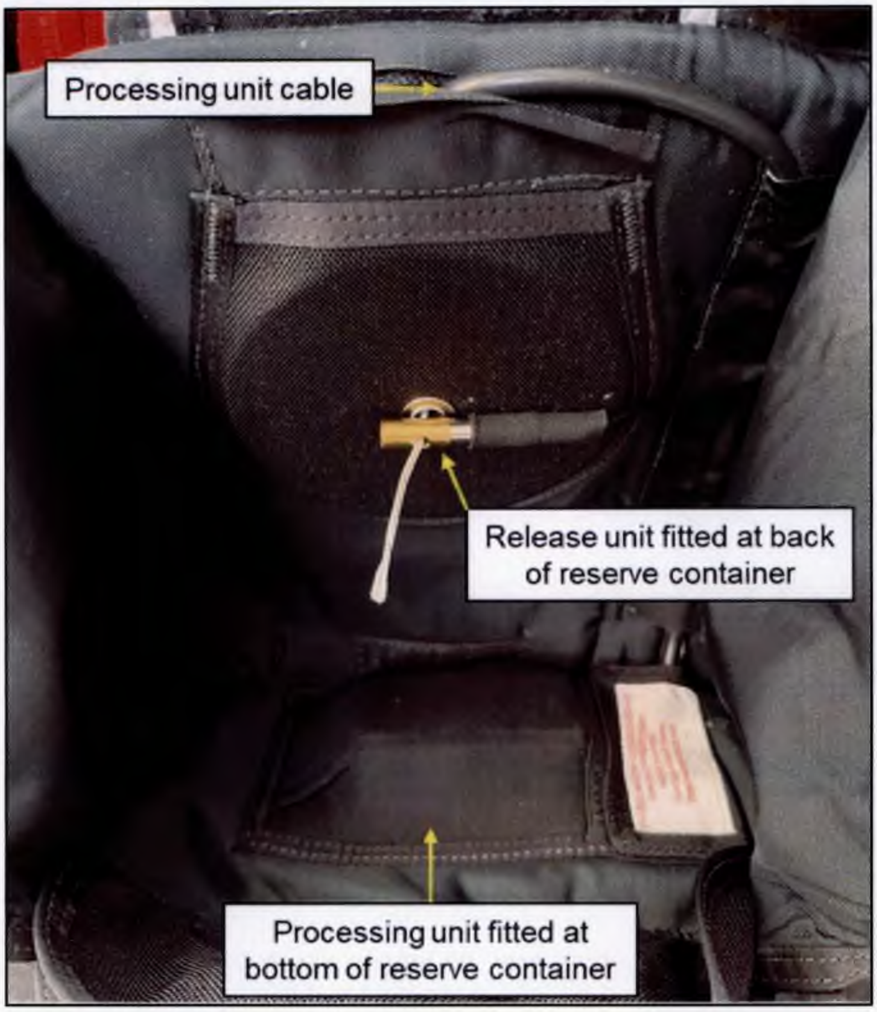

Figure 1.3.A.38 – CYPRES release and processing units.

Figure 1.3.A.39 – CYPRES control unit.

Larsen & Brusgaard ALFA Altimeter.[72]

Exhibit 108
Exhibit 110
Exhibit 109

1.3.A.36. The ALFA is a visual digital altimeter. This altimeter (Figure 1.3.A.40) was used during parachuting descents to enable the parachutist to maintain height awareness during both their freefall and canopy flying phase of descent. The ALFA could be worn on either arm using a low-profile forearm mount, providing the parachutist with a high contrast, no flicker, LCD display of their altitude. The ALFA would allow users to adjust the height of the ground level by inputting a manual air pressure in millibars (mb) if landing at a higher or lower location than the departure aerodrome or DZ.

Figure 1.3.A.40 – Larsen & Brusgaard ALFA altimeter.

1.3.A.37. **ALFA technical information.** The ALFA unit calibrated itself to ground level (field elevation) of the location at which it was switched on, and used measured air pressure for altitude calculations. Automatic calibration continued after each descent or landing and accounted for any pressure changes, thus ensuring the unit was always zeroed prior to each sortie. If the user adjusted the height using the altitude offset function, the ALFA would use absolute air pressure for altitude calculations. The software also included error correction to provide correct live altitude readings. The ALFA display (Figure 1.3.A.41) provided the user with the current configuration, time, battery level and height.[73]

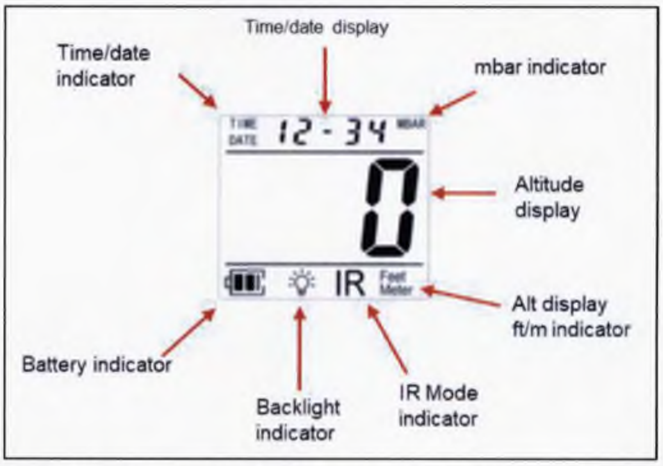

Figure 1.3.A.41 – Larsen & Brusgaard ALFA display symbols.[74]

[72] Larsen & Brusgaard ALFA - https://www.lbaltimeters.com/tactical/alfa.html
[73] Larsen & Brusgaard refer to height as altitude in their documentation.
[74] Image – Larsen & Brusgaard user manual. IR (Infra-Red) mode was used to enable remote access to the device.

1.3.A.38. **ALFA logbook information.** The ALFA altimeter stored each parachute descent to an internal logbook. The minimum amount of time in freefall required to generate a log entry was eight seconds in the normal programme mode.[75] It recorded exit height, deployment height, freefall time and speed for 200 jumps.

1.3.A.39. **ALFA parameters.** The operating parameters were as follows:

Function period	14 hrs from switch on
Power supply	Coin-cell batteries
Display	Feet or metres
Operating altitude	0 to 40,000ft (0 to 12,200m)
Operating temperature range	-30°C to +60°C (continuous operation)

Table 1.3.A.2 – ALFA parameters.

1.3.A.40. **ALFA tolerances.** The ALFA's firmware provided accurate information to parachutists within the following tolerances:

Altitude display	+/- 1%
Exit altitude	+/- 1.2%
Deployment altitude	+/- 1.2%
Freefall time	+/- 1 sec
Speed	+/- 3 mph
Millibar	+/- 1 mb

Table 1.3.A.3 – ALFA tolerances.

Larsen & Brusgaard ECHO.[76]

Exhibit 96
Exhibit 109
Exhibit 110

1.3.A.41. The ECHO was an audible altimeter which could be worn within or attached to the parachutist's helmet. The ECHO had three modes, Student, Tandem and Expert, with each mode able to emit a series of audible sounds at user defined heights during the ascent to altitude, the freefall descent and the canopy descent, and are described as 'warning banks' identified by the symbols in Figure 1.3.A.42. Each warning bank allowed the user to programme four warning heights.

Figure 1.3.A.42 – Larsen & Brusgaard ECHO audible altimeter.[77]

1.3.A.42. **High speed warning.** During a vertical descent with a speed of over 13m/s, each pre-set warning would sound a series of audible beeps as follows:

Warning	Duration	Type of alarm
1st warning	One 1.5 second alarm	pulsating, low repetition
2nd warning	One 3 second alarm	pulsating, low repetition
3rd warning	One 4 second alarm	pulsating, high repetition
4th warning	One continuous alarm (continuous while vertical speed remains over 13m/s)	high pitch siren

Table 1.3.A.4 – ECHO high speed warnings.

1.3.A.43. **ECHO technical information.** The ECHO audible unit calibrated itself to ground level when switched on and used measured air pressure for altitude calculations. If the user adjusted the height using the altitude offset function, the ECHO used absolute air pressure for altitude calculations. The software also included error correction to provide correct live height readings. The ECHO display (Figure 1.3.A.43) provided the user with its current configuration, including warning height, battery level and height.

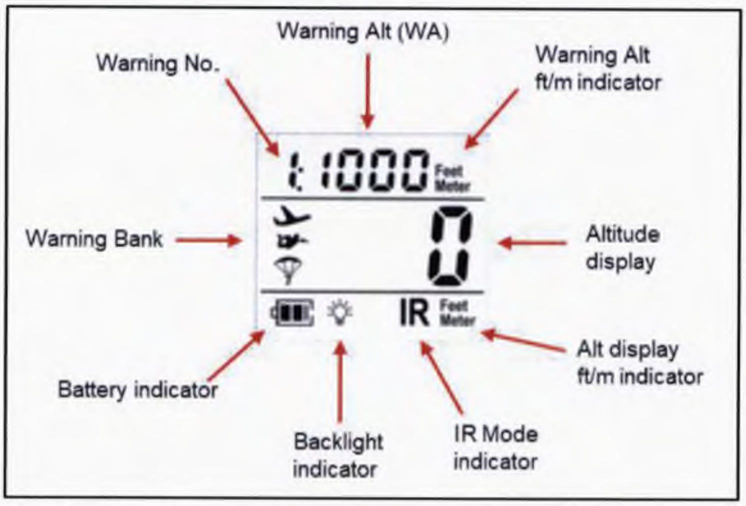

Figure 1.3.A.43 – Larsen & Brusgaard ECHO display symbols.[78]

1.3.A.44. **ECHO parameters.** The operating parameters were as follows:

Operating period	14 hours
Power supply	Coin-cell batteries
Display	Feet or metres
Operating altitude	0 to 40,000ft (0 to 12,200m)
Operating temperature range	-30ºC to +60ºC (continuous operation)

Table 1.3.A.5 – ECHO parameters.

[75] Student mode would generate a logbook entry after three seconds of freefall.
[76] Larsen & Brusgaard ECHO - https://www.lbaltimeters.com/tactical/echo.html.
[77] Image – Larsen & Brusgaard.
[78] Image – Larsen & Brusgaard user manual.

1.3.A.45. **ECHO tolerances.** Although the ECHO's firmware provided accurate information to parachutists, it was subject to tolerances. These are identified below:

Altitude display	+/- 1%
Millibar	+/- 1 mb

Table 1.3.A.6 – ECHO tolerances.

Cookie helmet[79]

1.3.A.46. **Cookie G4 helmet.** Manufactured by Fly Cookie, the G4 (Figure 1.3.A.44) was a purpose built parachuting helmet. The helmet comprised of an Acrylonitrile Butadiene Styrene (ABS)[80] outer shell for high impact, D3O®[81] liner for low impact protection, and a polycarbonate visor secured in place by the 'V-Mech' hinge. The helmet provided full head protection to the user via a fastening system which wrapped the helmet evenly around the head.

Exhibit 111
Exhibit 112
Exhibit 113
Exhibit 114

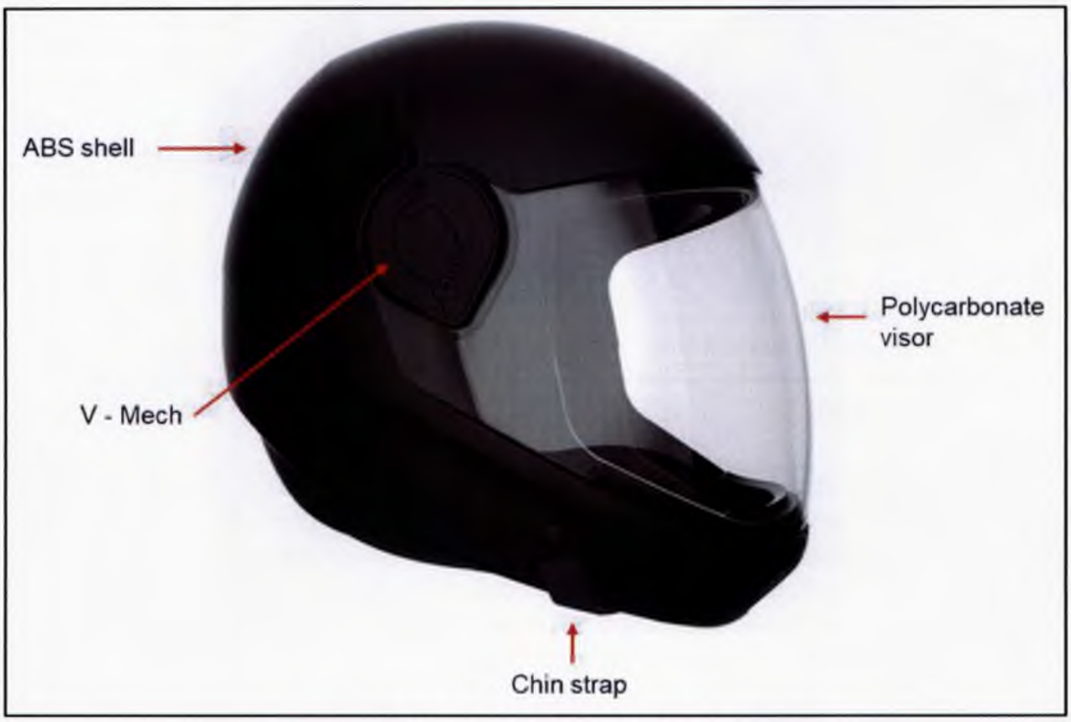

Figure 1.3.A.44 – Cookie G4 helmet.[82]

1.3.A.47. **ECHO and G4 helmet fitment.** The ECHO audible altimeter was positioned in the soft lining of the G4 helmet within a purpose-made pocket in the liner which placed it against the parachutist's ear.

[79] https://www.flycookie.com/skydiving-helmets/g4/.
[80] A thermoplastic polymer plastic.
[81] D3O® is a design and technology company that makes impact protection products, http://www.d3o.com/.
[82] Image – www.flycookie.com.

JEDI camera jacket and trousers[83]

1.3.A.48. **Camera jacket and trousers.** The camera jacket and trouser set were manufactured by Jedi Airwear and were designed to increase the user's freefall range by using the wings to decrease their vertical descent speed. This was achieved by introducing the wings to the airflow, thereby increasing the user's surface area. The Jedi camera jacket had the option of three different wing types: regular, fixed and 'sit', the main differences were size, shape and the means of attachment.

1.3.A.49. Made from Nylon, Cordura® and Lycra® the camera jacket and trousers were normally made to measure to provide the user with light and flexible clothing, yet durable to cope with parachuting activity. The camera jacket used in the accident was made with regular wings (Figure 1.3.A.45).

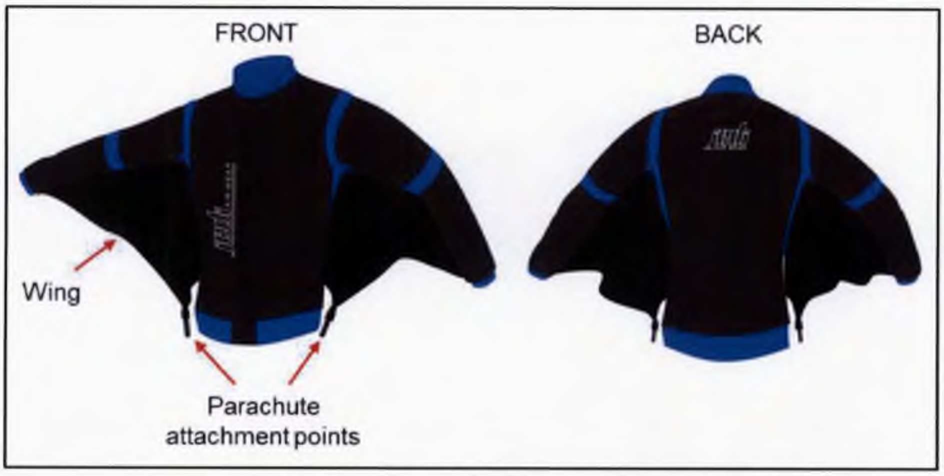

Figure 1.3.A.45 – Jedi Airwear camera jacket.[84]

1.3.A.50. **Camera jacket attachment to parachute system.** A camera jacket had multiple methods to attach the wing to either the trousers or parachute harness. The design included two loops at the base of the wing where the parachutist could add a method of attachment. The method used in the accident was a snap shackle (Figure 1.3.A.46) which allowed the parachutist to release the wing once they were under canopy to enable a greater range of movement.

Figure 1.3.A.46 – Snap shackle.

[83] www.jjediairwear.co.uk/skydiving-camera-jacket/.
[84] Image taken from Jedi Airwear order form.

GoPro™ Hero7 Black camera[85]

1.3.A.51. **GoPro™ camera.** The GoPro™ series of cameras were of high-definition fixed lens design purposely built for adventure sports such as parachuting. The model used in the accident was a GoPro™ Hero7 Black edition (Figure 1.3.A.47). Due to its placement, function and setup the camera provided numerous sources of information and data to the Inquiry. These included high-definition footage from the parachutist's perspective, accelerometer and gyroscope information on three-axis.

Exhibit 115
Exhibit 113
Exhibit 114
Exhibit 109

Figure 1.3.A.47 – GoPro™ Hero7 Black camera.[86]

1.3.A.52. **G4 helmet and GoPro™ camera attachment.** The GoPro™ was attached to the G4 helmet via a curved mount plate (Figure 1.3.A.48). This method of attachment to the G4 had been subject to test and evaluation and was cleared for use under the UK military release to service authority.

Figure 1.3.A.48 – Helmet mount for Cookie G4 helmet.[87]

[85] www.gopro.com/en/gb/update/hero7-black.
[86] Image – www.gopro.com.
[87] Image – RAF AP 1C3.

Parachute packing 'pull ups'

1.3.A.53. **Parachute packing pull up.** A pull up, or pull up cord (Figure 1.3.A.49), was a length of fabric (e.g. polyester) used to assist in the packing of a main parachute. Due to their durability, pull ups were used by parachutists for additional functions including tying harness leg straps together to prevent separation. Sgt Fisk used the pull ups similar to that shown in Figure 1.3.A.50 to attach the camera jacket snap shackles to the leg straps of her parachute systems.

Figure 1.3.A.49 – Pull up cord.

Figure 1.3.A.50 – Example of pull up attached to leg strap.

PART 1.4

Analysis and Findings

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Table of contents – Part 1.4

Table of figures – Part 1.4

Table of tables – Part 1.4

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Part 1.4 – Analysis and findings

All times are local for the time of the accident (GMT plus 1 hour), all imagery times are quoted in min:sec.ms (00:00.000), heights are displayed in feet (ft) and positions are in decimal degrees. In order to understand the analysis used throughout this part of the report it is important to read Annex A to Part 1.3 before reading Part 1.4.

Introduction

1.4.1. On Thu 2 Sep 2021, the Joint Service Parachute Centre (Weston) (JSPC(W)) were conducting parachuting Force Development (FD) activity at Royal Air Force (RAF) Weston on the Green (WOTG) for members of the catering department from RAF Marham. During the fourth (final) sortie of the day, two tandem instructors with students were being filmed by instructors conducting solo descents. Shortly after the last tandem instructor deployed their parachute, the group lost sight of Sergeant (Sgt) Rachel Fisk RAF who was acting as a camera operator.

1.4.2. Sgt Fisk was found by a National Police Air Service (NPAS) helicopter a short distance northeast of WOTG in a field adjacent to the M40 motorway. She was pronounced life extinct at the scene by the Helicopter Emergency Medical Services (HEMS) Doctor after attempts to revive her by the emergency services were unsuccessful. A post-mortem determined the cause of death as multiple injuries.

1.4.3. This part of the report will address the following analysis of factors:

a. Section 1: The accident.

b. Section 2: Safe System of Work.

c. Section 3: Wider parachuting activity within Defence.

1.4.4. The Service Inquiry panel has drawn conclusions and made recommendations throughout the report. A summary of accident factors are included at the end of Part 1.4 and a summary of recommendations are in Part 1.5.

Methodology

Accident factors

1.4.5. Once an accident factor had been determined to have been present it was then assigned to one of the following categories:

a. **Causal factor(s).** 'Causal factors' are those factors which, in isolation or in combination with other causal factors and contextual details, led directly to the incident or accident. Therefore, if a causal factor was removed from the accident sequence, the accident would not have occurred.

b. **Contributory factor(s).** 'Contributory factors' are those factors which made the accident more likely to happen. That is, they did not directly cause the accident. Therefore, if a contributory factor was removed from the accident sequence, the accident may still have occurred.

c. **Aggravating factor(s).** 'Aggravating factors' are those factors which made the final outcome of the accident worse. However, aggravating factors do not cause or contribute to the accident. That is, in the absence of the aggravating factor, the accident would still have occurred.

d. **Other factor(s).** 'Other factors' are those factors which, whilst shown to have been present played no part in the accident in question but are noteworthy in that they could contribute to or cause a future accident. Typically, other factors would provide the basis for additional recommendations or observations.

e. **Observations.** 'Observations' are points or issues identified during the investigation that are worthy of note to improve working practices, but which do not relate to the accident being investigated and which could not contribute to or cause future accidents.

Probabilistic language

1.4.6. The probabilistic terminology detailed below clarifies the terms used in this report to communicate levels of uncertainty within the report. It is based on terms published by the Intergovernmental Panel on Climate Change in their Guidance Note for Consistent Treatment of Uncertainties[88] as well as the Australian Transport Safety Bureau in their paper on Analysis, Causality and Proof in Safety Investigations.[89]

[88] https://www.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf.
[89] https://www.atsb.gov.au/media/27767/ar2007053.pdf.

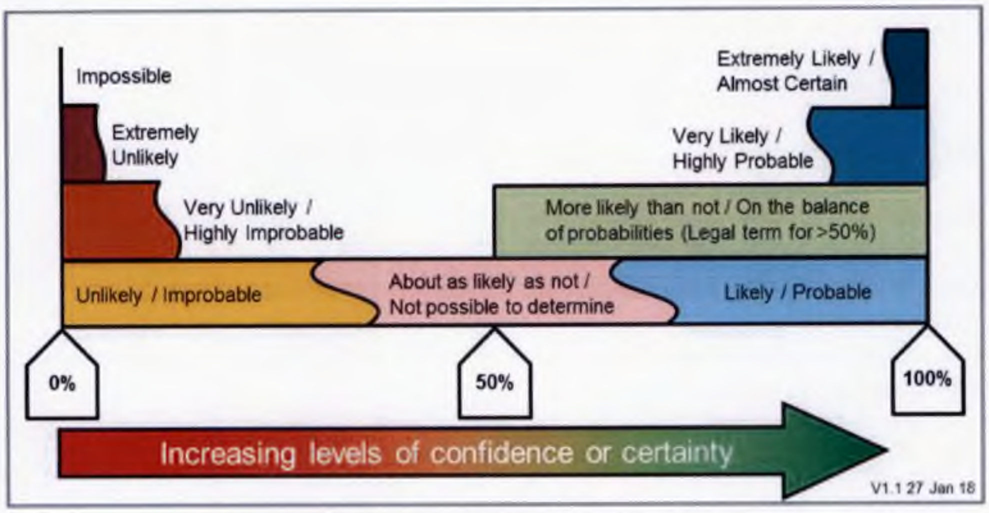

Figure 1.4.1 – Probabilistic terminology.

Available evidence

1.4.7. The panel had access to the following evidence:

a. The Defence Accident Investigation Branch (DAIB) Triage Report.

b. Formal witness interviews.

c. Evidence released to the SI panel from Thames Valley Police (TVP) and the Health and Safety Executive (HSE).

d. Sun Path Products, Inc. (container manufacturer).

e. British Skydiving Operations Manual (BSOM).

f. Joint Service Adventurous Training Parachute Operations manual (JSAT POM).

g. Key Ministry of Defence (MOD), RAF and Army documentation.

h. Relevant unit Standard Operating Procedures (SOP).

i. Training data and individual logbooks.

j. Environmental weather data from the Met Office.

k. Technical data from various sources.

l. Federal Aviation Authority (FAA) Technical Standard Orders (TSO) for equipment.

m. RAF Human Resources information from the Joint Personnel Administration (JPA) system.

n. A review of Sgt Fisk's medical records by a Defence Medical Services practitioner.

o. Photographs and videos produced by:

(1) Police Crime Scene Investigators.

(2) JSPC(W) and the Army Adventurous Training Air Wing.

p. Reports:

(1) HSE (QinetiQ) JSPC(W) parachute systems assessment.

(2) Special Operations Aerial Delivery Element (SOADE) vertical wind tunnel assessment.

(3) QinetiQ high speed digital video container interaction analysis.

(4) Human factors report provided by the RAF Centre of Aviation Medicine (RAF CAM).

(5) AirTec automatic activation device (AAD) data download report.

Services

1.4.8. The panel were assisted by the following personnel and agencies:

a. The Defence Accident Investigation Branch.

b. Thames Valley Police.

c. The Health and Safety Executive.

d. QinetiQ MOD Boscombe Down.

e. QinetiQ MOD Shoeburyness.

f. Sun Path, Products Inc. USA.

g. AirTec, Germany.

h. RAF Centre of Aviation Medicine.

i. Defence Medical Services.

j. Defence Cyber Operations.

Post-accident analysis activity

1.4.9. **Reserve deployment observation.** On the day after the accident, the British Skydiving investigators conducted a check of two parachute containers at JSPC(W). This was captured on video and consisted of a reserve deployment with one of the containers configured with the main canopy in the

Exhibit 45
Exhibit 46

container and one with it removed. This demonstrated a difference in performance between the two systems and is analysed in more detail in Part 1.4.

1.4.10. **Inspection of equipment at EuroFin.** A member of the DAIB and the panel parachuting SME attended the TVP led inspection of all equipment used by Sgt Fisk at the EuroFin forensic laboratories in Birmingham, these were conducted in forensic conditions.

1.4.11. **Visit to AirTec Germany.** A member of TVP and the DAIB attended the inspection and download of data of the AAD from Sgt Fisk's parachute system at the original equipment manufacturer's facility in Germany. Exhibit 47

1.4.12. **HSE inspection of parachute systems.** As an interested party, the panel attended HSE's inspection of several parachute systems from JPSC(W) at the TVP facility in Upper Heyford in the capacity of observers. Exhibit 48

1.4.13. **High Speed Digital Video (HSDV) trial.** Based on the observations made by the British Skydiving investigators and JSPC(W) staff as detailed at 1.3.39 the panel commissioned a trial utilising HSDV to understand any interactions between the components of the parachute container. Exhibit 49

1.4.14. **Visits to JSAT centres.** The panel visited all three JSAT parachuting centres to understand the working practices, governance and assurance of JSAT and sports parachuting activity within the military.

1.4.15. **Special Operations Aerial Delivery Element (SOADE) study.**[90] As the manufacturer for the parachute container, Sun Path, Products Inc. USA commissioned a study into a parachutist's turbulent wake, more commonly referred to as "burble". The stated aim was to determine how or to what degree an industry standard camera jacket/suit may impact the volume of the burble during emergency procedures and reserve parachute activation. Analysis of this study is included within Part 1.4. Exhibit 50

1.4.16. **Graphical Data Analysis System (GDAS).** The panel commissioned QinetiQ at MOD Boscombe Down to draw together all available data into a digital product to enable detailed analysis of Sgt Fisk's final parachute descent. This product is normally used for aviation incidents and had never been previously used for parachuting activity. Exhibit 42

Law and policy

1.4.17. **Health and Safety at Work etc Act 1974 (HSWA).** As an employer, the MOD was bound by the HSWA, with some exceptions provided within the legislation for specific activities. The Act stated: Exhibit 52

[90] SOADE is a USA based organisation that carries out airborne trials on behalf of the US military.

'it shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees'.

1.4.18. **Defence Safety Authority (DSA) policy.** DSA's regulation 01.1 outlined the legislative framework and departmental, health, safety and environmental policy for Defence. This described how the MOD would comply with the HSWA as legislated: Exhibit 53

The Legislative Framework and Departmental Policy

1. **Legislation** SofS's Policy Statement reinforces the requirement for Defence to comply with UK HS&EP legislation, (which includes legislation giving effect to the UK's international obligations). However, as a Department of the Crown, Defence has immunity from prosecution and there are provisions that allow total disapplication, specific disapplication, exemption or derogation from legislation:

a. A non-application of legislation is where an entire set of statutory requirements do not apply to MOD (e.g. Nuclear Installations Act 1965, Air Navigation Order or Control of Major Accidents Hazards);

b. Disapplications from specific parts of statutory requirements (e.g. Environmental Protection Act 1990, Explosive Regulations 2014);

c. Provisions within legislation for exemptions to be granted from specific requirements in recognition of a Defence imperative (e.g. the Health and Safety at Work Act etc. 1974 (HSWA74) permits the SofS's to exempt the Department from any or part of the Act by order "*to the extent that it appears to him requisite or expedient to do so in the interests of the safety of the State*"). Other H&S regulations alternatively specify the exemption in the interests of national security.

d. Derogations are a lessening of a statutory requirement for justifiable practical or operational reasons (e.g. smoking in single living accommodation recognises the distinction from temporary accommodation such as hotels and hostels).

Figure 1.4.2 – DSA 01.1 Legislation.

1.4.19. In order to provide clarity on the MOD's relationship with the Health and Safety Executive (HSE), a Memorandum of Understanding (MOU) was co-signed between the organisations in 2020.[91] This MOU described how despite being able to apply some dis-applications, derogations and exemptions, the MOD would strive to satisfy the requirements of the HSWA. Exhibit 54

[91] The HSE and MOD MOU was updated and re-signed in 2022.

MOD RESPONSIBILITIES AND ARRANGEMENTS

3. The MOD is the Department of State charged with the management and control of Her Majesty's Armed Forces and civilian personnel engaged in the defence of the United Kingdom (UK) and its citizens, property and interests at home and overseas.

4. MOD recognises its duty to comply with the Health and Safety at Work etc. Act 1974 (HSWA) and the relevant statutory provisions (RSP) in relation to its premises and when conducting MOD activities within the territorial scope of the Act/Order. This includes MOD activities outside mainland Great Britain only insofar as the HSWA 1974 (Application Outside Great Britain) Order 2013/240 permits. The responsibilities imposed by those duties are reflected in the Secretary of State for Defence's Policy Statement on Health, Safety and Environmental Protection.

5. The HSWA applies to all MOD civilian employees, Service Personnel under MOD employment and contractors working under the direction of MOD. Where there are Dis-applications, Exemptions, or Derogations *(See Note below)* from health and safety at work legislation, MOD will maintain Departmental arrangements that produce outcomes that are, so far as reasonably practicable, at least as good as those required by all relevant legislation.

Figure 1.4.3 – MOD/HSE memorandum of understanding.

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Analysis of factors

Section 1: The accident

1.4.20. This section analyses the facts surrounding the parachute descent that led to the death of Sgt Fisk.[92] Detailed analysis of the wider organisation surrounding parachuting within Defence is in the subsequent sections.

Cause of death

1.4.21. **Post-mortem.** A post-mortem indicated the cause of death as multiple injuries consistent with a sudden deceleration (ie, a body moving at speed suddenly coming to rest). The findings of the report and the associated police reports did not indicate any other factor that would warrant further investigation by the panel. Exhibit 51

Pre-emergency services attendance

1.4.22. At 18:08 on 2 Sep 2021 an NPAS helicopter located Sgt Fisk in a field at latitude 51.892101 N, longitude 1.207220 W, 1.743km from WOTG DZ (Figure 1.4.4). Imagery from the NPAS helicopter provided the panel with an overview of the scene prior to emergency services attendance. Exhibit 44 Exhibit 55

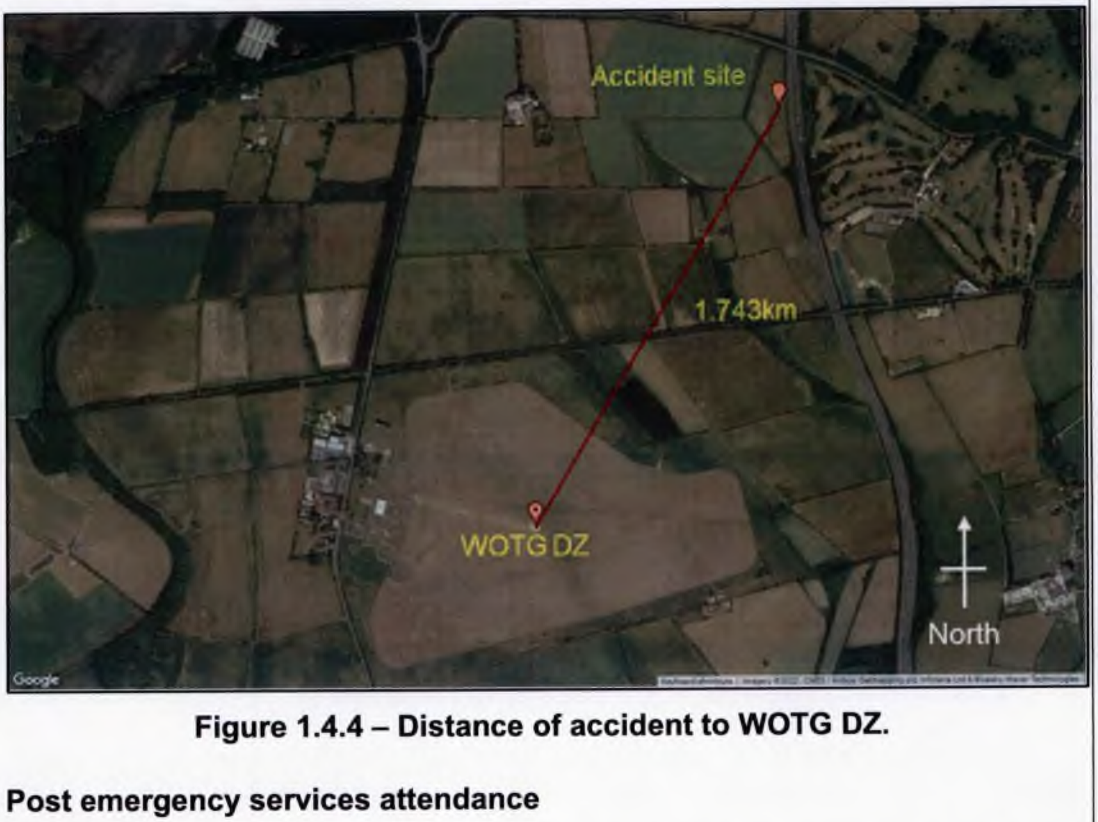

Figure 1.4.4 – Distance of accident to WOTG DZ.

Post emergency services attendance

1.4.23. Thames Valley Police (TVP) conducted a detailed investigation of the scene which included photographic evidence of the accident and all equipment Exhibit 56 Exhibit 57

[92] The term descent will be used throughout the report, this may be understood colloquially as a parachute jump.

worn by Sgt Fisk during the descent. These images, along with photographs provided by the Defence Accident Investigation Branch (DAIB), presented the panel with the initial evidence about the parachute system and Sgt Fisk's clothing. The panel's initial review of these images led it to believe that this depicted a scenario where Sgt Fisk's reserve parachute system was in the process of deploying, with no evidence of an obvious malfunction. This evidence is described below using detailed analysis. Exhibit 58 Exhibit 59 Exhibit 60

a. Sgt Fisk's parachute system was a Javelin Odyssey X container; the harness had been cut in several places. A statement from the TVP confirmed that the damage to the harness and canopy rigging lines was attributable to the emergency services actions during the attempt to resuscitate Sgt Fisk. Exhibit 70 Exhibit 71 Exhibit 48

b. The base of container (BOC) toggle and main pilot chute were extruding from their pocket.

c. Both the cutaway and reserve handles had been operated.

d. The main parachute was out of the container but remained within its deployment bag with all bungees securing the rigging lines.[93] Some rigging lines had been cut or showed signs of an attempt of being cut (Figure 1.4.5).

Figure 1.4.5 – Main canopy and damaged lines.

e. The reserve free-bag was out of the container with the reserve rigging lines removed from the free-bag and the stowage bungees. (Figure 1.4.6)

f. The free-bag was open, the reserve canopy was partially extracted with the bridle extended towards the reserve spring pilot

[93] Elastic bands used to secure the rigging lines and retain the main canopy within the deployment bag.

chute.

g. The reserve pilot chute was fully extended with the top cap towards the free-bag.

Figure 1.4.6 – Disturbed reserve parachute, free-bag and pilot chute.

h. The automatic activation device (AAD) (CYPRES) unit had a blank display (Figure 1.4.7).

Figure 1.4.7 – AAD with blank screen.

i. The AAD had activated, with the severed end of the closure loop found near the accident site (Figure 1.4.8).

Figure 1.4.8 – CYPRES cutter and closure loop.

j. Sgt Fisk was wearing a two-piece skydiving suit; camera jacket and trousers.

1.4.24. Sgt Fisk's ancillary equipment found at the site included:[94] Exhibit 41 Exhibit 25 Exhibit 61 Exhibit 62 Exhibit 63 Exhibit 64 Exhibit 65 Exhibit 66 Exhibit 67

a. GoPro™ Hero7 Black (GoPro™) helmet mounted camera.

b. Larsen & Brusgaard ALFA wrist mounted altimeter.

c. Larsen & Brusgaard ECHO audible altimeter.

d. Cookie G4 helmet.

e. Skydiving gloves.

1.4.25. The panel conducted a comparison of the imagery provided from the NPAS helicopter and the post-accident scene to identify any differences. The panel noted that an image of the free-bag from the NPAS footage showed the reserve canopy still packed within the free-bag, with the reserve pilot chute resting approximately one metre away. The panel was unable to determine from this image whether the reserve pilot chute was still entangled. Exhibit 01 Exhibit 68 Exhibit 69 Exhibit 354

1.4.26. From the comparison of the initial evidence provided, the panel concluded that it was extremely likely that there had been a significant degree of disruption to the accident site by the emergency services during the attempt to revive Sgt Fisk. The panel therefore identified a need for a detailed analysis of additional sources of information to establish the facts of the configuration of the equipment at the time of the accident.

[94] A full description of all Sgt Fisk's equipment is detailed within Annex A to Part 1.3 to this report.

Digital data sources

1.4.27. The panel identified the available data sources linked to the accident as: Exhibit 41 Exhibit 25 Exhibit 47 Exhibit 72

a. GoPro™ – Imagery, movement and acceleration.

b. ALFA altimeter – Altitude and speed.[95]

c. AAD – Altitude and speed.

d. The aircraft's global positioning system (GPS) in conjunction with Sky Demon – Altitude, speed and flight path.[96]

1.4.28. Sgt Fisk's GoPro™ camera had been recording at the time of the accident. This allowed the panel to conduct an immediate analysis of the descent to identify key events. The events noted by the panel that were immediately worthy of further investigation are captured in chronological order below (Table 1.4.1): Exhibit 41

GoPro™ Time	Observation
00:00:000	GoPro™ turned on
00:51.751	Sgt Fisk exits the aircraft
01:33.093	Tandem instructor deploys main parachute
01:36.463	PJI 3 seen moving away
01:39.632	Sgt Fisk enters cloud
01:42.786	Sgt Fisk exits cloud
01:43.086	Sgt Fisk turns left
01:54.114	1st sight of cutaway cable
01:55.298	1st sight of reserve cable
01:57.800	GoPro™ audio
01:58.334	1st sight of reserve pilot chute
02:00.453	2nd sight of reserve pilot chute
02:00.587	Point of impact

Table 1.4.1 – GoPro™ imagery observations.

1.4.29. Interpretation of the data sources listed at Para 1.4.27 enabled a Graphical Data Analysis System (GDAS) replication of the vertical and ground track of Sgt Fisk's descent.[97] All heights and timings within this report are based on the analysis of that data. Exhibit 42

Accident analysis

1.4.30. The evidence provided by the TVP demonstrated an attempt to deploy both the main and reserve parachute assemblies.[98] This led the panel to define the accident scenario as the probable non-deployment of the main and reserve canopies. The panel, therefore, focussed on the drills, procedures and Exhibit 23 Exhibit 74 Exhibit 42

[95] Larsen & Brusgaard ALFA altimeter has an integrated pressure sensor. The device will sample the pressure at ground level to offset any measured pressure altitude to provide an output of a height above ground level (agl).
[96] www.skydemon.aero/ – Visual flight rules flight planning and navigation software.
[97] A data analysis tool used to stitch together aviation data for post aircraft incident or crash investigation purposes.
[98] The non-deployment of a main canopy is referred to as a 'total malfunction'.

equipment used during the parachute descent as discussed in the following areas:

a. Freefall phase.

b. Audible cues.

c. Main canopy deployment.

d. Freefall malfunction.

e. AAD activation.

f. Reserve pilot chute.

g. Parachutist turbulence.

h. Pull forces.

Freefall phase

1.4.31. The panel was provided with the aims of Ex EAGLES DARE, which described the activity for sortie four and, therefore, provided an illustration of what they would expect to see during the freefall phase of Sgt Fisk's descent. The panel expected to see Sgt Fisk: Witness 09

a. In the role of secondary camera operator exiting the aircraft at a predetermined altitude, in company with PJI 3 (primary camera operator) and the tandem pair (PJI 4 plus a student).

b. On exit, adopting a neutral freefall position to capture the tandem pair and primary camera operator (PJI 3).

c. Post the tandem pair's main canopy deployment, checking her separation from PJI 3 to enable a safe main canopy deployment.

d. Once confirmed clear of PJI 3, deploying her main parachute at a predetermined height.

1.4.32. The panel reviewed all the available evidence surrounding the aircraft exit and freefall phase of the descent up to the point of expected main canopy deployment. Sgt Fisk's and PJI 3's GoPro™ data indicated that she made a stable exit from the aircraft immediately after PJI 3 and the tandem pair (PJI 4), at a height of 11,910ft agl. After exiting the aircraft, and once PJI 4 had deployed their drogue parachute,[99] PJI 3 was unable to adopt the primary camera position; Sgt Fisk therefore manoeuvred into this position at a height of 9,826ft agl. Footage demonstrated that she maintained the primary camera position for the remainder of the freefall phase of the descent. Despite Sgt Fisk taking over the primary camera position, the panel determined that this phase Exhibit 41 Exhibit 117

[99] A drogue parachute is designed to provide stability and reduce the freefall velocity of a tandem pair. It also provides the drag force to deploy the main parachute when released.

of the descent had been conducted as expected and was therefore **not a factor**.

Audible cues

1.4.33. There was notable damage to the ECHO audible altimeter fitted inside Sgt Fisk's helmet (Figure 1.4.9) which made the screen unreadable. However, the manufacturer was able to provide advice to the HSE on how to recover the data. As more than 14hrs had passed since the accident, the unit would have entered standby mode and switched off. An external report from the HSE identified that the ECHO was in 'Expert' mode and that the high-speed warnings had not been changed from the factory settings shown below: Exhibit 95 Exhibit 96

a. 1st warning – 8,000ft – 1.5sec, pulsating, low repetition alarm.

b. 2nd warning – 6,500ft – 3sec, pulsating, low repetition alarm.

c. 3rd warning – 5,000ft – 4sec, pulsating, high repetition alarm.

d. 4th warning – 4,000ft – One continuous, high pitch siren, which will continue while the vertical speed is over 13m/s.[100]

e. The audible pitch value setting was at eight which registered an internal sound test of 117 decibels.[101]

Figure 1.4.9 – Sgt Fisk's damaged Larsen & Brusgaard ECHO (left) and as stowed in helmet pocket (right).

1.4.34. Due to the damage caused to Sgt Fisk's ECHO and the amount of time that had lapsed since the accident before the data was extracted, it was not possible to determine whether the unit was switched on at the time of the accident. However, taking in to account the data extracted from other devices, along with the warning heights set as above, Sgt Fisk's freefall rate of descent would have been sufficient to initiate the warnings at the programmed heights. Of note, the 4th warning would have sounded during the final 4,000ft of the descent. Exhibit 96

[100] Once the ECHO registers a canopy deployment (velocity decrease below 40m/s (+/- 4.5m/s)), an increase in vertical velocity of over 35m/s must be reached before the high-speed alarm will re-activate.
[101] Pitch value can be set between 1 to 9.

1.4.35. The panel noted that the requirement to wear an audible altimeter only applied to tandem and accelerated freefall instructional descents in accordance with the Joint Service Adventurous Training (JSAT) Parachute Operations Manual (POM) and British Skydiving Operations Manual (BSOM). Therefore, although the ECHO was worn by Sgt Fisk, neither of these documents required an audible altimeter to be worn for the activity that she was conducting. Exhibit 97 Exhibit 99 Exhibit 116

1.4.36. The panel observed that the ECHO was set at the default factory settings, which, in its opinion would not have been suitable for the activity she was undertaking. Her PJI logbook indicated that earlier in the year she had conducted FE@R[102] parachuting activity which would have required the audible altimeter to be set in accordance with AP1C3 Sect 2 Chap 3-3.[103] This military publication directed specific altitude settings for the warnings and detailed a process for an independent check prior to use. It was, therefore, almost certain that Sgt Fisk's ECHO would have been set according to the stated publication when conducting that activity. However, the panel could not determine whether Sgt Fisk had reset the ECHO to factory settings on completion. Exhibit 95 Exhibit 114 Exhibit 21

1.4.37. If Sgt Fisk's ECHO was set correctly for JSAT parachuting activity, the panel assessed that it was more likely than not that it was switched on at the time of the accident. However, they were unable to determine if any warnings triggered a particular action during her descent. When considering her extensive familiarity with its operating parameters, it was very unlikely that she would have been distracted from conducting the emergency procedure (EP). This opinion was supported by the RAF Centre for Aviation Medicine (CAM) human factors report, which stated that 'the purpose of the audible alert is to positively distract the individual to ensure that they pull their BOC toggle and as such, is unlikely to have led her to have forgotten to pull the BOC toggle'. Exhibit 77

1.4.38. The specific requirements to set the ECHO for FE@R parachuting led the panel to doubt the accuracy of the settings downloaded from the device, but found no alternative evidence to discount the findings within the HSE report. The panel concluded that whilst the use of audible altimeters was not directed within the BSOM or JSAT POM for use by camera operators, the publication of a wider policy surrounding the use of audible altimeters for Defence sports parachuting would enhance safety, and as such was an **Other Factor**. Exhibit 95

1.4.39. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to produce the policy for the use and configuration of audible altimeters for sports parachuting.**

Main parachute deployment

1.4.40. At a predetermined height the parachutist would be expected to deploy their main pilot chute to initiate the main canopy deployment sequence, before conducting a controlled descent to the ground. The TVP photographic evidence from the scene of the accident, showed that Sgt Fisk's main pilot chute was Exhibit 01 Exhibit 41 Exhibit 74

[102] Military Capability is made up of force elements which are generated and combined by the Military Commands to enable the conduct of an operation or task. The Military Commands generate the force elements at the required level of readiness to deploy when needed. These are known as Force Elements at Readiness (FE@R).
[103] AP101A-1110-1C3 - Military parachutists instructors manual parachuting – ancillary equipment, general and technical information.

partially extracted. In addition, her main canopy deployment bag was no longer retained in the parachute container, which led the panel to consider:

a. Main pilot chute deployment.

b. The separation of the main canopy bag from the container. Exhibit 92

1.4.41. **Main pilot chute deployment.** In their report, RAF CAM described the activity that Sgt Fisk was undertaking as 'extremely routine' and assessed that she would be familiar with the actions required to be fulfilled at any single point of the descent. In its summary, the report discussed the most likely scenarios surrounding the main pilot chute being partially extracted to be: Exhibit 73

a. 'A combination of the toggle being snagged in the aircraft and the position of the BOC toggle [at the bottom of the container] meant that Instructor A [Sgt Fisk] would not have detected if it was snagged. In addition, the interaction between the airflow and snagged toggle may have led to Instructor A [Sgt Fisk] being unable to pull the toggle.'

or

b. 'Instructor A [Sgt Fisk] partly deployed the BOC toggle but was unable to complete the action due to inadequate force to fully deploy the toggle. Additionally, the interaction between the gloves and the BOC toggle meant that Instructor A [Sgt Fisk] was unable to maintain dexterity to complete the action.'

1.4.42. Prior to a parachutist boarding an aircraft they would receive a parachutist check which includes confirmation of the location of the BOC toggle and its accessibility. This check would be carried out by an appropriately qualified parachutist, with the aircraft manifest (JSPC(W) Form 15) annotated to confirm the check had been carried out. Exhibit 23 Exhibit 99

1.4.43. Photographic evidence provided the panel with an image of Sgt Fisk and her parachute system as she walked towards the aircraft to board for sortie four. This showed the main pilot chute fully housed within its Spandex® pocket with no excess material visible and the BOC toggle accessible. In addition, the aircraft manifest for sortie four and a witness statement confirmed that the parachutist check was completed prior to Sgt Fisk boarding the aircraft. Exhibit 23 Exhibit 74 Witness 15

1.4.44. The panel reviewed all available footage of Sgt Fisk's movements on the aircraft. PJI 1's footage showed Sgt Fisk initially sat on the port side of the aircraft, facing aft, which would have placed her BOC toggle towards the aircraft smooth internal panelling (Figure 1.4.10). Once groups one and two had exited the aircraft, PJI 3 moved to the aircraft door ready to exit with the tandem pair and Sgt Fisk. PJI 3's footage captured Sgt Fisk standing up in the centre of the aircraft and moving to her exit position. Therefore, there was no opportunity for the BOC toggle to interact with the aircraft whilst moving towards the aircraft door. On departure, PJI 3's footage captured Sgt Fisk in a stable freefall position. It did not indicate anything other than the BOC toggle stowed within its pocket. Exhibit 117 Exhibit 322 Exhibit 355

Figure 1.4.10 – Sgt Fisk's seating position within the aircraft looking forward.

1.4.45. The panel assessed that Sgt Fisk's BOC toggle was retained in the correct position during the ascent, exit from the aircraft and in freefall. It was therefore very likely that the BOC toggle was only displaced during attempts to deploy her main pilot chute. The panel concluded that the main pilot chute had not been extracted during the parachutist checks, from any interaction with the aircraft, or, up to the point PJI 3's camera footage no longer captured Sgt Fisk and, therefore, was **not a factor**.

1.4.46. Prior to deploying their main canopy, it is normal practice for a parachutist to ensure they have sufficient separation from others. After the tandem instructor's parachute deployment, it appeared that Sgt Fisk checked she had sufficient separation from PJI 3 before returning to a stable 'on heading' (SOH) position. The data then showed some initial movement[104] at a height of 3,588ft (GDAS event 5). The panel assessed this as being an attempt by Sgt Fisk to locate her BOC toggle in order to deploy her main canopy. Exhibit 42

1.4.47. Evidence from the accident site showed the main pilot chute partially extracted from its pocket by approximately 12cm (Figure 1.4.11).[105] This was consistent with the panel's expectation that Sgt Fisk would have attempted to deploy her main pilot chute. In reviewing the imagery from the accident site, the panel identified a clean area of material on the side of the parachute container, adjacent to main pilot chute Spandex® pocket. The size and shape of this clean patch of material appeared consistent with the partially extracted main pilot chute and BOC toggle and as such, led the panel to consider whether the debris was due to disturbance caused by life-saving measures or from protection by the main pilot chute during initial contact with the ground. It was the panel's opinion that the amount of ingrained debris (Figure 1.4.11) was extremely likely to have been caused during the initial impact with the ground and as such the clean area of material was very likely to have been due to Exhibit 75

[104] At 01:38.948 after Sgt Fisk's GoPro™ recording start time.
[105] Approximated by the panel via a reconstruction of the Police evidence.

protection by the partially extracted main pilot chute and BOC toggle. This led the panel to conclude that it was extremely likely that the main pilot chute and BOC toggle had been partially extracted during the descent.

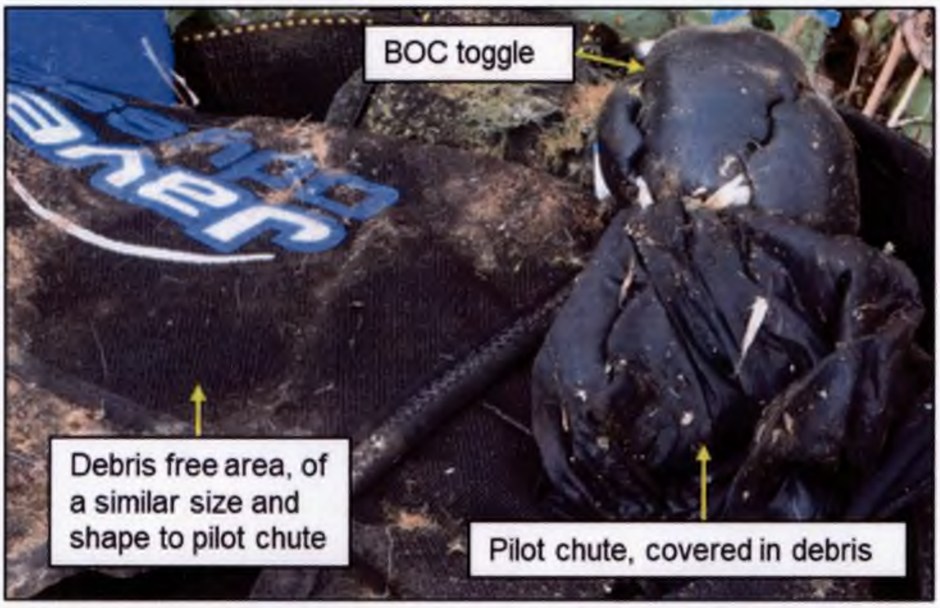

Figure 1.4.11 – Partial deployment of Sgt Fisk's main pilot chute.

1.4.48. The panel considered whether the likelihood of a main pilot chute restriction resulted in the partial extraction. Whilst gathering evidence at the scene, the TVP carried out an examination of the main pilot chute and looked for any indication of a stiff pull.[106] This was observed by British Skydiving representatives and was reported in their Board of Inquiry report that 'very little pressure was needed to extract the pilot chute' from the pocket (Figure 1.4.12). Following its extraction at the accident site, it was determined that the main pilot chute had been packed in accordance with an approved method as designated by the manufacturer.

Exhibit 31
Exhibit 32
Exhibit 76
Exhibit 339

[106] Stiff pull is a scenario in which the parachutist is unable to remove the BOC deployment method from its pocket due to a restriction, in order to initiate main canopy deployment.

Figure 1.4.12 – Main pilot chute being extracted by TVP.

1.4.49. TVP contracted Eurofins Forensic Services to examine the parachute used during the accident. Subsequently, the HSE contracted QinetiQ to conduct an independent examination of Sgt Fisk's parachute systems and a selection of other JSPC(W) parachute systems for comparison purposes. The inspection took place on 10 Feb 2022 with the panel in attendance. Exhibit 48

1.4.50. No measurement of the pull forces required to extract Sgt Fisk's main pilot chute was taken at the accident site. Therefore, the panel was unable to compare the extraction forces of the parachute system in use during the accident against similar systems. However, the QinetiQ examination did include a measurement of the extraction forces required to remove a selection of main pilot chutes from their Spandex® pockets for three of the additional JSPC(W) parachute systems.[107] These results were recorded as below: Exhibit 48

Parachute	One	Two	Three
Container size	J1KS	RSK1	TJNK
Main Canopy (sqft)	135	84	150
Reserve Canopy (sqft)	160	126	143
Main pilot chute extraction Force (Lb-F)	13.95	25.65	8.33

Table 1.4.2 – QinetiQ main pilot chute extraction force examination.[108]

1.4.51. The QinetiQ report noted that the elasticated pocket of Sgt Fisk's parachute container was of a typical size, shape and tautness, with no indication that excessive force would be required to deploy the main pilot chute. The pocket and main pilot chute assessment completed by QinetiQ provided the panel with an understanding of the force required to extract a main pilot chute. The report identified that the extraction force for parachute system two was 'higher than typical and represents a magnitude that may be difficult for a parachutist to achieve'. Whilst analysing these results the panel considered how the pressure of the of the main canopy within the container may have affected Sgt Fisk's main pilot chute pull force during freefall and assessed that it Exhibit 31 Exhibit 32 Exhibit 48 Exhibit 78

[107] The main pilot chute of Staff 08 was pulled at the scene; therefore, no data of extraction force was provided.
[108] Yellow denotes maximum size canopy permitted for container in accordance with the manufacturer container compatibility table.

was likely to have been higher than that observed during the inspection by the TVP at the scene. However, the panel recognised that a similar parachute system to that used by Sgt Fisk during the accident measured a pull force that was considered to be well within her capability to deploy the BOC toggle. There was also evidence that she had used the same parachute system on several occasions previously and it would, therefore, have been likely that she would have known if there were any obvious restrictions. It was the panel's opinion that it was unlikely that Sgt Fisk's main pilot chute was restricted within the pocket or that the pull force required to deploy the main pilot chute was outside of her capability. However, the panel was unable to completely discount this scenario.

1.4.52. The gloves worn by Sgt Fisk on the day were noted to be of a winter variety, which were slightly thicker than the summer/milder weather variants. However, they were of a type and make recognised for skydiving activities and were familiar to her as part of her normal equipment. The panel noted that that whilst Sgt Fisk's gloves were of the thicker variety, it took into consideration her level of experience and the fact that she had successfully deployed her other parachute system with the same gloves three times previously that day. Therefore, the panel concluded that Sgt Fisk's glove choice was unlikely to have contributed towards the accident sequence and was therefore **not a factor**.

Exhibit 65
Exhibit 66
Exhibit 67
Exhibit 90
Exhibit 91

1.4.53. The panel found no evidence that the parachute system would have malfunctioned if Sgt Fisk had been successful in deploying the main pilot chute. The reason as to why she was unable to complete this action could not be determined, a human factors error could therefore not be ruled out of the accident sequence. The panel concluded that Sgt Fisk's inability to deploy the main pilot chute was a **Contributory Factor.**[109]

1.4.54. **Additional attempts to locate the main pilot chute or BOC toggle.** Based on the probability that Sgt Fisk had attempted to deploy her main pilot chute, analysis of the available data suggested that the height of the observed movement seen on the GoPro™ was consistent with the average canopy deployment data for that day as extracted from her ALFA altimeter.[110] The panel also assessed whether it was likely that she had attempted to deploy her main pilot chute on more than one occasion; this is examined in more detail at Para 1.4.57. They also considered how the main pilot chute may have been subjected to airflow interaction if partially extracted. This theory was supported by the RAF CAM report which discussed a credible scenario of the potential interaction between the airflow and the partially extracted main pilot chute. This may have resulted in Sgt Fisk being unable to locate the main pilot chute or BOC toggle.

Exhibit 25
Exhibit 77

1.4.55. The British Skydiving accelerated freefall training manual, the United States Parachute Association (USPA) Safety Information Manual, a USPA guidance-based safety video, and, UK military parachuting manuals, all suggested that a parachutist should carry out a second attempt to locate their BOC toggle if the first attempt had failed. However, no detail of how long to

Exhibit 85
Exhibit 86
Exhibit 88
Exhibit 353

[109] 'Total Malfunction' scenario is defined as the situation in which the parachutist has been unable to deploy their main canopy.
[110] ALFA recorded average deployment altitude of 2886ft.

spend on this second attempt, or at which height that this should no longer be attempted, was provided.

1.4.56. The panel looked for evidence of a stated minimum deployment height for reserve parachutes within the BSOM and JSAT POM, in order to understand when a second attempt to locate the BOC toggle is a suitable course of action. The panel found no evidence in these publications. However, JSAT lesson plans did provide direction for students attending the 'category systems' and 'accelerated freefall' courses that: Exhibit 87 Exhibit 88 Exhibit 89

> '2,000ft is the minimum recommended cutaway height. Students are encouraged to react quickly and make a decision. Any cut away drills below 2,000ft should be discouraged and emphasis should be placed upon the consequences of cutting away at low altitudes'.

In contrast, the panel noted that for FE@R parachuting, all freefall parachutists were briefed on the minimum reserve deployment height prior to any descent, based on the parachute system used and the sortie profile, as an example this would be 2,000ft above the CATA for similar activity.[111]

1.4.57. The panel conducted further analysis to determine the actions conducted by Sgt Fisk. This identified additional significant movement that the panel assessed against the likelihood of further attempts to locate the main pilot chute or BOC toggle before initiating an EP. Exhibit 42

1.4.58. These movements occurred between 3,588ft agl and 1,532ft agl, over a period of 11.912sec. It was the panel's opinion that it was very likely that this movement was attributed to Sgt Fisk's initial and continued attempts to deploy her main pilot chute. The panel concluded that Sgt Fisk's actions during this phase of the freefall descent were in accordance with her training and the guidance provided within the parachuting operating manuals. However, the panel considered the lack of clarity in both British Skydiving and JSAT documentation as to when 'one further attempt' to locate the BOC toggle should or should not be made before initiating the EP, as an **Other Factor**. Exhibit 42

1.4.59. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define the minimum height at which 'one further attempt' to deploy a sports parachutist's main pilot chute should not be made before initiating the emergency procedure.**

1.4.60. In addition to the movement associated with Sgt Fisk attempting to deploy her BOC toggle, there were also two noticeable downwards camera pitch angle movements, the first at 2,016ft agl and the second 1,532ft agl. The panel deduced that either of these movements could indicate the start of the EP, with the latter the most likely (as discussed in Para 1.4.76). Exhibit 42

1.4.61. It was the panel's opinion that the absence of guidance on a minimum reserve deployment height for qualified parachutists reduced the safety margins of the activity. The panel concluded that the absence of clear direction for a

[111] CATA refers to CYPRES Activation Target Area, the point above the ground at the calculated release point for the parachutists.

minimum reserve deployment within either the BSOM or JSAT POM was an **Other Factor**.

1.4.62. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define the minimum height that a sports parachutist must be under a fully developed main canopy, in order to standardise the guidance within Defence.**

1.4.63. **The separation of the main canopy deployment bag from the container.** The TVP images captured at the accident site showed the main canopy deployment bag extracted from the container (Figure 1.4.13 (left)). This was evident in the NPAS helicopter footage of the scene prior to disturbance by the emergency services but was not consistent with Sgt Fisk's GoPro™ camera footage, which did not show any sign that the main pilot chute, bridle, or main canopy deployment bag had been deployed. The main canopy deployment bag was retained within the main container by four flaps secured by a pin through a nylon closure loop. Inspection of this closure loop showed evidence of significant damage with a break at the loop end (see Figure 1.4.13 (right)). This break would have released the retaining pin and permitted the main container flaps to open. Exhibit 01 Exhibit 92 Exhibit 93

Figure 1.4.13 – Main canopy bag and closure loop.

1.4.64. The panel assessed that it was highly likely that the main canopy closure loop snapped during the initial contact with the ground, allowing the main canopy deployment bag to be expelled from the main container. The panel concluded that the main canopy deployment bag was ejected from the container at the point of impact and was, therefore, **not a factor**.

Freefall malfunction

1.4.65. When a parachutist recognises that they are in a malfunction scenario, they are taught to carry out the emergency procedure.[112] The evidence that Sgt Fisk had not deployed her main canopy, meant that she would have been exposed to a situation known as a 'total malfunction'.[113] Dependant on the specific malfunction, training and the parachutist's experience, their reaction is likely to be varied. The video and photographic evidence from the accident Exhibit 41 Exhibit 86

[112] Also referred to as the 'Malfunction Drill'.

[113] Total Malfunction' scenario is defined as the situation in which the parachutist has been unable to deploy their main canopy.

showed that Sgt Fisk's emergency handles had been operated, the panel therefore considered the following:

a. Startle and surprise.

b. Emergency procedures.

c. Reserve canopy partially deployed.

Startle and surprise

1.4.66. The RAF CAM report reviewed the hazard recognition and time pressure associated with the accident. Startle is often accompanied by an emotional component which influences how a person responds to the event. The duration of this is normally up to 1.5sec dependent on the severity of the reflex. Startle can also inhibit muscular activity and can last between 100ms to 3sec (up to 10sec for complex motor tasks). In comparison, surprise is a result of disparity between a person's expectations and what is actually perceived. Cognitive response to surprise can include freezing and a loss of situational awareness, which can increase the duration of the surprise response in comparison to the startle reflex. Exhibit 77 Exhibit 94

1.4.67. The panel was able to identify a period of 1.618sec between movements post Sgt Fisk's initial attempt to deploy her BOC toggle, which could be attributed to startle, surprise, or the recognition that the BOC toggle had not deployed during her first attempt. Exhibit 79

1.4.68. The RAF CAM report deduced that neither startle nor surprise played a part in the accident. However, analysis of Sgt Fisk's logbooks showed no record of her experiencing any previous significant malfunction, and, therefore, the panel deduced that it would be more likely than not that some form of startle or surprise may have affected the time taken to complete all the required drills. If this was her first exposure to a significant malfunction, it would be reasonable to expect her response time to be between 1.5sec and 2sec if analysed as being similar to pilot reaction times cited in Defence Standard 970.[114] This response time, when combined with the time required to conduct the EP would equate to a total period of approximately 3sec to 6sec. As the EP is identical for all malfunctions, the panel assessed that the standardisation and training received, combined with being an experienced parachutist, would likely have kept the response time to a minimum. Exhibit 21 Exhibit 22 Exhibit 118

1.4.69. The panel concluded that it was likely that Sgt Fisk did experience some form of startle or surprise. However, it was not able to determine how these effects may have impacted on the time taken to conduct the EP. The fact that Sgt Fisk did complete the EP meant that startle and surprise was not a contributory factor, but the panel considered the possibility that it could affect the conduct of a parachutist's drills as an **Other Factor**.

[114] Defence Standard 970 - Design and Airworthiness Requirements for Service Aircraft.

1.4.70. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to incorporate a brief on startle and surprise into sports parachuting lesson plans.**

Emergency procedures

1.4.71. To simplify the EP for all malfunction scenarios, British Skydiving taught a common drill during the initial sports parachute training course which consisted of the following: Exhibit 03 Exhibit 99 Exhibit 116 Exhibit 119 Exhibit 120

a. **Look.** Visually locate the cutaway and reserve handles.

b. **Locate.** Take hold of the cutaway and reserve handle.

c. **Cut-away.** Peel the handle from its housing and pull in line with body.

d. **Pull reserve.** Remove handle from housing and pull in line with body.

e. **Arch.** Return to the normal freefall position providing a stable platform for the reserve to deploy.

1.4.72. A safety video based on USPA guidance, demonstrated the EP being carried out for various malfunctions and showed that on average it takes 3sec to 5sec to complete all the required actions. Exhibit 85

1.4.73. The EP currency requirements for students and tandem instructors were clearly defined within British Skydiving training documentation. However, the panel found no evidence of a requirement for a qualified parachutist to undertake any form of currency refresher training for them. Whilst chief instructors' (CI) can stipulate the training requirements for their parachute training organisation (PTO), there was no national guidance on how to ensure standardisation between training organisations. For FE@R parachuting, the panel noted that all parachutists were required to conduct a form of refresher training irrespective of the competency or currency level. The panel concluded that the absence of a requirement for experienced British Skydiving licensed parachutists to carry out regular EP currency training was very likely to lead to skill-fade and was therefore an **Other Factor**. Exhibit 99 Exhibit 121

1.4.74. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define the currency requirements for emergency procedure practice drills, in order to mitigate the risks of skill fade.**

1.4.75. The GoPro™ footage provided an image in which both the cutaway and reserve cable can be seen (Figure 1.4.14), indicating that Sgt Fisk had completed her EP. The height at which point both the cutaway and reserve cables were observed was 793ft agl, 5.3sec before contact with the ground. Exhibit 21 Exhibit 22 Exhibit 42 Exhibit 334

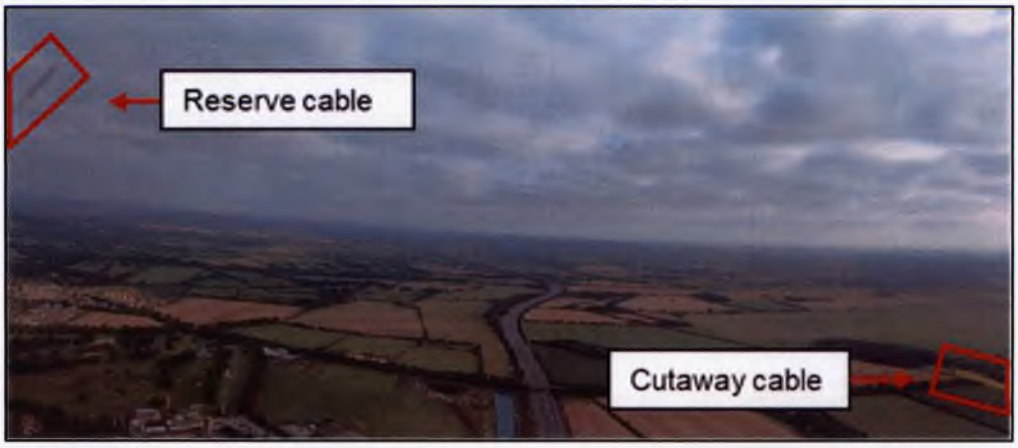

Figure 1.4.14 – Cutaway and reserve cables as seen on Sgt Fisk's GoPro™ footage.

1.4.76. The movements identified prior to seeing the cables indicated that the EP was likely to have been conducted between 1,532ft and 793ft agl (Figure 1.4.15). The key movements observed during that 4.4sec period are detailed below.

Exhibit 42
Exhibit 85
Exhibit 99
Exhibit 119
Exhibit 120

a. **Look.** At 1,532ft agl, a rapid head movement down was seen with a camera pitch angle from -3.7° to -50.1°.[115]

b. **Locate.** A period from 1,489ft to 1,302ft agl shows head and body movement that could be associated with an attempt to locate the cutaway and reserve handles.

c. **Cutaway.** At 1,041ft agl, movement is seen which brought the view towards the horizontal, followed by the cutaway cable coming into view 0.37sec later.

d. **Pull reserve.** A slow left turn that ceased at 898ft agl which was likely to be associated with the operating of the reserve handle.

e. **Arch.** At 828ft agl the view returns to the horizontal indicating a stable on heading (SOH) position, followed by the reserve cable being seen on camera 0.26sec later.

[115] Camera pitch angle is the angle between the longitudinal axis (where the GoPro is pointing) and the horizon.

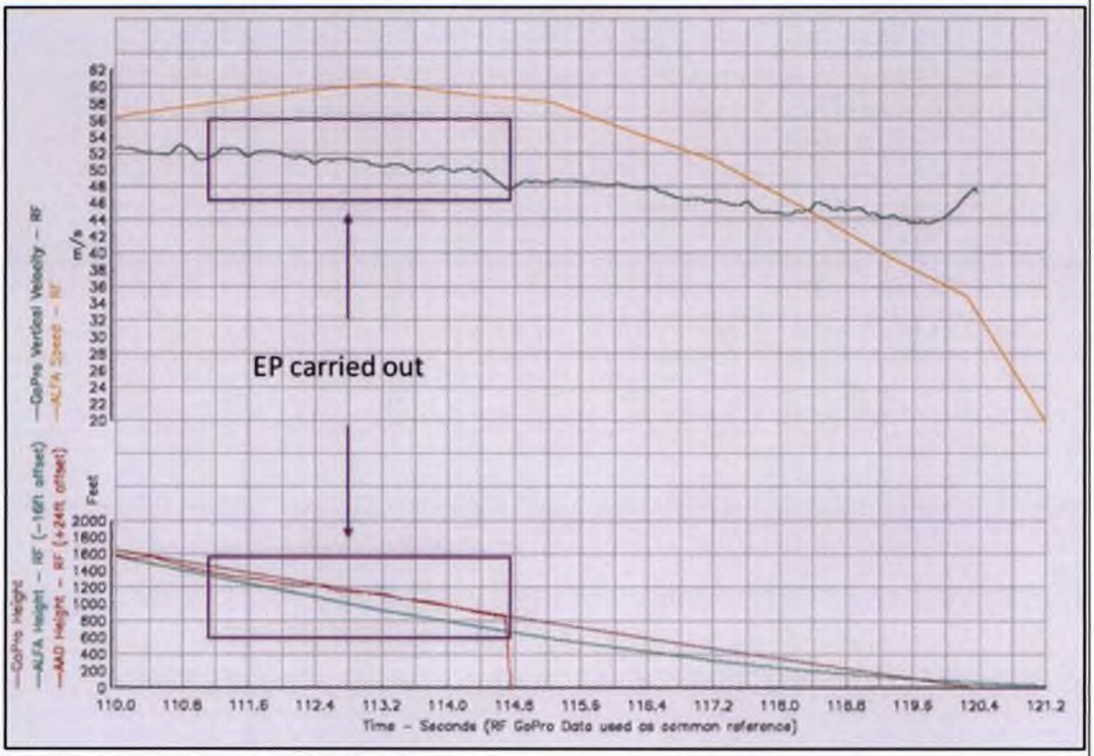

Figure 1.4.15 – GDAS velocity and height graph.

1.4.77. Sgt Fisk's parachute system was tested in accordance with Parachute Industry Association (PIA) Technical Standard (TS) 135, which outlined the functional test requirements for reserve parachute assemblies and directed that the approved standard for reserve parachutes was to deploy within 300ft or 3secs. Technical standards are discussed in more detail at Para 1.4.153. Exhibit 122 Exhibit 123 Exhibit 124

1.4.78. The panel assessed that it was very likely that Sgt Fisk's return to the neutral body position at 828ft agl indicated the completion of the EP. This was assessed as being above the height expected for a reserve parachute to fully develop, and above that at which the AAD was set to initiate. The panel recognised that although a period of 16.13sec had passed between the expected main canopy deployment and observation of the reserve cable on the GoPro™ footage, it was extremely likely that Sgt Fisk completed the EP at a height and time that should have resulted in a successful reserve deployment. Therefore, the height at which Sgt Fisk carried out the EP was considered **not to be a factor**. Exhibit 42 Exhibit 79

1.4.79. It was not possible to positively determine all of the actions between the expected deployment of the main pilot chute and the completion of the EP, but it was likely that they were associated with multiple attempts to locate the BOC toggle. In order to understand when an EP should be started, the panel explored the various parachuting manuals for any guidance on minimum heights. This identified that whilst military FE@R procedures stipulated a minimum height to complete reserve drills in their regulations, no formal guidance was available for AT and sports parachuting. The panel also noted that the BSOM stated that the minimum main canopy opening height for a C licensed parachutist was 2,500ft but could not find a definition of whether this meant under a fully developed canopy or simply the latest point at which Exhibit 42 Exhibit 99 Exhibit 116 Exhibit 121 Exhibit 125 initiation of the main pilot chute was acceptable. Therefore, it was the panel's opinion that both British Skydiving and JSAT documentation lacked clarity in the definitions of 'minimum canopy opening height' and the height by which an EP should be initiated for deploying the reserve parachute and as such was considered an **Other Factor**.

1.4.80. The panel assessed that Sgt Fisk's EP training was sufficient to meet the requirements of the regulations. However, the lack of a requirement to complete regular EP currency training within sports parachuting had the potential to affect the decision-making process surrounding the initiation of the EP. Although it was not a contributory factor, the panel considered the lack of EP currency training very likely to exacerbate any potential effects of startle or surprise and was, therefore, considered to be an **Other Factor**.

1.4.81. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define the minimum height that a sports parachutist must have initiated the emergency procedures, in order to standardise the guidance within Defence.**

Reserve canopy partially deployed

1.4.82. Photographic imagery from the scene showed the reserve free-bag separated from the parachute container with a partial deployment of the reserve canopy (Figure 1.4.6). At 02:00.653 (0.066sec after impact) Sgt Fisk's GoPro™ detached and captured an image of the free-bag separated from the container with further images capturing the reserve canopy rigging lines in the process of extending. The post-accident footage provided by the NPAS helicopter also showed the reserve canopy still packed within the free-bag.

Exhibit 01
Exhibit 80
Exhibit 84
Exhibit 334
Exhibit 356

Figure 1.4.16 – Disturbed reserve parachute, free-bag and pilot chute.

1.4.83. The GoPro™ video evidence gave no indication that the free-bag had been extracted from the parachute container throughout the freefall phase. However, it is very likely that the reserve container flaps were open due to the evidence indicating that the reserve handle had been operated during the descent. Therefore, it was extremely likely that the initial contact with the ground caused the reserve free-bag to be dislodged from the container. This was also extremely likely to have removed the rigging lines from the free-bag

Exhibit 80
Exhibit 84

prior to the emergency services attendance. The noticeable partial deployment of the reserve canopy from the free-bag differed between the NPAS helicopter footage and that observed after the emergency services attendance. This was, therefore, extremely likely to have been attributed to disturbance during the provision of medical aid. This led the panel to conclude that the partial deployment of the reserve parachute assembly was as a result of contact with the ground and was, therefore, considered to be **not a factor**.

AAD activation

1.4.84. Sgt Fisk's parachute system was fitted with an AirTec CYPRES 2 AAD manufactured in Aug 2019. The TVP photographic evidence from the scene showed that the AAD display was blank. However, verbal confirmation was provided by PJI 3, that the AAD had been switched on. The AAD cutter also showed visible signs of activation and the cut end of the CYPRES closure loop was found close to the parachute container (Figure 1.4.17). An examination conducted on behalf of HSE identified that the CYPRES closure loop was cut flush against the metal CYPRES disc.

Exhibit 36
Exhibit 126
Exhibit 127
Exhibit 327
Exhibit 48

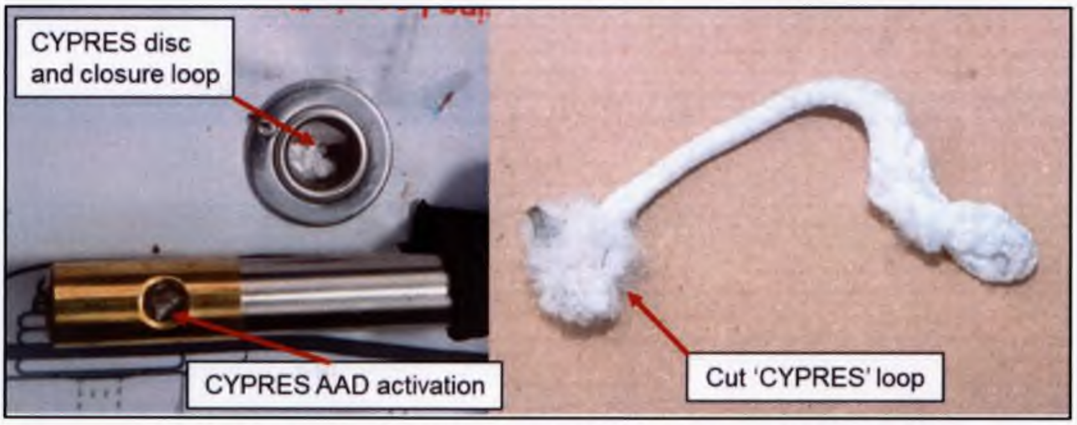

Figure 1.4.17 – The parachute system AAD cutter and CYPRES closure loop.

1.4.85. The AAD was sent to the manufacturer (AirTec) to recover any data held on the internal memory of the device. The downloaded data provided the following information:

Exhibit 47
Exhibit 106
Exhibit 128

a. It was switched on at 10:08:45 on 2 Sep 2021, recording a pressure of 1019.3mb.

b. The system was in 'Expert' mode with the activation height set to 750ft.

c. No faults were recorded on the 2 Sep 2021.

d. A flight cycle was recorded at 16:49:30 with a pressure reading of 1016.7mb.

e. The cutter operated at a height approximately 250m (820ft) above the flight cycle pressure reading.[116]

f. The average descent rate was recorded between 55-58m/s.

g. Immediately prior to cutter activation the descent rate was recorded at 45m/s.

h. Data post activation was lost due to damage sustained on impact with the ground.

1.4.86. The AirTec report identified that the AAD cutter activated at 820ft. This figure was based on the barometric pressure of 1016mb recorded at the start of the AAD flight cycle; the METAR for WOTG DZ corroborated the reported pressure.[117] Exhibit 47 Exhibit 129

1.4.87. The panel was able to identify the flight cycle start location as latitude 51.878060 N, longitude 1.223602 W with a ground elevation of 259ft above mean sea level (amsl). It was also able to identify the location at which the AAD cutter operated as latitude 51.892407 N, longitude 1.206396 W with a ground elevation as 285ft amsl (Figure 1.4.18). This equated to an elevation difference of +26ft. However, when averaged against other online mapping applications, this provided a difference of +24ft. Exhibit 42 Exhibit 130 Exhibit 131 Exhibit 132

Figure 1.4.18 – Ground heights for AAD flight cycle initiation and activation.[118]

1.4.88. The AAD automatically took into account the freefall velocity and increased the firing height accordingly. This accounted for the activation height being annotated as approximately 70ft higher than the default setting of 750ft agl. Based on the ground elevation difference between the flight cycle start point and AAD activation point, the reported activation height of 820ft would have equated to 796ft agl above the accident site. The panel noted that within Exhibit 34 Exhibit 349

[116] CYPRES AAD tolerance is approximately 1-2m.
[117] Meteorological Terminal Air Report
[118] Online elevation finder app used.

sports parachuting no consideration was given to the topography within the DZ operating area which could reduce the effective AAD cutter activation height above ground level. In comparison, military FE@R parachuting considered local topography and input an offset into their AAD settings before a planned descent. This would ensure that the AAD would activate above the set minima with sufficient vertical separation from the ground.

1.4.89. Based on all available data and evidence, the panel assessed that the AAD activated after Sgt Fisk had carried out the EP. The panel concluded that the CYPRES AAD functioned in accordance with the design specification and, therefore, was **not a factor**. Exhibit 56 Exhibit 130 Exhibit 327

1.4.90. An online article written in a skydiving magazine provided evidence that an increase in AAD height above the minimum set by the manufacturer was a live debate within the skydiving community. The discussion revolved around whether there was any benefit in doing so in order to give more time to a parachutist to deal with any malfunctions following a reserve canopy deployment. Whilst the panel was unable to determine whether an increased firing height would have changed the outcome for this accident, they recognised that additional height would have provided more time to potentially influence the outcome. Exhibit 350 Exhibit 351

1.4.91. The panel assessed it to be extremely unlikely that an increased AAD activation height would have changed the outcome of this accident. However, there was no reason for most JSAT parachuting disciplines to require the AAD to be set at its minima as a standard and considered this to be an **Other Factor**. Exhibit 116

1.4.92. The panel concluded that the local topography surrounding a DZ could reduce the AAD cutter activation height below the manufacturers' recommended minima and considered this to be an **Other Factor**.

1.4.93. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define the automatic activation device minimum height settings for each parachuting discipline, in order to mitigate the risks associated with low level malfunctions.**

1.4.94. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define the procedures for the setting of the automatic activation device height settings in order to mitigate the risks of uneven topography around drop zones.**

Reserve pilot chute

1.4.95. On the operation of either the reserve handle or AAD, a spring-loaded pilot chute is ejected from the parachute container. The reserve pilot chute (RPC) is constructed using rip-stop nylon above a mesh section surrounding the spring (Figure 1.4.19), and is designed to create sufficient drag once inflated by the airflow to extract the reserve free-bag from container and allow the reserve canopy to deploy. Exhibit 98 Exhibit 334

Figure 1.4.19 – Reserve pilot chute.

1.4.96. Photographic and video evidence provided the panel with images of Sgt Fisk's RPC before and after the accident. The footage from her GoPro™ captured two occasions where the RPC was in a different configuration to that seen in Figure 1.4.19. It was the panel's opinion that the RPC spring had not fully extended, with the mesh material appearing to be positioned above the rip-stop nylon. The panel assessed it as very likely that the configuration of Sgt Fisk's RPC seen in Figure 1.4.20, was the result of an entanglement. The panel, therefore, investigated how this malformation could occur and how it may have affected the deployment of the reserve canopy. Exhibit 42 Exhibit 334

Figure 1.4.20 – Malformed reserve pilot chute, 2.153sec and 0.084sec prior to impact.

Malformed RPC

1.4.97. To determine how an RPC entanglement could occur, the panel considered the following factors:

a. RPC deployment.

b. Container interaction and RPC performance.

c. Parachutist turbulence.

d. Pilot chute spring extractor hesitation.

e. Bridle interaction.

f. Pull forces.

(1) MARD (Skyhook) interaction.

(2) Free-bag extraction.

(3) RPC drag force.

(4) Free-bag line stows.

g. Recognition of reserve deployment failure.

RPC deployment

1.4.98. During a total malfunction, the deployment of the reserve parachute can only be initiated by the release of an RPC attached to the reserve free-bag via a bridle (Figure 1.4.21). The spring element of the RPC is held under compression in the parachute container by the reserve pin which, on completion of the EP (removal of the reserve pin), would be ejected away from the container into the airflow. When in freefall, the RPC was designed to create sufficient drag to pull the reserve free-bag from the container, extend the rigging lines and release the reserve canopy. In 2016, the Parachute Industry Association carried out testing of several manufacturers' RPCs to assess the

Exhibit 98
Exhibit 133

peak and sustained force created when deployed at terminal velocity.[119] The results indicated a peak force[120] between 64 to 142lb-F and a sustained force between 34 to 57.7lb-F.

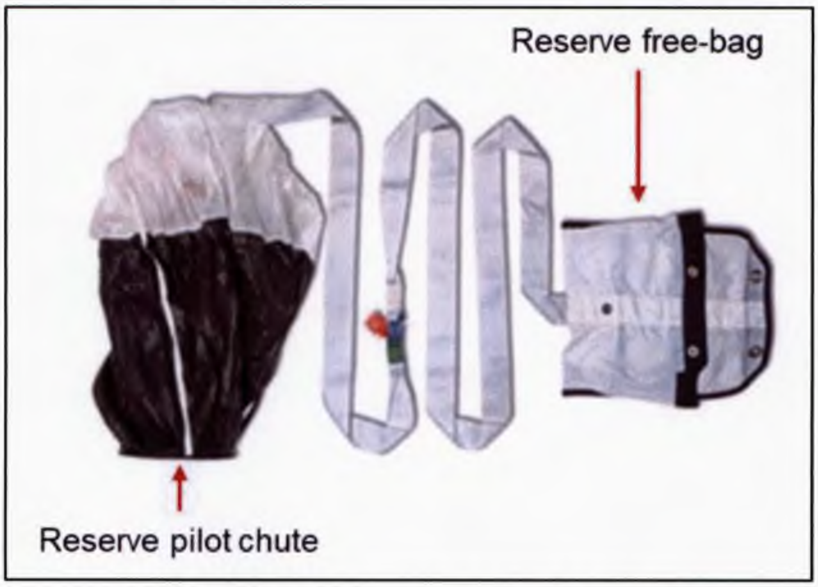

Figure 1.4.21 – RPC, bridle and free-bag.

1.4.99. Sgt Fisk's RPC was deemed serviceable at the time of the reserve inspection and repack. This was completed and recorded by a JSPC(W) rigger on 14 Apr 2021.[121] The TVP photographs of the RPC taken following the accident showed it had returned to is normal shape, with no signs of the malformed state seen previously in the GoPro™ footage (Figure 1.4.22). Exhibit 36 Exhibit 134 Exhibit 135

Figure 1.4.22 – RPC as seen following the accident.

Exhibit 136

[119] Terminal velocity for a parachutist is approximately 120mph.
[120] A peak force is generated due to the initial acceleration of the RPC at the point it reaches the full length of the bridle, prior to the sustained force generated as a result of drag.
[121] British Skydiving qualified advanced packer and rigger.

Container interaction and RPC performance

1.4.100. Following the accident, British Skydiving conducted an initial investigation at JSPC(W) focusing on the deployment of RPC's. The JSPC(W) staff demonstrated two reserve parachute deployments, one configured with the main canopy within the container and the other configured with the main canopy out of the container. These videos demonstrated a significant difference in the performance of the RPC in terms of height achieved and trajectory.

1.4.101. Subsequently, the panel tasked QinetiQ to conduct an assessment to understand the deployment characteristics of the RPC in various container configurations. High speed digital video (HSDV) cameras were used to record any deployment interactions between the RPC and containers, with the footage and supporting data providing the following evidence: Exhibit 49 Exhibit 138 Exhibit 139 Exhibit 334 Exhibit 336

		Number of deployments		
		Main and reserve in container – main pin in	Main canopy in container - main pin pulled	Main canopy removed from container
Interaction	Significant	24	0	0
	Minimal	0	3	1
	None	3	6	7
	Total	**27**	**9**	**8**
Minimal interactions were assessed as a visible deflection but no impact on ability of the RPC to achieve a full deployment.				

Table 1.4.3 – HSDV trial test deployments.

a. 27 of the tests conducted during the HSDV trial were in a total malfunction configuration. In 24 of those 27 deployments, the RPC top cap and pilot chute material interacted with the bottom reserve container flap, affecting its speed and trajectory (Figure 1.4.23 and Figure 1.4.24).[122] The remainder of the tests were all conducted in configurations where the main canopy pin had been removed. Of the nine deployments configured with the main canopy in the container but with the main canopy pin pulled, three had minimal interaction, and six had no interaction, with the bottom reserve flap. After examining all of the RPC deployment videos, the panel noted that the bottom reserve flap's movement was predominantly restricted in those scenarios in which the main canopy was in the container, but this was less evident if the pin had been removed. However, in general, this restriction was more likely than not to lead to some form of interaction with the RPC. The panel made an **Observation** that RPC interactions with the parachute container were more likely to occur during reserve deployment in which the main was still within the container.

[122] Of the three that did not interact, two were on the larger student containers and one was due to a different RPC packing technique trialled on one pull.

Figure 1.4.23 – HSDV test R17 in a total malfunction configuration, top cap interaction.

Figure 1.4.24 – HSDV test R17 in a total malfunction configuration, RPC material interaction.

b. The two-dimensional (2D) calculations for the test deployments[123] identified the trajectory of the RPC using fixed locations on the RPC assembly and bridle (Figure 1.4.25).[124] On reviewing the 2D data (Figure 1.4.26), the panel noted a difference in both performance and trajectory between a container configured with the main canopy in and pinned, against an unpinned main container, or with the main canopy removed. It was the panel's opinion that the observed difference was caused by the reserve bottom flap movement being restricted when the main canopy was in the container, thus creating an interaction between the bottom reserve flap and RPC top cap or material. The panel made an **Observation** that the parachute container configuration (i.e. main

[123] 2D calculation provided for deployments 1 to 35.
[124] Disc leading edge and centre, and bridle stitching.

and reserve canopies in or out of the container) may significantly affect the performance of the RPC.

Figure 1.4.25 – 2D calculation locations.

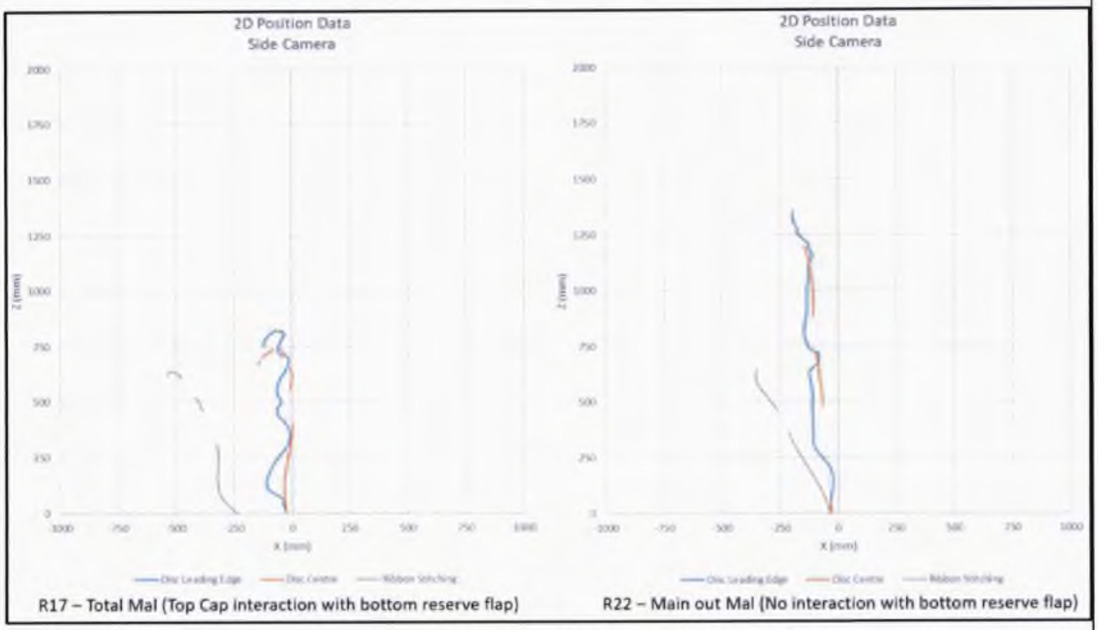

Figure 1.4.26 – RPC trajectory.

c. The data presented within the QinetiQ report also showed that the RPC acceleration and velocity were affected when deployed in a configuration with the main canopy in the container, in comparison to deployments with an unpinned main container, or with the main canopy removed. The data demonstrated that the deployment with the main canopy in the container had a higher initial acceleration in comparison to the deployment without a main. However, that initial velocity reduced very quickly and resulted in an increase in the overall RPC deployment time. Whereas with the main canopy removed, the deployment had a longer acceleration period and sustained velocity which reduced the

RPC deployment time. The panel, therefore, judged that although it was likely that the initial RPC deployment acceleration in either configuration may not be a factor, it was judged that the subsequent interactions observed when the main canopy was still in the container were very likely to contribute to the resultant reduced velocity of the RPC. The panel made an **Observation** that the reduced velocity of an RPC when deployed in a total malfunction scenario could significantly affect the overall performance of the RPC.

1.4.102. In analysing the three observations made at Para 1.4.101 a to c, the panel identified that in comparison to a reserve deployment with the main canopy removed from the container, a total malfunction scenario increased the likelihood of interaction between the RPC top cap and reserve container flaps. Therefore, it was likely to affect its acceleration, trajectory, vertical and rotational velocity. The combination of these factors was very likely to lead to a reduction in efficiency and would likely affect how the RPC interacted with the airflow surrounding the container. Exhibit 336

1.4.103. The panel concluded that the increased likelihood of interaction between the RPC top cap and reserve container flaps following a total malfunction, had the potential to reduce the overall performance of the RPC's function and was, therefore, considered an **Aggravating Factor**. Based on these findings the panel issued Urgent Safety Advice to the user community. Within the advice the panel recommended that a review of emergency procedures should be undertaken to ensure that the activity risk remained as low as reasonably practicable (ALARP) and tolerable. Exhibit 140

1.4.104. **Recommendation. Air Officer Commanding No. 22 Group is to lead an urgent review of the emergency procedures for a parachuting total malfunction, in order to ensure that the risk associated with this malfunction remains as low as reasonably practicable and tolerable.**[125]

[125] Recommendation duplicated from the WOTG SI Urgent Safety Advice.

Parachutist turbulence

1.4.105. As a parachutist falls through the air their body position and velocity would create a turbulent wake.[126] This wake was created by air being forced around their body and equipment, creating a turbulent boundary layer and an area of low pressure drag behind them (Figure 1.4.27). The size of the turbulent wake would vary dependent on body mass and surface area, combined with the velocity at which they were falling. The panel reached out to industry to understand whether there was a way of modelling this effect. However, despite approaching several organisations with knowledge in this area they were unsuccessful in gaining a reply. Exhibit 326 Exhibit 334

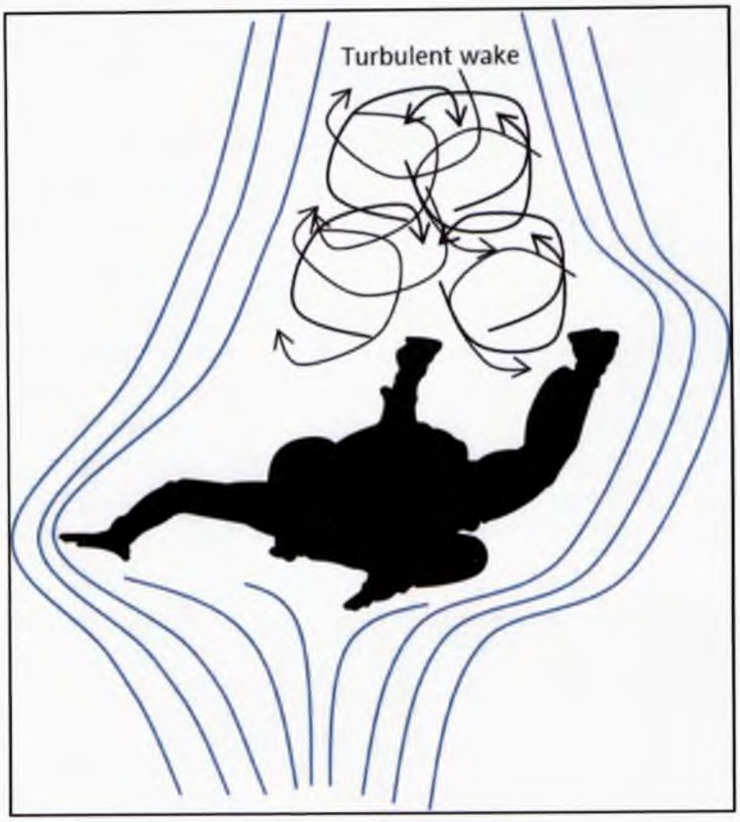

Figure 1.4.27 – Parachutist turbulent wake.

1.4.106. During the freefall phase, Sgt Fisk was captured by PJI 3's GoPro™ footage in what is referred to as a 'neutral' body position whilst carrying out her duties as a camera operator (Figure 1.4.28). Data showed her average freefall rate of descent was approximately 55m/s (123mph). This was consistent with the rate associated with terminal velocity for freefall parachutists. Exhibit 42 Exhibit 334

[126] Activity conducted in a liquid or gas environment causes a disturbance to that substance as an external body passes through it. This would include freefall activity.

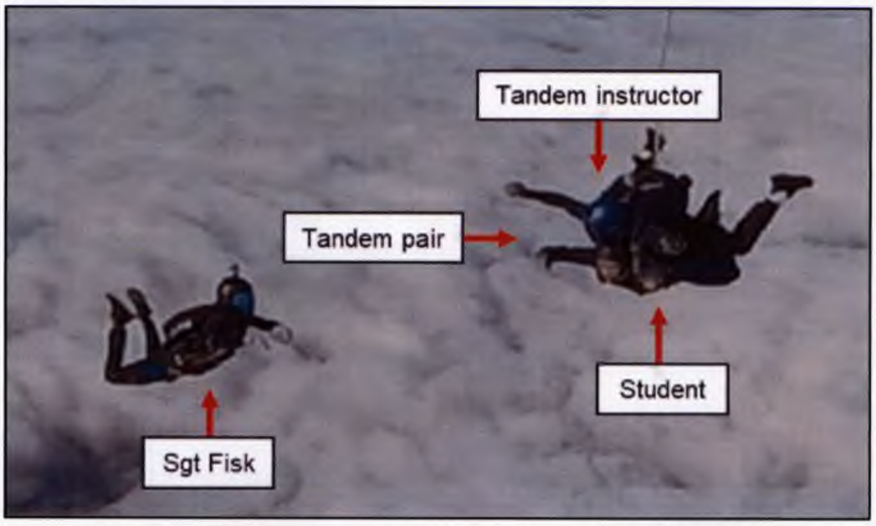

Figure 1.4.28 – Sgt Fisk's freefall body position.

1.4.107. Sgt Fisk was wearing a camera jacket which allowed her to adapt her freefall speed during the descent through the adjustment of the amount of wing surface area presented to the airflow. A replica camera jacket was provided by the manufacturer (Jedi Airwear), which allowed the panel to calculate the increased surface area that the camera jacket would offer as 1.415m^2 for each wing.[127] Photographic and GoPro™ evidence also showed the fitting of her camera jacket wing and attachment. This was assessed to have been routed under the main harness lateral strap before being connected via a snap shackle and pull up to the leg strap (Figure 1.4.29).[128] This was confirmed during witness interviews, which also established that this fitment was consistent with previous sorties.

Exhibit 35
Exhibit 42
Exhibit 137
Exhibit 141
Exhibit 337
Witness 15

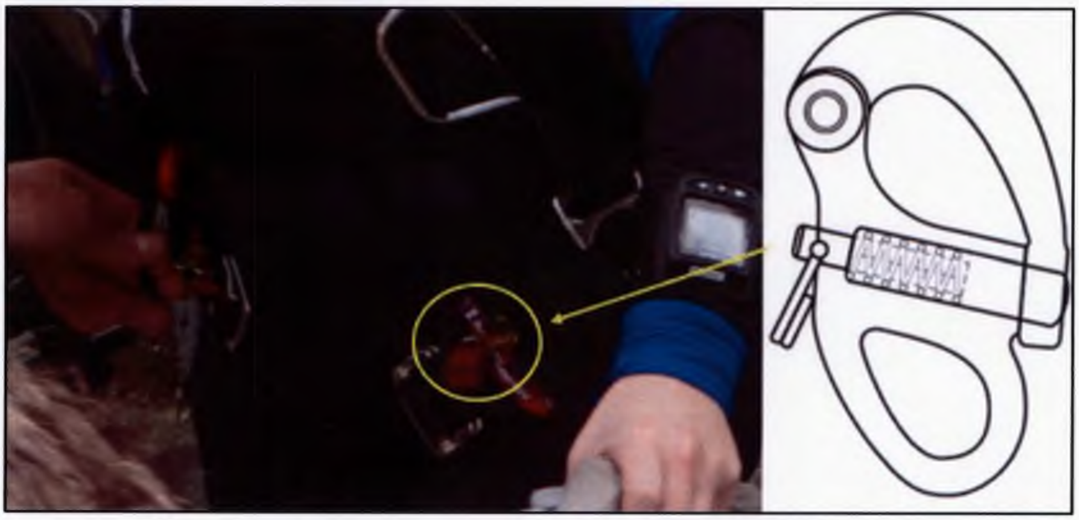

Figure 1.4.29 – Camera jacket attachment.

1.4.108. The data captured Sgt Fisk's head and body movement, attempts to deploy the main pilot chute and the movement surrounding the carrying out of the EP; all of these actions would have affected her freefall velocity and

Exhibit 24
Exhibit 42

[127] Utilising AUTOCAD®.
[128] Pull up is a length of material that is used to pack the main parachute into the container.

turbulent wake. The data also showed that immediately after completing the EP she returned to a stable position. During this period the AAD data, provided by AirTec, showed a reduction in descent rate from 49m/s to 45m/s (109mph to 100mph). Following the AAD activation her freefall speed did not exceed 50m/s (112mph).

1.4.109. As an experienced skydiver, Sgt Fisk was known to maintain a good body position that was steady throughout her descents, the panel assessed that this would be sufficient to create a consistent area of turbulent wake. The panel judged it as being highly likely that the introduction of a camera jacket would have caused an increase in the amount of wake being generated. However, the panel was unable to determine the full extent of the increase because of the reduction of wing size due to its routing under the parachute harness. The action of Sgt Fisk returning to a stable position after conducting the EP, which likely reintroduced the camera jacket wings to the airflow, was, therefore, extremely likely to be linked to the sudden reduction in her freefall rate of descent. This would have created an associated change in the turbulent wake. However, the panel was unable to accurately determine the amount of this change.

Exhibit 42
Exhibit 117
Witness 09

1.4.110. Whilst analysing the fitment of the camera jacket, the panel found no evidence of any guidance as to how it should be connected to a parachute system or clothing. Witness statements assessed it as a parachutist's personal choice. It was the panel's opinion that the lack of any formal direction regarding the fitting and attachment of the camera jacket led users to decide for themselves how this was achieved. Allowing temporary modifications to the parachute system without a formal guidance or assessment had the potential to degrade the safe operating margins of the system and was, therefore, an **Other Factor**.

Exhibit 142
Witness 11
Witness 13
Witness 15

1.4.111. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define how camera jackets are attached to either parachute systems or clothing.**

1.4.112. **Recommendation. The Air Officer Commanding No. 1 Group, in consultation with Air Officer Commanding No. 22 Group, should direct a study to determine the effects of turbulent wake created by a parachutist in all equipment configurations, in order to identify any associated risk.**

Pilot chute spring extractor hesitation

1.4.113. Pilot chutes deployed by a spring extractor were commonly used within Defence to deploy main or reserve parachute systems. Spring extractor hesitation was a known phenomenon and was caused by the pilot chute being trapped within the turbulent wake of a parachutist. Although the spring extractor was designed to overcome the effects of turbulent wake, the panel found an example of spring extractor hesitation in JSAT activity (Figure 1.4.30) during which the pilot chute was trapped in the chaotic airflow. Exhibit 143

Figure 1.4.30 – Spring pilot chute caught in turbulent wake.

1.4.114. The panel observed that spring extractor hesitations had predominately been witnessed during main parachute deployments. However, as turbulent wake was not limited to one small area above the parachutist, it was extremely likely that a hesitation of the RPC was plausible. The panel recognised that the potential addition of container interaction (see 1.4.100) affecting the RPC performance would increase the likelihood of an RPC hesitation. The panel found no evidence of any guidance or procedures surrounding pilot chute hesitation within British Skydiving or JSPC(W) documentation. Exhibit 144

1.4.115. The panel's previous assessment that Sgt Fisk's body position remained consistent throughout the descent led it to conclude that the airflow around her body would have created a turbulent wake that was very likely to have remained relatively constant. Whilst the amount of turbulence created was an unknown factor, there was sufficient evidence that a lack of a clean airflow for the RPC to deploy into was very likely to increase the risk of reserve pilot chute hesitation as discussed below. It was the opinion of the panel that the turbulent wake created by Sgt Fisk's freefall position was a **Causal Factor**.

1.4.116. The panel concluded that Sgt Fisk's RPC was extremely likely to have been influenced by her turbulent wake and as such was very likely to have been susceptible to spring extractor hesitation. The panel found that any spring extractor hesitation set the conditions for further interactions with ancillary equipment or parachute components; the panel determined that whilst this increased the likelihood of a further malfunction, they could not positively state that it occurred in this accident. Therefore, on the basis that spring extractor hesitation was about as likely as not to have occurred, the panel assessed it to be a probable **Contributory Factor**.

1.4.117. During the investigation the panel found sufficient evidence that spring extractor pilot chute hesitation for main canopy deployments existed. The lack of guidance within training documentation on the actions that should be conducted following a spring extractor hesitation was considered to be an **Other Factor**.

1.4.118. **Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to develop a risk assessment or safety case to assess the required drills, procedures or mitigations against reserve pilot chute hesitation.**

Bridle interaction

1.4.119. The bridle which connects the RPC to the free-bag could become entangled on the parachutist or parachute system during deployment after an EP, depending on body position and airflow. Imagery showed that the bridle did not entangle on any part of Sgt Fisk or her parachute system other than the RPC itself. The manufacturer (Sun Path) conducted an independent assessment of the RPC deployment within a vertical wind tunnel. The Special Operations Aerial Delivery Element (SOADE) at Fort Bragg, USA carried out the assessment on both slick[129] and camera operator freefall activity.[130] Results showed that the RPC bridle could overtake the RPC (Figure 1.4.31), indicating the possibility of bridle entanglement. Exhibit 41 Exhibit 50

Figure 1.4.31 – SOADE vertical wind tunnel trials.[131]

[129] Slick is the term used by SOADE for a parachutist without equipment or camera jacket.
[130] Camera operator wearing a camera jacket.
[131] Image supplied by the Special Operations Airborne Delivery Element, Fort Bragg, USA

1.4.120. The panel was provided with additional evidence of situations in which a bridle had interacted with a spring activated pilot chute and had resulted in an entanglement (Figure 1.4.32). A video file showed two different UK military systems used for FE@R parachuting activity, both fitted with spring extractor deployed main canopies. It was evident from the footage that the performance of the spring extractor had been affected by the parachutist's turbulent wake, allowing the bridle to become entangled with the pilot chute. Exhibit 145

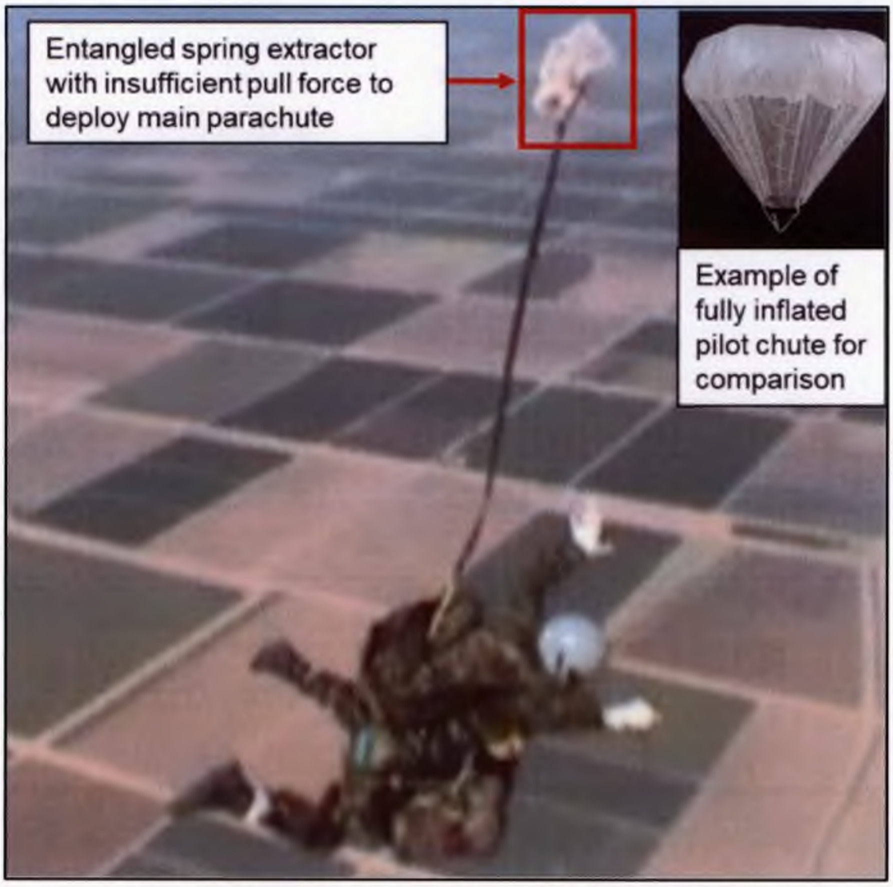

Figure 1.4.32 – Pilot chute entanglement.[132]

1.4.121. It was, therefore, the opinion of the panel that during the accident it was extremely likely turbulent wake exacerbated any hesitation of the RPC and affected both the reserve pilot chute and bridle in such a way that it led to an entanglement and subsequent malformation. The panel concluded that the malformed RPC was a **Causal Factor**.

[132] The example pilot chute is not a direct replica of the pilot chute used in the image.

Pull forces

1.4.122. Although the evidence demonstrated that the RPC did deploy, albeit in a malformed state, it was understood that even in this state the RPC would have an element of drag force. As the evidence pointed to the free-bag remaining in the container until impact, the panel considered the following areas:

a. RPC drag force.

b. MARD (Skyhook) disconnect.

c. Free-bag extraction.

d. Free-bag line stows.

RPC drag force

1.4.123. The panel was provided with evidence from several sources regarding the pull force of the RPC in both a normal and malformed state. A PIA technical report completed in 2016 assessed the drag force produced by an RPC on seven different parachute systems, which included terminal velocity and AAD deployments of the RPC. The Report recorded: Exhibit 48 Exhibit 50 Exhibit 133

a. An average peak force of 84.32lb-F and a sustained force of 46.14lb-F for handle-deployed RPCs.

b. AAD activation at terminal velocity showed an average of 54lb-F peak force.

1.4.124. As part of the SOADE assessment in the vertical wind tunnel, the drag forces generated by the RPC at various bridle lengths were recorded for both a slick parachutist and a camera operator wearing a camera jacket similar to that worn by Sgt Fisk.[133] A +/- 2lb-F margin of error was applied to the data to take into account the angle at which the RPC deployed. Exhibit 48 Exhibit 50

1.4.125. The SOADE assessment included data capture of both a fully formed and malformed RPC, recording the peak force produced at each bridle length, providing the panel with the following information:

a. The data for a fully formed RPC showed average drag forces of 78lb-F for a 12ft bridle length. This supported the 2016 PIA report.

b. In contrast, the data also demonstrated that the peak drag force of a malformed RPC was significantly reduced when compared to a fully formed RPC at all bridle lengths, with up to a 50% reduction for those deployments configured as a camera operator.

[133] RPC bridle length tested: 12ft, 7ft, 5ft, 33ft, and 1.5ft.

1.4.126. QinetiQ also assessed the sustained drag of an RPC with a reduced radius due to being malformed. It was assessed that there was a 56% reduction in drag force if the RPC radius was reduced by 10cm. The resultant drag force was assessed to be in the range of 15.51lb-F to 55.53lb-F.	Exhibit 48
1.4.127. The panel analysed the data provided by the PIA, SOADE and QinetiQ to assess how this could affect the deployment of the reserve canopy. This is discussed below in sequence of interaction of the three main obstacles, the MARD, free-bag release from the container and line-stows.	

MARD (Skyhook) disconnect

1.4.128. The Skyhook was positioned approximately 154cm from the RPC and was intended to operate in all malfunction scenarios. During a total malfunction the Skyhook was designed to detach from a red lanyard (Figure 1.4.33) which connected it to one of the main canopy risers via the reserve static line. The assessments conducted by SOADE and QinetiQ determined the pull force required to disconnect the Skyhook as being between 8 to 14lb-F.	Exhibit 48 Exhibit 50 Exhibit 98 Exhibit 334

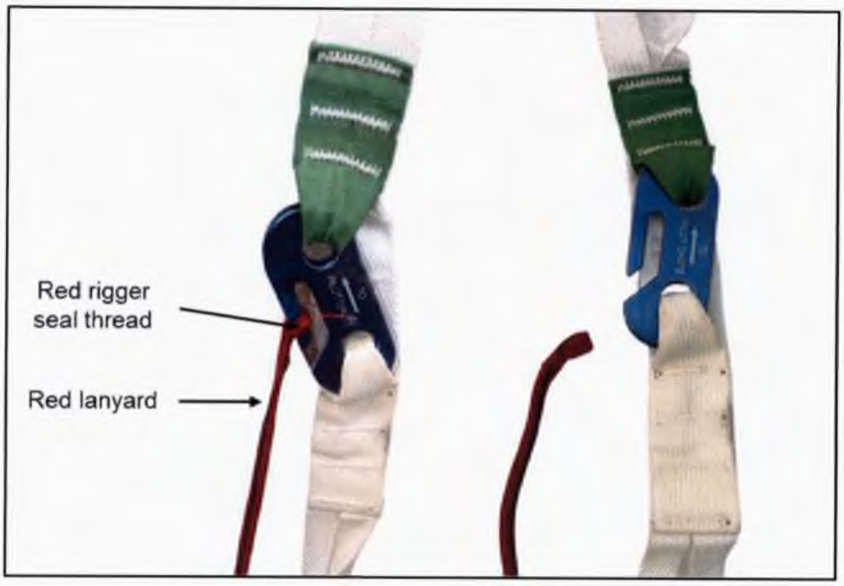

Figure 1.4.33 – Skyhook disconnect.

1.4.129. Images provided by both Sgt Fisk's GoPro™ and the TVP showed that the Skyhook had disconnected (Figure 1.4.34). This indicated that the reserve bridle had been able to fully pay out. Although the Skyhook had disconnected, it was noted that the red lanyard had remained within its pocket (Figure 1.4.35).	Exhibit 42 Exhibit 48 Exhibit 50 Exhibit 107 Exhibit 146 Exhibit 147 Exhibit 323 Exhibit 334

Figure 1.4.34 – Sgt Fisk's MARD (Skyhook).

Figure 1.4.35 – Sgt Fisk's MARD (Skyhook) red lanyard.

1.4.130. As part of the HSDV trial, the panel conducted their own assessment of the pull force required to disconnect the Skyhook from the RPC bridle. This supported the HSE and SOADE observations that it required 8-14lb-F to detach the Skyhook from the red lanyard. It was also observed during the trial that on occasion the red lanyard would remain seated within its pocket. However, the manufacturer (United Parachute Technologies) verbally stated that due to its position within the Javelin Odyssey system it was common for the red lanyard to remain in the pocket during a reserve deployment following a total malfunction. During the HSDV trial the panel was unable to distinguish whether there was a difference in pull force between the red lanyard disconnecting from the Skyhook whilst in or out of its pocket.

1.4.131. The panel concluded it was extremely likely that the forces produced by a fully formed RPC would almost certainly detach the Skyhook as designed and was, therefore, considered **not a factor**. They acknowledged that Sgt Fisk's GoPro™ footage provided confirmation that her malformed RPC produced sufficient force to detach the Skyhook. However, the panel made an **Observation** that when ancillary equipment such as a camera jacket was being used, a scenario may exist where a malformed RPC could have insufficient force to disconnect the Skyhook. Exhibit 323

Free-bag extraction

1.4.132. Evidence provided in a report on behalf of the HSE included the extraction force of the free-bag for the six JSPC(W) parachute systems inspected as part of the HSE investigation.[134] A force meter was used to measure the pull-force with each parachute system on the ground and with the free-bag pulled at approximately 30° from the vertical towards the top of the container.[135] A pull force ranging from 6.75lb-F to 39.60lb-F was measured across the systems. The panel gathered further evidence during the HSDV trial. Using a further six systems manufactured by Sun Path, the pull force required to extract the free-bag in a total malfunction configuration (Figure 1.4.36) showed an average force of 20.91lb-F.

Exhibit 48
Exhibit 49
Exhibit 340
Exhibit 338

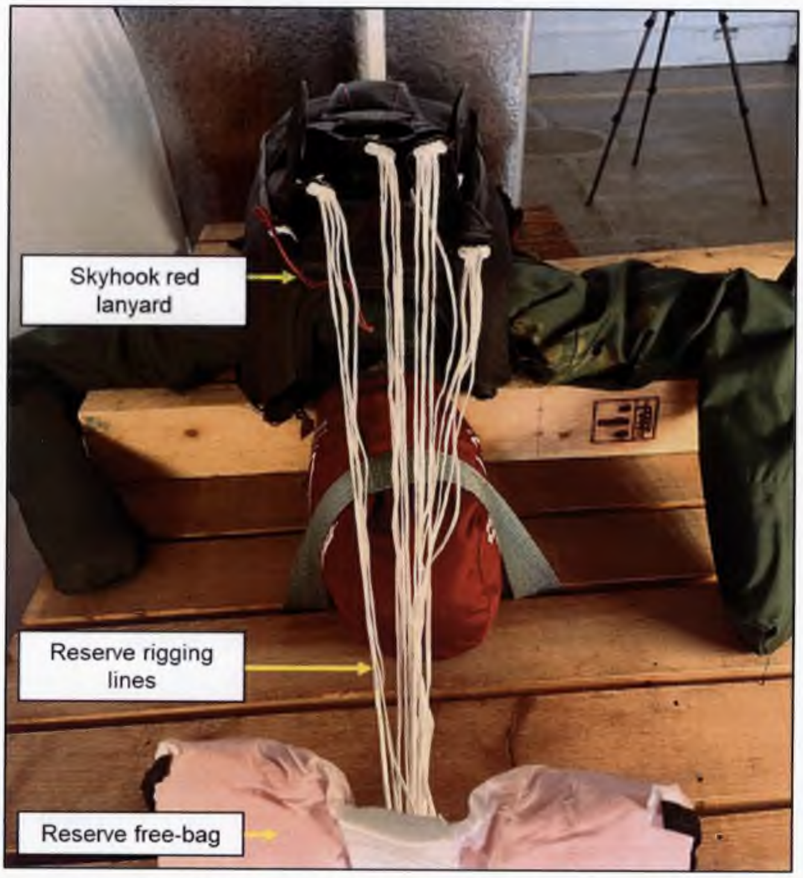

Figure 1.4.36 – HSDV reserve deployment trial.

[134] One system provided had the main and reserve canopies in an unpacked state, so no deployment force data was recorded.
[135] In accordance with the method described in the British Skydiving documentation.

1.4.133. Using the data provided by the SOADE, HSE and HSDV reports, the panel overlayed the pull force of the JPSC(W) and HSDV parachute systems against the force produced by a malformed RPC in the vertical wind tunnel (Figure 1.4.37).[136]

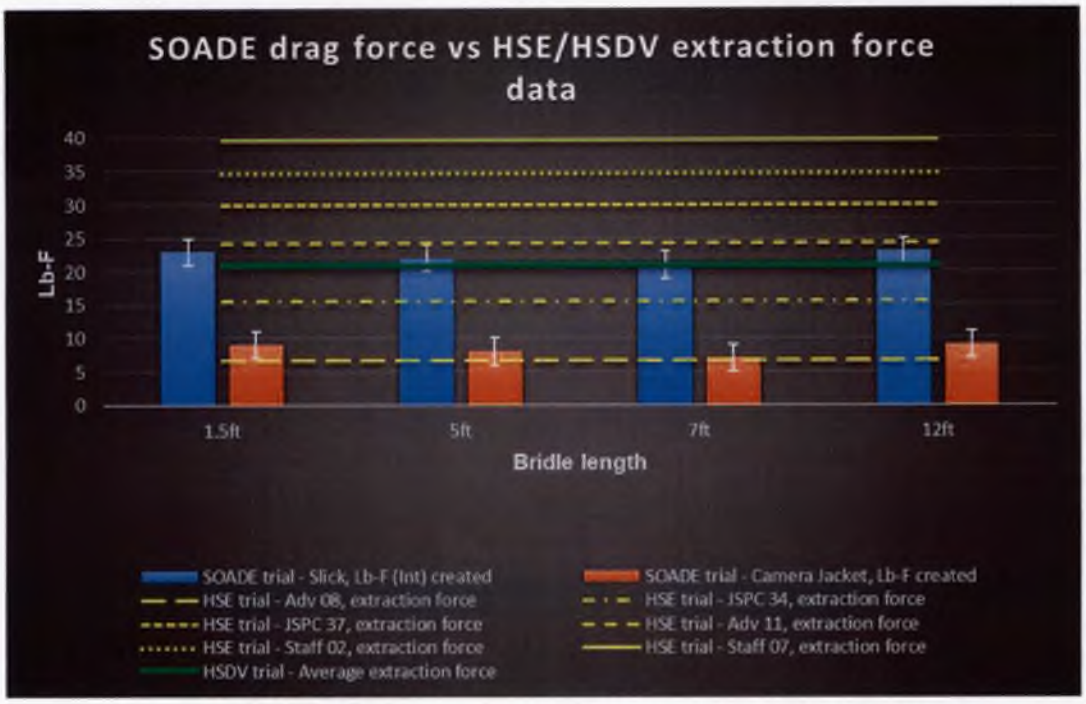

Figure 1.4.37 – Malformed RPC pull force vs extraction force data comparison.

1.4.134. On reviewing all available information surrounding extraction forces, the panel noted the following:

a. The peak drag force produced by a malformed RPC when wearing a camera jacket was unlikely to be sufficient to extract the free-bag (within the margin of error) when assessed across all tested systems in a total malfunction scenario.

b. Although the slick parachutist had a higher peak RPC drag force, when the data was extrapolated across the bridle lengths it also showed that the forces fell within the margin of error of some of the previously recorded free-bag extraction forces.

c. When considering the vast number of main and reserve container configurations available to users, the panel recognised that the pull forces required to extract the canopy bags from the container would considerably vary. The evidence indicated that there was a direct correlation to greater pull force requirements when the maximum canopy sizes were used within a container. This was likely to be more apparent as the container size reduced.

[136] SOADE only provided data for slick parachutist at 1.5 ft bridle length, the panel extrapolated the data across the additional bridle lengths base on the information provided from the camera operator.

1.4.135. The panel deduced that it was very likely that the associated reduction in drag force produced by a malformed RPC, could be insufficient to extract the reserve free-bag from the parachute container in cases involving a total malfunction. The panel concluded that the installation of the maximum permitted canopy sizes within a parachute container was very likely to affect the force required to extract the free-bag, which, when combined with an RPC malfunction was considered to be a **Contributory Factor**. Also see Para 1.4.166

1.4.136. **Recommendation. Air Officer Commanding No. 22 Group should include the link between the size of main and reserve canopies and parachute containers, and the extraction force required to deploy them, within their risk assessments and equipment safety cases.**

Free-bag line stows

1.4.137. In addition to the pull forces discussed above, the reserve rigging lines also required the RPC to deploy them. These rigging lines were secured by two elasticated stows which kept the mouth of the free-bag closed, with the remaining lines stowed into a pocket on the free-bag, secured by a Velcro® strip. Although the free-bag remained within the container the HSE report included an assessment on the pull force required to remove the reserve rigging lines from their stows. The data provided, across the various systems, identified that the pull force required ranged between 4.725lb-F to 17.1lb-F. The panel assessed that should the malformed RPC generate enough force to extract the free-bag from the container, it would also be sufficient to remove the rigging lines from their pocket and the two elastic stows. The free-bag line stow pull force requirement was, therefore, considered to be **not a factor**. Exhibit 98 Exhibit 48

GoPro™ audio

1.4.138. Sgt Fisk's GoPro™ footage captured an audio clip at 01:57:634, but despite an attempt by audio specialists to clean up the clip in an effort to identify what was said, it remained inaudible. The panel assessed that this audio did not offer any evidence towards determining the cause of the accident and it was, therefore, considered to be **not a factor**. Exhibit 41 Exhibit 341

GoPro™ video evidence

1.4.139. The scene presented by the NPAS helicopter video and the TVP photographs would, in isolation, have led the panel to a different conclusion to the accident sequence observed through analysis of Sgt Fisk's GoPro™ footage. The panel made an **Observation** that without this footage and digital data for post-accident analysis, it would not have been possible to determine how and when the reserve parachute was activated, or observe the evident malfunction of the RPC. Exhibit 01 Exhibit 56

Section summary

1.4.140. In this section, the panel concluded that turbulent wake and the malformed RPC were the causal factors that led to the accident. It also found 5 contributory factors and 1 aggravating factor, along with numerous other factors as listed at the end of the Part 1.4. Recommendations made on these findings are consolidated into a list at Part 1.5. Analysis of the safe systems of work in place at the time follow in Section 2.

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Section 2: Safe systems of work

1.4.141. Safe System of Work (SSW) was a systematic examination of a task to identify all hazards, with the aim to eliminate or reduce the risks associated with the identified hazard, provide uniformity of practice and clarity of implementation. All military SSW consisted of a common format which was broken down into four parts

a. Safe equipment.

b. Safe person.

c. Safe place.

d. Safe practice.

1.4.142. As a subset of SSW, Safe System of Training (SST) fell within Safe Practice. This took into account that those under training are not yet competent but set the conditions under which training was to be conducted. It was the panel's view that the activity conducted at JSPC(W) fell under both the SSW and SST. Therefore, the SSW and SST methodology was considered in the review of all other associated factors relating to the accident.[137]

Safe equipment

1.4.143. Safe equipment is any equipment brought into service with appropriate documentation and should include a safety case defining the safe operation and maintenance of the equipment under Service conditions. Where no safety case exists, any equipment hazards should form part of the activity's specific risk assessment (RA). The panel considered the following safe equipment factors:

a. Work equipment.

b. Personal protective equipment.

c. Parachute system.

d. Ancillary equipment.

e. Aircraft.

Work equipment

1.4.144. Work equipment was defined within Joint Service Publication (JSP) 375, Management of Health and Safety in Defence, as 'any equipment which is used by an employee at work'. Where this equipment was bought as 'commercial off the shelf', it was required to be procured via local purchase procedures or an acquisition team, which should establish appropriate through-life safety management arrangements.[138] These must ensure that the equipment is safe to Exhibit 148

[137] The Safe System of Training was in place to ensure that the risk resulting from any training activity was as low as reasonably practicable (ALARP) by ensuring those who conduct the training were competent.
[138] Equipment that is not unique to the military and available to the wider commercial market.

use and that associated risks are reduced to ALARP. The publication also discussed the procurement of 'complex systems' which required a Defence Equipment and Support[139] compliant process and safety case to be agreed with the duty holder.[140] However, the panel **Observed** that there was no evidence of a definition of a complex system within Defence publications.

1.4.145. The equipment used for sports parachuting within Defence was procured via a local purchase arrangement. Due to a lack of SQEP within the procurement chain other than the JSAT users, no consideration appeared to be given to the scrutiny of the safety standards that the equipment was manufactured to. As such, no safety assessment or safety case was produced, and it was the panel's assessment that the requirements of JSP 375 were, therefore, not being fully met. The panel concluded that the local purchase procedures for equipment used for high-risk activity were not robust and as such this was an **Other Factor**.

1.4.146. **Recommendation. Director Health Safety and Environmental Protection should define the policy for when a safety case is required for locally procured equipment that is intended for high-risk activities.**

Personal protective equipment (PPE)

1.4.147. To fulfil the requirements of the HSWA, Regulation 4 of the Personal Protective Equipment at Work Regulations 1992 stated that: Exhibit 149 Exhibit 150

> 'Every employer shall ensure that suitable personal protective equipment is provided to his employees who may be exposed to a risk to their health or safety while at work except where and to the extent that such risk has been adequately controlled by other means which are equally or more effective'.

1.4.148. Regulation (EU) 2016/425 (personal protective equipment) was extant at the time of the accident. The associated guidelines to this legislation discussed emergency parachutes as falling under equipment excluded from the scope of the PPE regulation, referred to in the document as 'Not PPE'. This was due to the following statement, which associated emergency parachutes as: Exhibit 151

> 'PPE for exclusive use on seagoing vessels or aircraft that are subject to the relevant international treaties applicable in Member States'.

As a parachutist's emergency parachute is not for exclusive use on an aircraft, the regulation did not provide guidance on whether it should be classed as PPE. However, the panel noted that emergency parachutes for use on aircraft were authorised by international aviation authorities through FAA Technical Standard Orders (TSO). See Para 1.4.153.

[139] DE&S was a bespoke trading entity within Defence responsible for the procurement and support for all Defence equipment.
[140] A duty holder was an appointed accountable individual who was to actively manage the risk to life for military activity. Mitigating the associated risk to a level that was considered as low as reasonably practicable (ALARP) and tolerable.

1.4.149. The panel discovered that the reserve (emergency) parachute assemblies of sports parachutes were regulated in line with all other emergency parachute systems via the same FAA TSO authorisation. These authorisations ensured that all parachute assemblies accepted under the scheme met a known performance standard. Exhibit 122 Exhibit 123

1.4.150. From the analysis conducted of regulations, orders and standards, the panel assessed that the current HSWA PPE regulations should be updated to clarify the required certification standards for a parachutist's emergency parachute. The panel concluded that the lack of clarity in the regulations for parachutists' emergency parachutes within the PPE regulations was an **Other Factor**.

1.4.151. **Recommendation. The Director of the Office for Product Safety and Standards should engage with the Director of the Health and Safety Executive, in regard to clarifying the status of emergency parachutes within the guidance surrounding the relevant PPE regulations, including those made under the Health and Safety at Work etc Act 1974.**

Parachute system

1.4.152. The parachute systems used by JSPC(W) staff and students comprised of various Sun Path models fitted with Performance Designs main and reserve canopies. The containers and canopies were authorised via a TSO issued by the Federal Aviation Administration (FAA). The systems that Sgt Fisk used on the 2 Sept 2021 were inspected and maintained by the JSPC(W) rigger. Her container was manufactured on the 3 Apr 2019 and was brought into service at JSPC(W) on 18 May 2020. This included the fitting of a CYPRES 2 AAD and a Performance Designs manufactured reserve canopy. To understand the suitability and maintenance of the various components of the parachute system the investigation focused on the following areas: Exhibit 36

a. Technical Standard Orders.

b. Container compatibility.

c. Inspection and maintenance.

d. JSPC(W) parachute allocation.

Technical Standard Orders

1.4.153. The parachute systems used on the day of the accident were certified under a TSO issued by the FAA. The FAA's website stated that: Exhibit 152

> 'a TSO is a minimum performance standard for specified materials, parts, and appliances used on civil aircraft. When authorized to manufacture a material, part, or appliances to a TSO standard, this is referred to as TSO authorization. Receiving a TSO authorization is both design and production approval. Receiving a TSO authorization is not an approval to install and use the article in the aircraft. It means that the

article meets the specific TSO and the applicant is authorized to manufacture it.'[141]

1.4.154. For emergency parachute systems FAA TSO C23-f detailed the minimum performance standards (MPS) required for personnel parachute assemblies and components.[142] Assemblies and components approved under a previous FAA TSO version were still permitted to be manufactured under the provisions of its original approval, with many available sports parachute systems still being manufactured under TSO C23-d (6 Jan 1994), including those used on the day of the accident. Exhibit 123 Exhibit 122

1.4.155. **Minimum performance standards (MPS).** In order to achieve TSO authorisation there was a requirement to meet the MPS laid down within the relevant order. For TSO C23-d, the MPS was set within the Society of Automotive Engineers, Inc., (SAE) Aerospace Standard (AS) 8015B – Parachute Assemblies and Components, Personnel, dated July 7,1992. This document applied to, 'personnel parachute assemblies to be carried in aircraft or worn by passengers, crew or parachutists for emergency use'. In 2012, TSO C23-f superseded all previous versions of the order, with new equipment required to meet the PIA Technical Standard (TS) 135. Para 4.1.3 of this standard added a requirement for the manufacturer to ensure that, 'When installed but not deployed, the main parachute assembly shall not interfere with the proper function of the reserve parachute assembly Ref: Table 2', this was a change to previous standards.[143] Exhibit 123 Exhibit 122 Exhibit 153 Exhibit 124

1.4.156. **Acceptance of TSOs across international borders.** FAA TSOs were recognised by the European Union Aviation Safety Agency (EASA), which replicated the original TSO as a European Technical Standard Order (ETSO). EASA and the FAA signed a mutual acceptance agreement for TSOs in 2016, thereby automatically accepting each other's authorisations. As part of the UK Civil Aviation Authority's (CAA) transition away from EASA regulation post the UK leaving the European Union, the CAA also signed a mutual acceptance agreement with the FAA in Jan 2021. The CAA also accepted that all previously accepted ETSOs could remain valid within the UK until updated. Exhibit 154

1.4.157. Despite newer standards being introduced, the equipment used at the time of the accident was manufactured under the older TSO C23-d authorisation. This order was reliant on testing in accordance with the retired SAE AS8015B standard. Whilst not mandated by the regulations, the panel sought evidence as to whether any gap analysis had been conducted on products previously authorised under TSO C23-d. The response from the container manufacturer was that this had not been completed as it was not a requirement. The panel noted that unless a user understood the manufacturing authorisation process for parachute systems, they were unlikely to be aware of the differences in standards that a system may have been tested and authorised to. Exhibit 324

[141] https://www.faa.gov/aircraft/air_cert/design_approvals/tso.

[142] C23-f was the most recent order dated 9 Sep 2012. However, some parachute systems, including those used on the day were manufactured to older versions of this FAA TSO.

[143] Table 2 referred to human factors and actuation force tests.

1.4.158. During the panel's review of TSOs, it discovered that TSO C23-f provided an addendum to TS-135, removing the reference to Table 2, which was deemed inappropriate by the FAA for the requirement being set. The panel, therefore, contacted the PIA to request information on the required success criteria for this element of the standard. The PIA responded with: 'proper function of the reserve parachute system requires meeting the success criteria for Direct Drops per TS-135 section 4.3.8.1, which defines time to open and altitude loss limits'. The panel agreed that the drop test requirement may well provide an answer to proper function, i.e. the parachute develops and arrests the rate of descent within the height loss criteria. However, this may not provide sufficient evidence of any unwanted interference, which could influence a change in the behaviour of the reserve assembly such as when the main canopy remains in the container as seen during the HSDV trial.

1.4.159. The panel considered that the definitions of 'interference' and 'proper function' within TS-135 were not clear and, therefore, open to interpretation. The panel could find no evidence that any consideration was given to determine the effects of one or a combination of the following factors:

a. Any change in performance through the interaction of the various parts of the assembly with the container.

b. The ability of the bridle to overtake the pilot chute when experiencing pilot chute hesitation (1.4.113).

c. The minimum pull force required to remove the free-bag from the container when configured with the maximum sized canopies during the worst-case emergency scenario of a total malfunction.

1.4.160. The panel found no evidence to suggest that equipment tested under the requirements set in TSO C23-d would have prevented authorisation under the latest order. However, as the manufacturer was not required to state that the equipment was still being manufactured to a previous standard, or whether any gap analysis had been undertaken, it was considered to be an **Other Factor**.

1.4.161. The panel concluded that the TSO system did provide some independent oversight of the PIA owned standards. However, there was an issue if the TS-135 was not read alongside the addendum within TSO C23-f. In the view of the panel, TS-135 should be updated to reflect the changes within the TSO as a minimum, in order to prevent any potential misinterpretation. As such, the panel considered this to be an **Other Factor**. Additionally, where terms such as 'interference' or 'proper function' were used, they should be accompanied with a clarification note as to the pass or fail criteria for the requirement, the panel considered this to be an **Other Factor**.

1.4.162. **Recommendation. The Civil Aviation Authority, Director General Aviation should coordinate with the Federal Aviation Authority to request an update to Technical Standard 135 by the Parachute Industries Association, in order to ensure clarity of the requirements of the standard.**

1.4.163. **Recommendation. The Civil Aviation Authority, Director General Aviation should coordinate with the Federal Aviation Authority to either, request an update to the Federal Aviation Authority Technical Standard Order C23f, or consider the issue of a UK Technical Standard Order Authorisation (UKTSOA) to require parachute assembly manufacturers to provide evidence of gap analysis of safety critical parachuting equipment manufactured under obsolete standards.**

Container compatibility

Exhibit 36
Exhibit 352

1.4.164. The manufacturer for the main and reserve canopies was Performance Designs, and were manufactured in accordance with the parameters laid down in FAA TSO C23-d. The canopies used on sortie four were both ram air parachutes (1.3.A.16):

a. Main canopy. Performance Designs Sabre 2, size 150sqft, serial number 022576, manufactured Jan 2020.

b. Reserve canopy. Performance Designs Optimum, size 160sqft, serial number 020274, manufactured Jan 2019.

1.4.165. Performance Designs recognised that canopy pack volume could vary by 10-20% dependent on the material, canopy construction and the packing method used. Due to this variation, they recommended that the container manufacturer guidelines should be followed when configuring a parachute system. Exhibit 357

1.4.166. Although a generic pack volume table was produced by the PIA, the canopy manufacturers did not identify which canopies could be fitted to specific containers due to the number of variables in their designs.[144] Purchasers were directed to the container manufacturers for guidance as they had been provided canopies by the various manufacturers to make their own assessment. The manufacturers produced containers in various sizes designed to accommodate specific pack volumes of main and reserve canopies which had been assessed against the products provided. Sun Path produced a container compatibility table which provided guidance on the maximum canopy sizes that could be fitted within each container (Figure 1.4.38). Examination of Sgt Fisk's container by QinetiQ, on behalf of the HSE, assessed that all components of the parachute system met the compatibility requirements detailed in Sun Path's user manual. It also identified that both the main and reserve canopies represented the maximum size approved for this model of container.[145] An associated **contributory factor** is at Para 1.4.135.

Exhibit 98
Exhibit 358

[144] Technical Standard 104 Canopy Volume Study attachment 1 (1 Jun 2009).
[145] Sgt Fisk's container model was JSK1.

Container/ Model	F-111 Reserve Canopy	Low Bulk Reserve Canopy	Zero Porosity Main Canopy	Hybrid F-111/ ZP Main Canopy	Low Bulk Main Canopy	Crossbrace Main Canopy	Main Pilot Chute Diameter (F-111)
RSK	106 - 120	113 - 126	83 - 99		107	68 - 75	28
RSK.5	106 - 120	113 - 126	100 - 107		120	80 - 88	28
RSK-1	106 - 120	113 - 126	109 - 120	135	135	88 - 96	28
NJK	113 - 120	126	109 - 120	135	135	96 - 103	28
ONKY	126	143	109 - 120	135	135	96 - 103	28
TJNK	126 - 135	143	135	150	150	108 - 120	28
TJNK.5	126 - 135	143	150	170	170	120	33
OJK	143 - 150	160	135	150	150	120	28
J1KS	143 - 150	160	150	170	170	135	33
J1KL	143 - 150	160	170	190	190		33
J2K	160 - 170	176	150	170	170	135	33
J3K	160 - 170	176	170	190	190		33

Model	F-111 Reserve Canopy	Low Bulk Reserve canopy	Zero Porosity Main Canopy	Hybrid F-111/ZP Main Canopy	Low Bulk Main Canopy	Crossbrace Main Canopy	Main Pilot Chute Diameter (F-111)
J1KS	143-150	160	150	170	170	135	33

Figure 1.4.38 – Sun Path canopy compatibility table.

Inspection and maintenance

1.4.167. All JSPC(W) parachute systems were maintained and inspected biannually by the JSPC(W) rigger, this included the repacking of a reserve canopy of which, the panel, was shown the full inspection process during the investigation. A record of inspection for any given parachute system was annotated on British Skydiving record of inspection Form No.205403. Exhibit 155

1.4.168. The panel was informed that there was no requirement for JSPC(W) staff to keep a record of their own main canopy packing. However, if the canopy was packed by a different member of staff, a packing slip was completed and attached to the parachute system. The panel found no evidence surrounding the packing of Sgt Fisk's main canopy prior to the accident, suggesting that she had packed it herself. Exhibit 36

Rigger training and rigging regulations

1.4.169. The JSPC(W) rigger held a British Skydiving advanced rigger qualification. The requirements to meet this qualification were outlined on the British Skydiving website in Form 201. An individual would be required to complete a period of training under the supervision of another rigger before being authorised by a British Skydiving rigger examiner. During this time, they would also be expected to design and manufacture a parachute system to a known manufacturers specification. The required knowledge and skills were extensive, however there was no externally accredited qualification given to the role other than through British Skydiving. The British Skydiving training documentation was limited in its scope and relied heavily on the USPA Parachute Rigger Handbook and another source reference publication.[146] Both of these documents gave detailed guidance on all aspects of parachute rigging. Exhibit 156 Exhibit 157 Exhibit 158 Exhibit 100

[146] Poynter D. (Vol 1 1984 & Vol 2 1991). *The Parachute Manual: A Technical Treatise on Aerodynamic Decelerators.* USA: Parachuting Publications.

1.4.170. A British Skydiving rigger would be expected to re-validate their qualification annually. This was achieved by an individual passing examples of their paperwork, to someone qualified to at least the level of an advanced rigger for scrutiny. No other assurance activity was required, and witness statements confirmed that there was an opportunity for an individual to gain a signature by being selective in where they sent their paperwork. However, the panel found no evidence of this being a factor within Defence and heard consistent testimony to the skill, professionalism and integrity of the MOD employed British Skydiving qualified riggers. The panel made an **Observation** that the assurance of the rigger revalidation process did not appear to be sufficiently robust. Exhibit 158 Exhibit 159

1.4.171. The panel acknowledged that the British Skydiving rigger syllabus was extremely demanding and appeared to test every aspect of repair work that a rigger could be asked to carry out. The syllabus was above that required of the FAA approved rigger qualifications and allowed the British Skydiving rigger more freedom to conduct repairs to equipment.

1.4.172. Whilst the panel acknowledged that the syllabus was rigorous it relied heavily on the use of the documents produced within the United States. These handbooks and manuals were very detailed, but they only referred to American standards approved through the FAA. The British Skydiving community, therefore, lacked national guidance on what was acceptable to the CAA. The panel also found that the British Skydiving forms detailing rigging and packing were spread randomly across the British Skydiving forms numbering system. This was confusing and meant that the process of finding quick answers to rigging requirements, qualifications and currency was frustrating. As an example, British Skydiving Form 238 pointed the reader to 33 other forms and six other sources of information such as manuals, meeting minutes and notices. Exhibit 158 Exhibit 160

1.4.173. The panel made an **Observation** that United States rigger qualifications were controlled by the FAA with each rigger being issued a nationally recognised licence. This system provided a more formal standing and created a regulated system with external validation.

1.4.174. The panel concluded that whilst the British Skydiving rigging system could be improved, it did appear to set some of the highest standards. The panel, therefore, made the **Observation** that a CAA endorsed qualification process along with formal and independent assurance would enhance the standing of these qualifications to the benefit of the sport.

1.4.175. The panel also noted that the 1 Rifles parachuting accident Service Inquiry in 2015 recommended to the British Parachute Association (trading as British Skydiving) the introduction of a six-monthly assurance check of reserve parachute packing. This recommendation was not implemented by the British Parachute Association. However, during the panel's visit to the Joint Service Parachute Centre Cyprus (JSPC(C)) it was found that the CI had implemented this assurance check. Exhibit 331

1.4.176. The panel determined that whilst the 1 Rifles' recommendation was made solely to the British Parachute Association, it would have been easily achieved within Defence, as shown by JSPC(C). The panel concluded that the intent of the recommendation for six-monthly reserve parachute packing assurance checks remained valid for this inquiry and should be widened to include all Defence sports parachuting activity, and, as such, was an **Other Factor.** Exhibit 325 Exhibit 331

1.4.177. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to introduce six-monthly assurance checks of reserve parachute packing for sports parachute systems.**

Rigging tools and equipment

1.4.178. Due the variations amongst parachute systems and canopy manufacturers, there was no set tool list for parachute rigging. Some equipment manufacturers did, however, suggest or stipulate which tools were suitable for use on their equipment. The British Skydiving riggers' training and regulatory documentation was limited, referencing the United States Parachute Rigger Handbook and the Dan Poynter books previously mentioned as a key source of information. However, no British Skydiving documentation stipulated whether these references provided a definitive or approved list of tools and equipment. The Parachute Rigger Handbook did discuss hand tools, exposing the fact that there are many options available to a rigger, with some tools simply being homemade items. It also specified some rigging functions that required the use of a calibrated pull-force tester or spring scale, such as setting the pull tension on the reserve pull handle, or to verify the strength of the parachute canopy fabric. However, the panel could not find any requirement for the use of calibrated equipment within British Skydiving documentation. Exhibit 157 Exhibit 100

1.4.179. As British Skydiving did not stipulate which rules and guidelines British Skydiving riggers should be adhering to, the requirements for minimum tool sets and acceptable measuring equipment was left to the individual rigger. For tools being manufactured in-house, there was no oversight on whether any of these devices could cause damage to the parachute systems or ancillary equipment whilst being used. The panel observed different types of measuring devices in use in rigging lofts, many of which were uncalibrated, off the shelf, spring and fishing scales.[147]

1.4.180. The panel concluded that British Skydiving should specifically stipulate the documentation to be followed for rigging practices, in order to provide a standard to be used across the sport. This was considered to be an **Other Factor**. The panel also concluded that where rigging equipment and tooling had not been specifically recommended by the manufacturer, a lack of formal assessment for suitability and risk against damaging parachute assembly components was an **Other Factor**. The lack of clear direction within British Skydiving procedures and operating manuals regarding the calibration of pull-force measuring equipment was considered to be an **Other Factor**.

[147] The room allocated for rigging within a PTO was known as a rigging loft.

1.4.181. **Recommendation. British Skydiving should stipulate the documentation to be followed for rigging procedures against a recognised standard.**

1.4.182. **Recommendation. British Skydiving should stipulate an authorised tools list for rigging purposes, including the calibration requirements for pull force measuring equipment, in order to minimise the risk of damage to parachute systems and ensure accurate pull force test results.**

HSE examination of JSPC(W) parachute systems

1.4.183. The HSE examination of additional JSPC(W) parachute systems found that the main and reserve parachutes had been packed in accordance with the instructions provided by the manufacturers' manuals. The panel was present for the HSE examinations and agreed with their findings. The panel concluded that the standard of maintenance and quality of reserve canopy packing had no influence upon the failure of either the main or reserve canopies to deploy and was, therefore, **not a factor.** Exhibit 161

JSPC(W) parachute allocation

1.4.184. WOTG held a stock of staff, student and advanced parachute systems of various sizes. Staff parachute systems were configured with the appropriate container, harness and canopy combinations in relation to the individuals experience and wing loading. Wing loading is a number indicating the load per unit of surface of a parachute. It is calculated by dividing a parachutist exit weight (body weight + equipment weight) in lbs by the surface area of the parachute in sqft.

1.4.185. The canopy manufacturer also provided a canopy sizing table (wing loading chart) which stated the minimum and maximum weight limit for a parachutist when using their canopies. According to the table, the Sabre 2 150sqft canopy used by Sgt Fisk, had weight limits ranging between 61.2kg to 102kg, dependent on the parachutist's experience. Exhibit 347 Exhibit 348

1.4.186. The BSOM only provided maximum wing loading direction for first jump solo student skydivers and solo students that had completed at least one solo descent. For licenced skydivers below 2,000 descents, British Skydiving produced canopy sizing charts within their published forms,[148] which were derived from a combination of wing loading and canopy training competency levels.[149] Exhibit 162

1.4.187. The total acceptable exit weights for JSPC(W) parachute systems were recorded in an online database, with the maximum exit weight for the Staff 08 parachute system allocated to Sgt Fisk annotated as being 100kgs. Sgt Fisk's logbook documented her exit weight as being 83kg, based on her British Skydiving medical forms recorded body weight of between 66kg and 67.3kg in 2019 plus the weight of her parachute system.[150] Exhibit 163 Exhibit 22

[148] British Skydiving Form 330-ii Canopy size chart – CT2.
[149] Sgt Fisk canopy grading was at CT2 (CH2), British Skydiving Form 330-ii.
[150] Parachute system weight approximately 15kg.

1.4.188. The panel assessed that Sgt Fisk's canopy sizes, in terms of wing loading, for her main and reserve canopies were within the parameters set by the canopy manufacturer, British Skydiving, and JSPC(W). Whilst the panel was unable to confirm whether the weighing scales used to determine Sgt Fisk's weight had been calibrated, her indicated weight was sufficiently below the maximum weight parameters for the canopy she was using. The panel was, therefore, confident that Sgt Fisk remained within the stated limits for her allocated parachute system and concluded that the allocation of the canopy sizes in relation to Sgt Fisk's experience and exit weight was **not a factor**.

Container sizing

1.4.189. Sgt Fisk was allocated two containers on assignment to JSPC(W): Exhibit 36 Exhibit 37

a. ADV 08. Container size J3K.

b. STAFF 08. Container size J1KS.

Sun Path used the reference J1 or J3 to represent the size of the container, with an 'S' signifying that a container was of a slim design.[151] To assist with the investigation, the manufacturer provided a size comparison template (Figure 1.4.39) showing the length and width differences between the two containers. The dimensions in the figure below show that the J1 container was smaller than the J3 container in width and length.

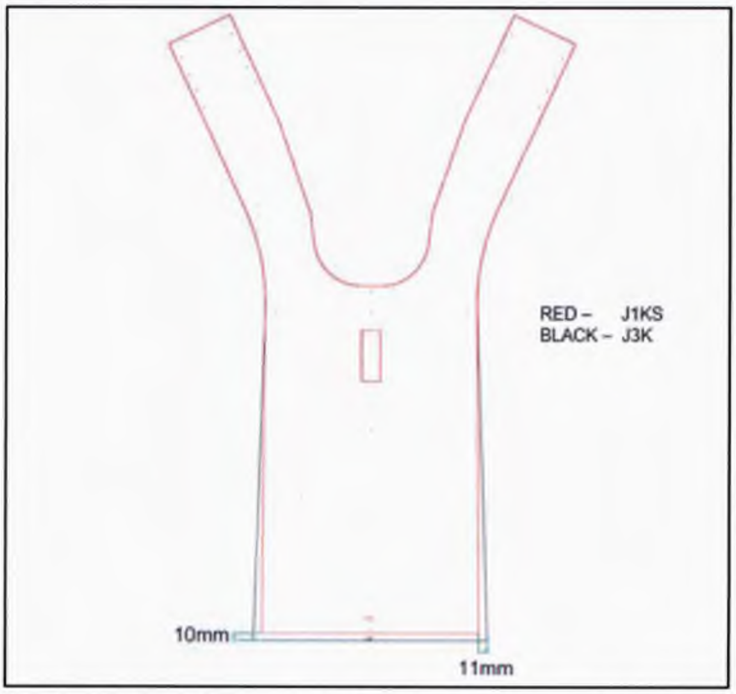

Figure 1.4.39 – Staff 08 and ADV 08 container size comparison.

1.4.190. The panel considered whether a difference in size could have affected the ability of Sgt Fisk to pull the BOC toggle. Whilst Sgt Fisk's two parachute systems differed in size, these differences were minimal, and it was the panel's view that the number of descents that she had carried out using these systems

[151] Refers to the cubic capacity of the containers main canopy tray.

would have demonstrated a high level of familiarity. The panel, therefore, concluded that the allocation of two different sized parachute systems by JSPC(W) was **not a factor**.

Ancillary equipment.

1.4.191. In addition to camera jacket and trousers, Sgt Fisk had been wearing the ancillary equipment identified in Para 1.4.25. This equipment had been issued by No. 2 Gp and JSPC(W). Exhibit 164 Exhibit 35

1.4.192. With the exception of gloves and camera jacket, Sgt Fisk's previous roles within Airborne Delivery Wing (ADW) required the use of equipment that had been subject to the MOD's Release to Service (RTS) process and was captured within the Compendium of Airborne Equipment Release Certificate (CAERC). All items that were included in this certificate had a safety assessment and the parameters of use were identified within relevant Defence Publications. However, the panel became aware that for sports parachuting activity there was a permitted culture of individual choice with regards to the wearing and fitting of ancillary equipment. This was relevant to the fitment of the camera jacket worn by Sgt Fisk at the time of the accident, which used parachute pull up cords tied around her harness leg straps to secure the lower corners of the wings. Exhibit 109 Exhibit 114 Exhibit 165

1.4.193. Although specific items of ancillary equipment had undergone a safety assessment, the lack of inclusion in a RTS, with the expected subsequent procedural information, meant that there was no formal direction regarding the configuration and fitment of the camera jacket. Therefore, the risk of personnel using the equipment incorrectly or in an unsafe manner was not known.

1.4.194. The panel concluded that the ability to apply personal choice to the use of certain items of equipment could have negative safety implications and increase the risk to the user. The camera jacket may not have led directly to the accident, but the fact that it had not been formally risk assessed undermined the overall safety assessment of the activity and was, therefore, deemed a **Contributory Factor**.

1.4.195. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to provide direction for the use and fitment of ancillary equipment for sports parachuting, in order to ensure that any identified risk remains ALARP and tolerable.**

Aircraft

1.4.196. The aircraft used on the day of the accident was a Cessna 208B Caravan, registration N208AD, which had an approved modification for the conduct of parachuting activity. The pilot was a CAA licensed and British Skydiving approved pilot, pilot examiner, and jump pilot. All licencing, registration, servicing, and maintenance requirements were conducted in accordance with CAA regulations. Exhibit 167 Exhibit 343

Support contract

1.4.197. The aircraft was under contract between United Kingdom Parachute Services (UKPS) and the MOD as a commercial charter. This contract also covered other requirements and services such as the provision of a suitably qualified pilot and a British Skydiving qualified rigger. Exhibit 343

Contractual assurance

1.4.198. The Military Aviation Authority (MAA) had a regulatory article covering the assurance of aircraft contracted under charter. This included areas such as continuing airworthiness and insurance factors. Regulatory Article (RA) 1240 required the provision for a safety assessment to an approving officer.[152] The panel discovered that WOTG did not have the required approval in place, and on further investigation only one of the three JSAT parachuting centres had completed the regulatory process. Analysis of the available documentation provided by the Robson Academy of Resilience appeared to show sufficient evidence to support the approval for charter in accordance with RA1240. However, there was a general lack of awareness of the regulation, which was predominantly observed by the panel to be due to the fact that sports parachuting as an activity was not regulated by the MAA and, as such, the JSAT centres did not routinely read the MAA publications. Exhibit 166

1.4.199. The panel concluded that this was an example of the challenge that organisations faced in having to be compliant with regulations across several regulatory boundaries. It was very likely that sufficient evidence was available to achieve an approval for chartering the aircraft for sports parachuting activity in accordance with RA1240. However, the lack of a formally approved safety assessment was considered an **Other Factor**.

1.4.200. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to ensure awareness of the requirement to comply with the requirements for chartering of aircraft within Regulatory Article 1240 for the purposes of sports parachuting.**

Sorties on 2 Sep 2021

1.4.201. The aircraft sorties on 2 Sep 2021 were conducted in accordance with section nine of the BSOM and the British Skydiving Jump Pilot Manual. The JSPC(W) serials were annotated on JPSC(W) Form 14 (Aircraft Manifest) and Exhibit 23 Exhibit 167 Exhibit 168

[152] MAA RA1240, https://www.gov.uk/government/organisations/military-aviation-authority.

the UKPS Tech Log/Flight sheet. The aircraft also used Sky Demon GPS flight planning and navigation software which provided a log of aircraft movement from take-off to landing. This data was exported and applied to additional software which provided the panel with an overview of the flight profile (Figure 1.4.40). Exhibit 169

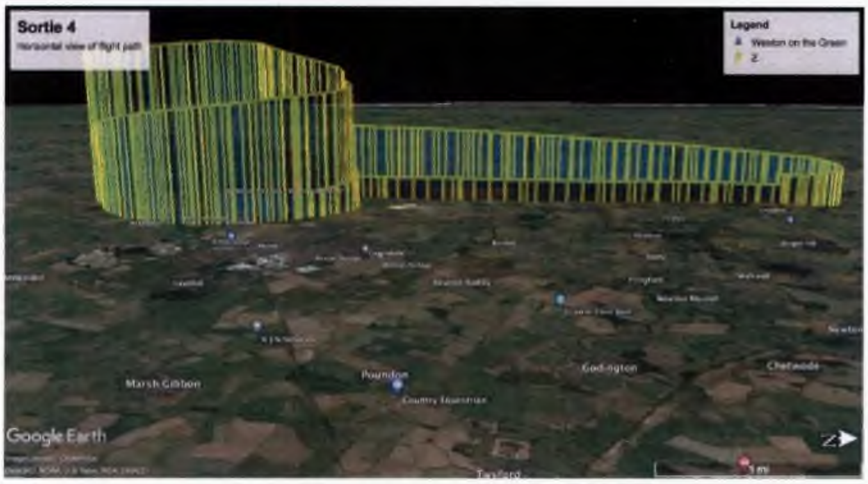

Figure 1.4.40 – Sortie four aircraft track.

1.4.202. During the panel's analysis of the flight profile and the documentation used to achieve the parachuting activity at WOTG, the panel observed that the British Skydiving Jump Pilot Manual published under the heading of 'Safety Manuals', contained out of date information. The opening paragraphs of the document did provide a caveat that there was a requirement to check the BSOM and Air Navigation Order for the most up to date information. However, most of the publication had not been reviewed since 2008. The regulations stated within the document were from before EASA cohered their regulations for the whole of the European Union, such as for aircrew licencing[153] took place and the subsequent return to UK sovereign state regulations, after leaving the European Union. The panel's overall impression was that whilst the Jump Pilot Manual was useful, much of the detail was hidden between out-of-date information and, therefore, lost its impact or could be overlooked. Exhibit 170

1.4.203. The panel concluded that the jump pilot and sortie profile did not contribute to the accident and were, therefore, considered as **not a factor**. However, the out-of-date Jump Pilot Manual was likely to cause confusion and should either be updated or included within the BSOM. As such, the panel considered this to be an **Other Factor**.

1.4.204. **Recommendation. British Skydiving should review and update the Jump Pilot Manual, in order to ensure the information provided is in accordance with current regulation and policy.**

[153] COMMISSION REGULATION (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew
pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council

Safe person

1.4.205. A 'safe person' was defined as someone considered to be a competent person who has received the appropriate information, instruction, training, and supervision to carry out a specific task.[154] The panel has considered the following under SSW Safe Person: Exhibit 171

a. Qualifications and experience.

b. Training.

c. Medical and fitness.

d. Fatigue, alcohol and distraction.

Qualifications and experience

1.4.206. Sgt Fisk was a British Skydiving 'C' licensed sports skydiver and UK military freefall parachutist who had been parachuting since 2014. Over a seven-year period she had obtained numerous qualifications and competencies in both the UK Mil PJI and British Skydiving training systems. The British Skydiving qualifications relevant to her role at JSPC(W) are detailed below: Exhibit 172

a. British Skydiving 'C' licence.[155]

b. Formation skydiving (FS) 1 and FS coach.

c. Tracking 1 and 2.

d. Canopy handling (CH) 1, 2 and CH coach.

e. Category systems instructor (CSI).[156]

f. Approved packing certificate.

g. Radio operator certificate of competence.

[154] A competent person is deemed so by virtue of qualification, currency, experience and maturity.
[155] British Skydiving initial licence awarded on qualifying is 'A', skydivers will then progress through 'B', 'C' and 'D' licence after a designated number of descents and completion of the required elements of the grading system as published within the British Skydiving Operations Manual.
[156] A CSI was an instructor qualified to instruct the British Skydiving category system course, which was a static line progression course, also referred to as the ram-air progression system (RAPs).

1.4.207. Evidence from her parachute logbooks and ALFA altimeter showed that she had conducted a total of 594 parachute descents (Table 1.4.4).[157] Of the 515 freefall descents recorded, she had acted as camera operator on 102 occasions. Exhibit 21 Exhibit 22 Exhibit 25

System / Canopy	Round	Square
Static Line	36	43
Freefall	n/a	515
Totals	36	558
	594	

Table 1.4.4 – Sgt Fisk's parachute descents.

1.4.208. **Canopy deployments.** Sgt Fisk's ALFA altimeter provided data for the descents conducted between 29 Jul to 2 Sep 2021. The data for descents 169 to 172 provided the panel with the following information:[158] Exhibit 25

Jump No.	Date	Exit height (Feet)	Opening height (Feet)	Freefall time (s)	Average freefall speed (mph)	Maximum freefall speed (mph)
172	2 Sep	11600	8000[159]	68	126	146
171	2 Sep	11700	3140	53	123	134
170	2 Sep	11700	2820	57	120	134
169	2 Sep	11900	2700	57	119	129

Table 1.4.5 – Sgt Fisk's ALFA data for 2 Sep 2021.

1.4.209. This data also provided details of the main canopy deployments[160] for her previous 35 descents, which showed a mean main canopy deployment height of 3,066ft agl with a standard deviation of 359.57ft (Figure 1.4.41 and Figure 1.4.42).[161] Exhibit 25 Exhibit 346

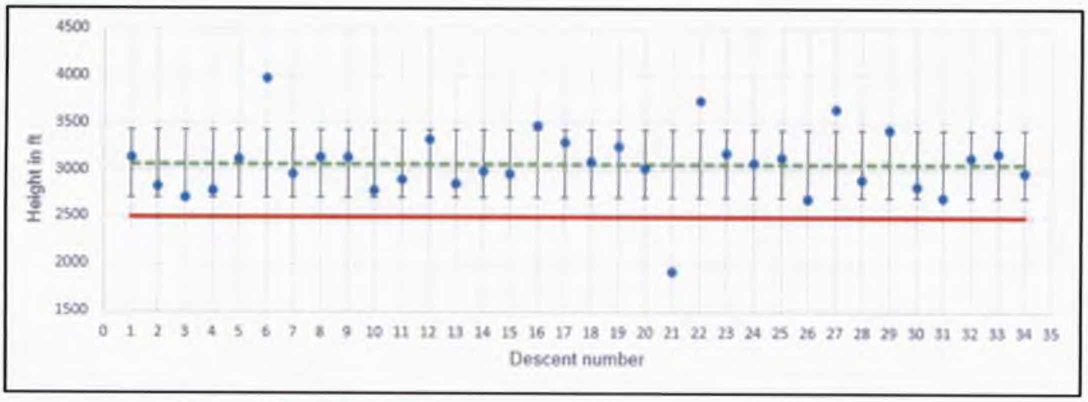

Figure 1.4.41 – Sgt Fisk ALFA canopy deployments.

[157] In accordance with MAA RA2401(3): Accurate and detailed records of flying times shall be maintained by operating Aircrew or other personnel as directed by ADH and AM(MF) orders.
[158] Numbers recorded on the ALFA altimeter.
[159] Data showed no reason for the registered opening altitude, freefall rate of descent was 61-59m/s over this period of the descent.
[160] ALFA canopy deployment height recorded at a deceleration to 90mph (+/- 1mph).
[161] Descent 35 (Incident descent) was discounted due a false reading of 8000ft agl.

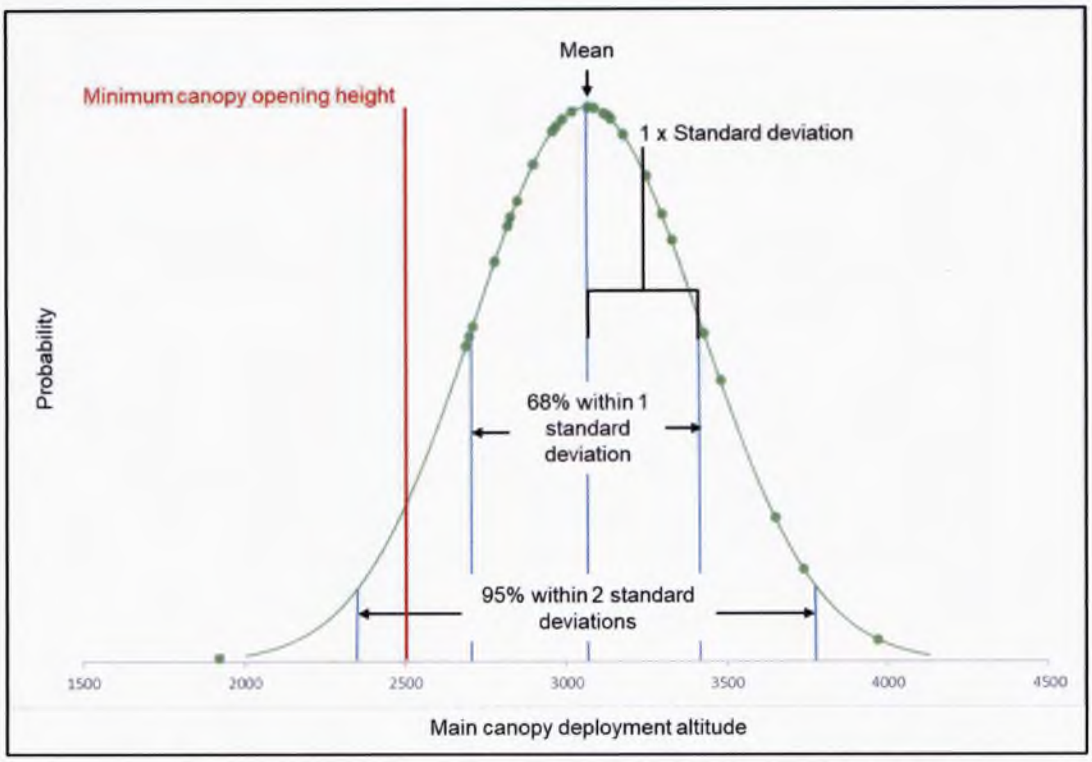

Figure 1.4.42 – Sgt Fisk canopy deployment, standard deviation.

1.4.210. The panel confirmed that Sgt Fisk had held the appropriate British Skydiving qualifications for the activity she was undertaking, and was regarded as an experienced and competent individual within both military and sports parachute training systems. Analysis from her ALFA data demonstrated that she operated within the bounds of the regulations set by the BSOM and the JSAT POM, however, it was noted that a single deviation was recorded on the ALFA on 3 Aug 2021. The panel could not find any evidence to link the exit altitude recorded for this descent directly against other available data sources and was, therefore, unable to determine whether the entry was valid. As this entry was inconsistent with the overall trend of Sgt Fisk's descent record, the panel considered it inconclusive. When judging this occurrence against the full range of data downloaded from Sgt Fisk's ALFA it was considered that there was little evidence to warrant further investigation and it was, therefore, determined to be **not a factor**.

1.4.211. The panel's overall assessment for the descents made by Sgt Fisk on 2 Sep 2021 was that her canopy deployment heights were gradually increasing. This was likely to have been in relation to the changing meteorological conditions. An experienced skydiver, Sgt Fisk had demonstrated that she operated consistently within the regulations; the panel, therefore, assessed her qualifications and experience as **not a factor**.

Training

1.4.212. **Camera operator training.** Sgt Fisk's JSPC(W) and PJI logbook had both been annotated to show that she had undertaken relevant training to conduct the duties of a camera operator for both JSAT and UK military parachuting activity. Her JSPC(W) logbook had been marked with a tick in the box marked 'Camera Brief' and her PJI logbook had a signed entry on 21 Jan 2020, with the description 'Camera Brief', in relation to the ADW Military Freefall Observers (MFFO) Course assessment strategy. Exhibit 21 Exhibit 22 Exhibit 173 Exhibit 174

1.4.213. ADW documentation showed that Sgt Fisk undertook MFFO training on several training exercises, with the signed annotation in her PJI logbook correlating with ground training objectives completed on a PJI exercise in Jan 2020. However, there is no evidence to demonstrate she had completed all of the freefall training objectives to be awarded the MFFO competency. Although Sgt Fisk's JSPC(W) logbook had been annotated that she had received the British Skydiving camera brief, the panel found no evidence as to when it had taken place. However, the British Skydiving training for a camera operator was to be completed in accordance with the BSOM (Sect 6) and the British Skydiving Camera Flying Coaching Manual. This stated that cameras could be worn by British Skydiving 'C' licence skydivers after inspection and approval of a chief instructor (CI). No formal qualification was awarded once these requirements had been met. Whilst the panel could not identify when Sgt Fisk had completed the British Skydiving camera brief, the fact that she had completed the MFFO ground training would have meant that she would have received all of the elements required by British Skydiving within this course. The panel made an **Observation** that British Skydiving had no formal qualification associated with the camera operator proficiency. Exhibit 174 Exhibit 175

1.4.214. The panel also attempted to quantify Sgt Fisk's experience of wearing a camera jacket. However, of the 98 descents that were logged as a camera operator between Oct 2018 and Sep 2021, and annotated in her military and civilian logbooks, the entries did not identify when she had worn a camera jacket. Exhibit 174

1.4.215. Analysis of the information demonstrated that although Sgt Fisk had not completed all of the freefall elements of the MFFO course due to aircraft availability, she had completed the ground training and some camera operator descents under the supervision of the ADW training system. The military training system did not allow for a full sign-off as an MFFO unless the activity had been conducted from all the required aircraft types. This was different to the British Skydiving qualification and as such, the two were separate qualifications. The panel was able to verify that she was qualified for the tasks she was undertaking on the day of the accident.

1.4.216. The panel concluded that Sgt Fisk had received sufficient training and the relevant briefs to carry out her duties as a camera operator and, therefore, assess camera operator training as **not a factor**.

1.4.217. The panel carried out a full review of Sgt Fisk's recorded qualifications, which included her parachute related competencies held on the Joint Personnel Exhibit 20 Exhibit 21

Administration system (JPA). The JPA record provided to the panel only recorded the British Skydiving competencies, with no UK military competencies identified. It was evident from Sgt Fisk's logbook that she had received several UK military parachuting jumping, instructional and despatching competencies since her PJI course in 2016. Additional evidence of these competencies was found within the ADW SharePoint site personal training records.[162] The panel acknowledged that her PJI logbook was the definitive record for her military qualification status, but made an **Observation** that all PJIs should have their role related competencies on the JPA system.

Medical

1.4.218. Sgt Fisk's PJI logbook had a signed entry for a level 4 medical on 25 Mar 2021 at the David Stone Medical centre, RAF Brize Norton.[163] Her Joint Medical Employment Standards were recorded as A3 L1 M1 E1, fit for PJI duties, with an expiry date in Mar 2022.[164] As part of the investigation, the panel also received a summary of her recent medical history from the Defence Medical Services. Whilst not directly linked to her medical record, her logbook also showed that she had attended the High Altitude, High Opening (HAHO) Course at the Aviation Medicine Training centre, RAF Henlow on 29 Apr 2019 which included hypoxia training.[165] Exhibit 176 Exhibit 28 Exhibit 335

1.4.219. In addition to her PJI medical records and in accordance with British Skydiving medical requirements, documents held at JSPC(W) showed that she had completed the following: Exhibit 177 Exhibit 178

a. British Skydiving Form 115E, licensed parachutist self-declaration of fitness to parachute, dated 29 Jul 2019.

b. British Skydiving Form 116A, solo parachute instructor medical certificate, dated 18 Oct 2019.

1.4.220. Based on the medical information provided, the panel assessed that there was no indication within Sgt Fisk's medical records to suggest that she had any illness or injury on 2 Sep 2021. The panel also considered whether hypoxia could have contributed to the accident but found no evidence to suggest that it was a factor in the events surrounding the accident. Sgt Fisk's medical status was, therefore, considered as **not a factor**. Exhibit 51

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162 MOD web-based collaborative platform for document management and storage.
163 RAF Form 7540.
164 MES Code A3 (Air) = Fit for duties in the air within the stated employment', L1 (Land) = Fit for unrestricted duty, M1 (Maritime) = Fit for unrestricted duty, E1 (Environmental and medical support) = Fit for worldwide service in all environments.
165 Hypoxia is reduced levels of oxygen in body tissue, which can be linked to ascents to high altitudes. Although hypoxia can cause confusion, occurrences are extremely rare in parachuting activity at altitudes below 12,000ft amsl especially when taking in to account the amount of time spent at 12,000ft amsl.

1.4.221. During the investigation the panel was provided with a JSPC(W) instructor document folder held by the CI, which included the British Skydiving forms pertinent to the JSPC(W) staff's role. Whilst reviewing Sgt Fisk's medical status, the panel noted that JSPC(W) did not hold copies of the British Skydiving medical forms for all staff members. The panel made an **Observation** that JSPC(W) needed to decide what records it was required to hold and update their orders accordingly. Exhibit 163

Fitness

1.4.222. All physical education requirements for JSPC(W) Service personnel were provided by RAF Brize Norton as part of the parenting agreement between the two organisations. Sgt Fisk's JPA records showed that she had completed the RAF Fitness Test (RAFFT) on the 6 Aug 2021 in which she achieved an enhanced pass.[166] Her records also identify that her previous RAFFT expired on 9 Jul 2021, meaning that she was out of date for her fitness test between 9 Jul and 6 Aug 2021. Exhibit 20

1.4.223. Whilst all physical education support was provided by RAF Brize Norton, JSPC(W) personnel did not appear as part of the trawl within JPA which would identify personnel who were out of date for their fitness test. The panel was unable to establish whether Sgt Fisk's period of expired RAFFT was attributed to this or the return to testing, post a policy-based cessation due to the COVID Pandemic. However, the panel was able to assess that Sgt Fisk was physically fit to conduct the duties associated with her trade and specialisation at the time of the accident. However, the panel acknowledged that she had conducted parachuting activity whilst on duty during the expired RAFFT period. The panel concluded that Sgt Fisk's fitness at the time of the accident was **not a factor.**

Fatigue, alcohol and distraction

1.4.224. Sgt Fisk was identified as the lead instructor for the week commencing 30 Aug 2021. Whilst attending to a personal administrative matter on one occasion, the use of a suitable stand-in for this did not compromise her working routine. The panel reviewed the programmed schedule for the week and found that due to meteorological conditions only one descent took place prior to the activity on 2 Sep 2021. The panel was also able to determine that there was no evidence of Sgt Fisk consuming alcohol prior to the accident. Exhibit 51 Witness 7 Witness 12

1.4.225. The panel was satisfied that the activity during the week leading up to the accident was routine and would not have induced any undue fatigue. The panel concluded that fatigue, alcohol or distraction were **not a factor**.

[166] Enhance Pass equalled a currency of 24 months.

Safe place

1.4.226. A safe place was defined as a place in which the controls, necessary to enable authorised activity and training to be conducted safely are present. It included the use of site-specific risk assessments for an activity through appropriate standing orders, such as a parachute operating manual. The panel considered the following under the SSW safe place: Exhibit 179

a. Organisation on the day of the accident.

b. Employers' responsibilities.

c. JSAT parachute regulations.

d. Risk assessments.

e. Defence Aerodrome Manual and WOTG DZ.

Organisation on the day of the accident

1.4.227. **The Robson Academy of Resilience (RAR).** The RAR was the training provider (TP) for Adventurous Physical Development Training (APDT), JSAT and Force Development (FD) as well as specialist training on behalf of the MOD. These JSAT activities were delivered by subordinate units known as Robson Resilience Centres (RRC). At the time of the accident all of these centres were grouped under the command of the RAR Resilience Wing (Res Wg). Exhibit 11

1.4.228. **The Robson Resilience Centre (Weston) (RRC(W)).** The RRC(W) was commanded by a squadron leader with the responsibility for the day-to-day management of the whole of RAF WOTG. In addition, the OC RRC(W) was responsible for supervisory oversight of the JSPC(W).

1.4.229. **JSPC(W).** Led by a flight lieutenant, JSPC(W) was responsible for the provision of FD and JSAT parachuting at RAF WOTG. For the purposes of sports parachuting activity, the DZ was authorised by British Skydiving as a parachute training organisation (PTO).

1.4.230. The parenting responsibilities for the provision of real-life support and facilities to JSPC(W) were split between RAF Cranwell and RAF Brize Norton. Exhibit 04

Employers' responsibilities

1.4.231. **HSWA.** Uniquely within sports parachuting, the MOD operated its PTOs as an employer and was, therefore, bound by the requirements of the HSWA. This required the MOD to provide a safe operating environment and equipment for their employees. Exhibit 180

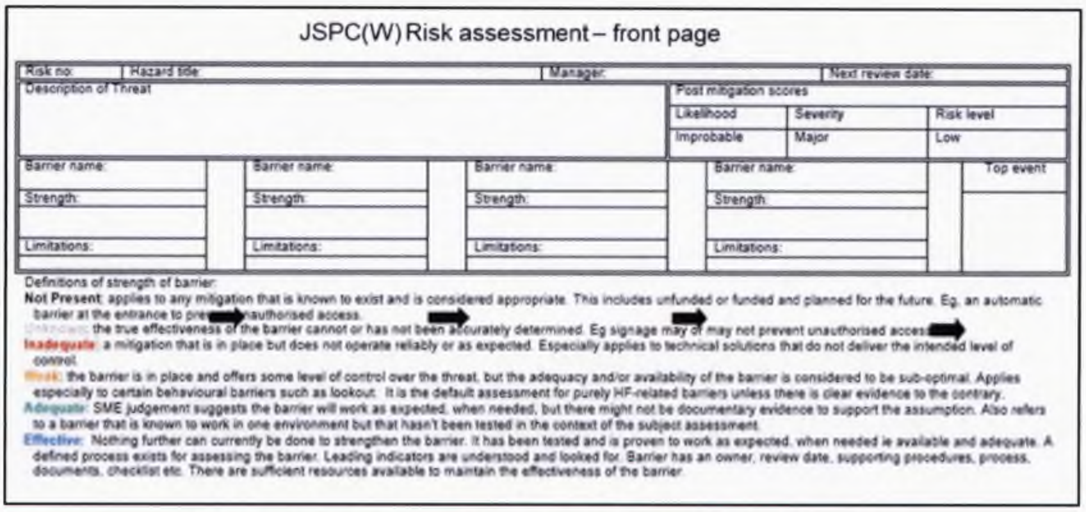
JSAT parachuting regulations

1.4.232. **The JSAT Parachute Operating Manual (POM).** In order to meet the requirements of the HSWA and all other subordinate Defence policies and Exhibit 116 regulations applicable to the activity, a JSAT POM was produced to cover any deficiencies in the rules set out within the BSOM. The JSAT POM was written by the RAR as the lead sponsor for JSAT sports parachuting within Defence.

Risk assessments (RA)

1.4.233. In accordance with British Skydiving policy all PTO RAs were to be recorded on Form 244b using the guidelines within Form 244a. Exhibit 181 Exhibit 182

1.4.234. The panel was provided an electronic copy of RAs for JSPC(W) which were produced using a local form (Figure 1.4.43 and Figure 1.4.44) as opposed to RAF RA Form F7548 directed by the No. 22 Gp Functional Safety Management Plan (FSMP) and JSP 375. Although the local form used the BowTie analysis methodology, which was the favoured method described in the No. 22 Gp Air Safety Management Plan, the format differed to that of recognised BowTies used within the Group. Further comment on the use of this method of RA is made within Para 1.4.307 of this report. Exhibit 183



JSPC(W) Risk assessment – front page

Risk no:	Hazard title:	Manager:	Next review date:

Description of Threat	Post mitigation scores		
	Likelihood	Severity	Risk level
	Improbable	Major	Low

Barrier name:		Barrier name:		Barrier name:		Barrier name:		Top event
Strength:		Strength:		Strength:		Strength:		
Limitations:		Limitations:		Limitations:		Limitations:		

Definitions of strength of barrier:

Not Present: applies to any mitigation that is known to exist and is considered appropriate. This includes unfunded or funded and planned for the future. Eg. an automatic barrier at the entrance to pre[illegible]nauthorised access.

Unknown: the true effectiveness of the barrier cannot or has not been [illegible]curately determined. Eg signage may [illegible] may not prevent unauthorised acces[illegible]

Inadequate: a mitigation that is in place but does not operate reliably or as expected. Especially applies to technical solutions that do not deliver the intended level of control.

Weak: the barrier is in place and offers some level of control over the threat, but the adequacy and/or availability of the barrier is considered to be sub-optimal. Applies especially to certain behavioural barriers such as lookout. It is the default assessment for purely HF-related barriers unless there is clear evidence to the contrary.

Adequate: SME judgement suggests the barrier will work as expected, when needed, but there might not be documentary evidence to support the assumption. Also refers to a barrier that is known to work in one environment but that hasn't been tested in the context of the subject assessment.

Effective: Nothing further can currently be done to strengthen the barrier. It has been tested and is proven to work as expected, when needed ie available and adequate. A defined process exists for assessing the barrier. Leading indicators are understood and looked for. Barrier has an owner, review date, supporting procedures, process, documents, checklist etc. There are sufficient resources available to maintain the effectiveness of the barrier.

Figure 1.4.43 – JSPC(W) RA (front page) example.

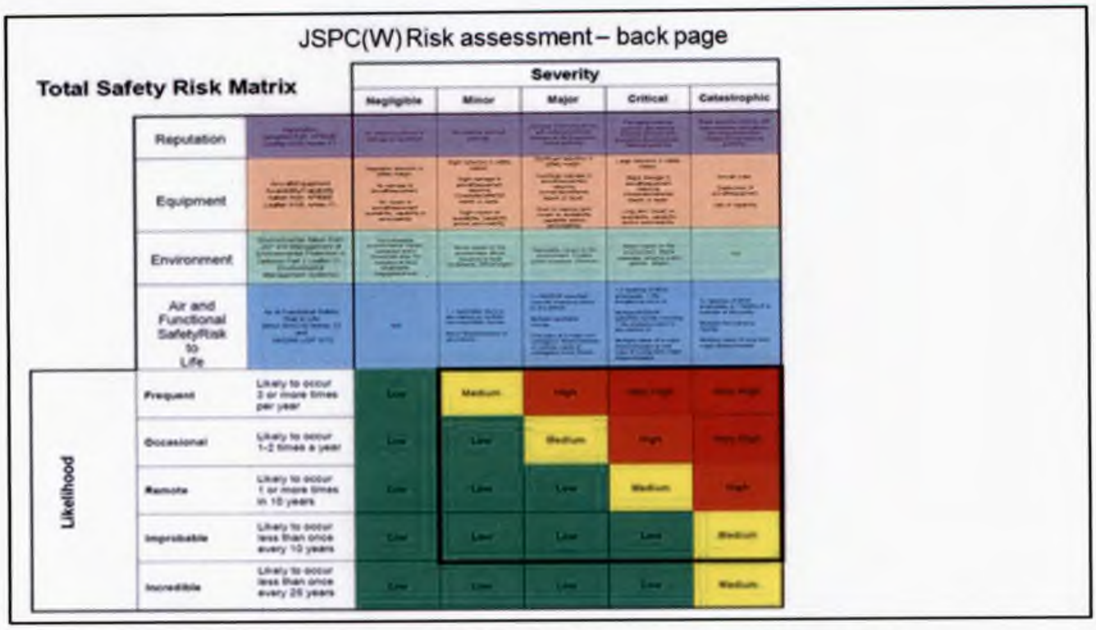


Figure 1.4.44 – JSPC(W) RA (back page) example.

Defence Aerodrome Manual (DAM) and WOTG DZ

1.4.235. The DZ was located within Danger Area 129 with jurisdiction over the airspace 2nm (3.7km) radius from the designated Point of Impact (PI) [167] from the surface up to flight level 120.[168] Both FE@R and FD/AT parachuting activity were carried out at the WOTG DZ, with the main user being ADW at RAF Brize Norton. Due to its use for FE@R activity, the DZ had also been subject to an Air Mobility Force HQ, No. 2 Gp DZ Recce Report, which identified the safe usable area (Figure 1.4.45), obstructions, hazards and other operating considerations. RAF WOTG was a British Skydiving PTO, licenced to conduct sports parachuting activity in accordance with the BSOM.

Exhibit 184
Exhibit 185
Exhibit 186
Exhibit 187

[167] The point of impact is designated as the desired point where the first parachutist or airdropped stores should land on all DZs.
[168] International Civil Aviation Organization states flight level as being 'A surface of constant atmospheric pressure which is related to a specific pressure datum, 1013.2 hPa (1013.2 mb), and is separated from other such surfaces by specific pressure intervals'. When using a pressure type altimeter calibrated in accordance with the standard atmosphere and set to a pressure of 1013.2 hPa (1013.2 mb), it may be used to indicate flight levels.

Figure 1.4.45 – RAF WOTG DZ safe useable area (within the red boundary).

1.4.236. The panel recognised that No. 22 Gp had carried out significant work to align RAF WOTG with the requirements of a Defence Aerodrome for both JSAT and FE@R activity. The panel concluded that WOTG DZ met all the requirements to conduct parachuting activity in support of Defence parachuting, including AT and FD, and was deemed **not a factor**.

Safe practice

1.4.237. Safe practice was defined as the safe conduct of any activity in accordance with drills, procedures, and instructions, to ensure the risk to life remained ALARP. Safe practice included the delivery of effective training, the briefing of all warnings, cautions and controls for the activity being conducted. The panel considered the following under SSW safe practice:

Exhibit 179

a. Operating documentation.

b. JSPC(W) procedures.

c. Personnel tracking.

Operating documentation

1.4.238. Throughout the investigation the panel examined the various operating documents which JSPC(W) were using. These included:

Exhibit 03
Exhibit 99
Exhibit 116

a. The BSOM.

b. The JSAT POM.

c. The JSPC(W) Standard Operating Procedures (SOP).

1.4.239. **BSOM.** The BSOM in circulation at the time of the accident was at amendment three, dated Jun 2021. The manual was separated into sections, which provided information regarding the various areas of British Skydiving activity. This included the classification of skydiver qualifications, training, and safety.

Exhibit 99

1.4.240. Within the BSOM the panel found examples of regulation or guidance that were open to interpretation. The panel determined that the ambiguous nature of some areas of the document meant that individuals or PTOs could choose their own definition of the requirement, for example, regarding canopy opening heights (Figure 1.4.46). The reader could interpret the direction as either the height that the canopy should be fully developed by or the time by which the deployment sequence (action of operating the main canopy deployment method) should be carried out by.

Exhibit 99

OPENING HEIGHTS

Minimum canopy opening heights for main parachutes:

4.1.	British Skydiving 'B' Licence skydivers and below	3,000ft AGL
4.2.	British Skydiving 'C' Licence skydivers and above	2,500ft AGL
4.3.	Student Tandem Skydivers	5,000ft AGL
4.4.	British Skydiving 'C' Licence holders, on displays	1,500ft AGL

Figure 1.4.46 – BSOM main canopy opening heights.

1.4.241. **JSAT POM.** The majority of the information within the JSAT POM was a 'cut and paste' of the BSOM. However, No. 22 Gp, as the lead sponsor for the activity, had included some additional information, regulation and direction that was intended to enhance the level of safety and assurance.[169] The JSAT POM stated that display parachuting was not included under the JSAT scheme and as such this chapter was left blank. Exhibit 188

1.4.242. The panel found at least one example where version control of documents on the Defence intranet was an issue. As an example, the panel made an **Observation** that depending on which organisation's intranet front-page was accessed, the associated link to the JSAT POM could lead you to a different version. When running an intranet search, an even wider number of versions were available. Of note, both versions accessed via the organisational front-pages preceded the latest updates made to the BSOM in Jun 2021. As such, personnel could have been working to out of date information. Exhibit 116 Exhibit 330

1.4.243. **JSPC(W) SOPs.** In addition to both operating manuals, JSPC(W) had site specific SOPs, dated Oct 2020. These SOPs directed the routines and procedures for all staff operating at JSPC(W). When updated, a red/green T-card system was used to alert the staff to read the latest amendment.[170] Exhibit 03

1.4.244. The panel noted that there was at least one example of a statement within the JSPC(W) SOPs that appeared to contravene the direction given within the BSOM. This was associated with the requirement for packing records to be maintained for each parachute in use as PTO equipment (Figure 1.4.47). A log was required to be maintained for every packing, re-packing and modification to the parachute to which they related. However, the JSPC(W) SOP for packing did not require the instructors to log the packing of their main canopies unless they had either packed them on behalf of someone else or had used a parachute system allocated to another staff member. Exhibit 03

10. **PACKING RECORDS**

10.1. PTOs will maintain a record for each parachute in use as PTO equipment.

10.2. Student Skydivers will maintain a record for their personal parachutes.

10.3. Packing records will log every packing, re-packing and modification to the parachutes to which they relate.

10.4. Records must incorporate the date of packing and signature of the holder of a relevant packing certificate, at each of the stages of packing that requires inspection.

Figure 1.4.47 – BSOM Packing records requirements.

1.4.245. The panel recognised the importance of operating manuals and SOPs but assessed that the duplication of information between them may have led to publications which did not align post amendment if the update cycle was not synchronised. This was evidenced by the various document review dates where changes did occur in the higher-level document (BSOM) but were not immediately captured within either the JSAT POM or SOPs. Exhibit 99 Exhibit 116

[169] The information included two additional sections: Expedition activity (section 15) and procedures (section 16).

[170] A system used to provide oversight to the CoC when a change to documentation has occurred, all personnel's cards would be turned red, once the new information had been read and signed for the card can be turned green.

1.4.246. The panel made an **Observation** that the JSPC(W) SOPs did not align with the BSOM requirements for PTO equipment packing records. The panel concluded that the review process for parachuting operating manuals and orders was not aligned and could lead to out-of-date information being presented and followed; this was, therefore, an **Other Factor**.

1.4.247. **Recommendation. Air Officer Commanding No. 22 Group should align the amendment cycle for the JSAT Parachute Operating Manual and standard operating procedures with the relevant higher-level policy and documentation.**

JSPC(W) procedures

1.4.248. In the following section the panel reviewed the JSPC(W) SOPs that were required to be carried out for the FD activity on 2 Sep 21. These included, but not limited to:

a. Briefings.

b. Authorisation.

c. DZ activation.

d. Aircraft manifest.

e. Meteorological conditions.

f. Incidents and emergency response.

g. Reporting.

Briefings

1.4.249. In accordance with JSPC(W) SOPs, all staff involved in the FD programme were present at the daily brief which covered the details outlined in the JSPC(W) Flight Authorisation Form.[171] The form completed by Sgt Fisk showed that she had conducted both the daily parachute and aircraft / parachute emergency briefs for the 2 Sep 2021. Exhibit 03 Exhibit 189

Authorisation

1.4.250. The flight authoriser allocated for the 2 Sep 2021 was the JSPC(W) CI, who had signed the JSPC(W) Form 15 following the daily brief. However, the panel noted that the RA element of Form 15 had not been completed. Exhibit 189

[171] RPCW Flt Auth Form 15.

DZ activation

1.4.251. On the 2 Sep 2021, the WOTG DZ was activated up to flight level 120 at 14:36 and deactivated at 18:22. This was coordinated by the JSPC(W) staff and was annotated in the Ops/ATC watch book in the manifest building after they contacted the following agencies: Exhibit 329

a. RAF BZN, Brize Radar.

b. Oxford Airport (Kidlington).

c. London Military (Swanwick).

Aircraft manifest

1.4.252. In accordance with the BSOM and the JSAT POM the aircraft manifests (JSPC(W) Form 14) for all four sorties were confirmed as completed as evidenced by a signature against each parachutist's name. PJI 3 confirmed that they had carried out Sgt Fisk's equipment check prior to boarding the aircraft for sortie four. They also stated that during the check they had questioned the configuration of her camera jacket and attachment to the parachute harness and requested that she perform an arch and reach for her BOC toggle. Sgt Fisk also confirmed that she was happy with the fitting and that she had worn the camera jacket in the same configuration for the previous two sorties. The panel assessed that all the necessary parachutist checks and relevant paperwork was completed prior to the accident sortie. Therefore, the panel determined the pre-boarding requirements for a JSPC(W) sortie were **not a factor**. Exhibit 23 Witness 15

Meteorological conditions

1.4.253. The Met Office at RAF Brize Norton issued a meteorological forecast 24hrs in advance of planned parachute activity; JSPC(W) received the forecast for 2 Sep 2021 at 08:36 on the morning of the 1 Sep 2021. This was updated by the daily freefall DZ forecast which was issued at 05:40 on the day, valid for the period 07:00 to 19:00. This forecast provided temperature, wind direction and speed, at increments of 1,000ft from the surface to 12,000ft agl, as well as any expected cloud cover. On the morning of 2 Sep 2021, the freefall DZ forecast identified that although WOTG would have overcast to broken cloud (5-7 oktas) at 1,000ft to 4,500ft agl, between 07:00 to 13:00 it would potentially lift to between 3,000ft to 4,500ft agl and reduce to broken to scattered cloud (3-4 oktas) between 13:00 and 19:00. Exhibit 38 Exhibit 39

1.4.254. Section eight of the BSOM provided the meteorological skydiving limitations. It stated the maximum ground wind speed limitations, for both accelerated freefall and category system student skydivers, as 15 knots, whereas for an 'A' licenced and above skydiver, this was 20 knots (this also included student tandem skydivers). The minimum flight visibility was to be at least 5km. However, no specific cloud limitations were stated other than, 'Skydivers must not leave the aircraft if, at the point of exit, the ground between the opening point and the intended landing area is not visible'. Exhibit 99

1.4.255. The panel was also provided with the Meteorological Aerodrome Report and Terminal Area Forecast, which reported that the cloud in the Oxford area as being broken to scattered/broken between 2,700ft to 3,200ft agl between 14:50 to 17:50.[172] Meteorological conditions on sortie four were similar to the previous three sorties and consistent with the issued Meteorological forecasts, as was confirmed by JSPC(W) staff and the aircraft pilot in interview. The reported conditions prior to the descent were as follows: Exhibit 129

a. Cloud, broken (5-7 oktas) at 3,800ft, thickness 300ft.

b. Wind direction, 040 degrees.

c. Surface winds, 15 – 18 knots.

1.4.256. PJI1, acting as JM for sortie four provided evidence that at the point of exit a layer of cloud between the ground and aircraft was visible but had significant gaps allowing identification of the WOTG main hangar (Figure 1.4.48). Exhibit 322

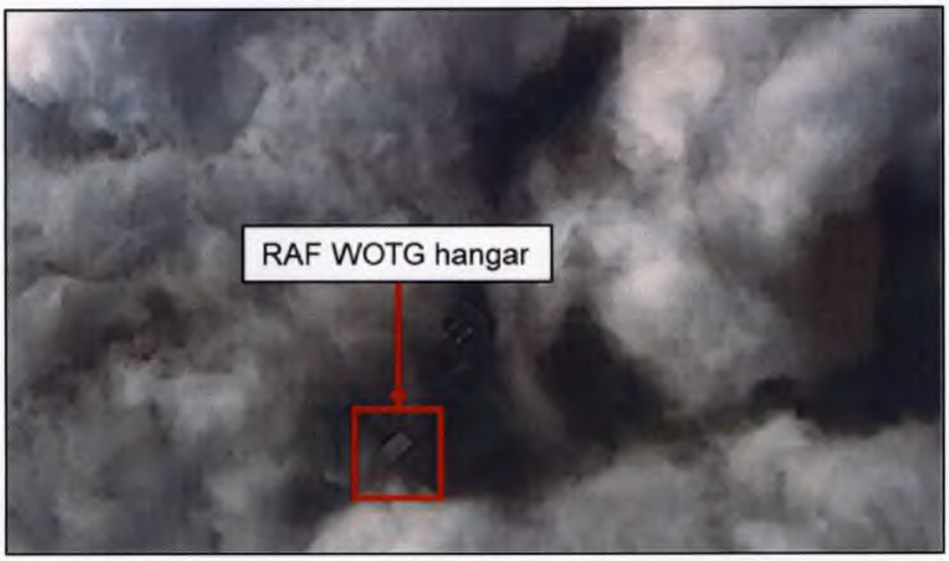


Figure 1.4.48 – RAF WOTG hangar seen on sortie four.

1.4.257. Data showed that Sgt Fisk passed through the cloud layer between approximately 3,500ft and 3,000ft agl, in what appeared to be a gap, as seen from the aircraft. Exhibit 42

1.4.258. The panel agreed that the meteorological conditions on the day were within the current guidelines for parachuting and also agreed that the conditions, combined with the familiarity of the surrounding area, were suitable for the experience levels of the personnel involved. The panel did note, however, that these parameters differed from those used for UK military parachute activity.

1.4.259. The panel determined that the forecast was consistent with the meteorological conditions on the day, including cloud and wind limitations laid down in the BSOM and, therefore, concluded that the weather was **not a factor**.

[172] METARs are submitted in 30min intervals iaw CAA publication CAP 746.

However, the panel believe that a review of the meteorological limitations used, against those mandated for military parachuting, would remove any ambiguity in Defence sports parachuting operating limits and was, therefore, an **Other Factor**.

1.4.260. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to define the meteorological limitations to be used for Joint Service Adventurous Training parachuting activity.**

Incidents and emergency response

1.4.261. JSPC(W) held several documents outlining the procedures to be followed after an incident, including a flow chart, located in the manifest tin,[173] as published within the WOTG Defence Aerodrome Manual (DAM).[174] The JSPC(W) SOP provided direction in line with the BSOM and British Skydiving Form 146 (incident procedures), whereas the WOTG DAM guidance was in accordance with the MAA Manual of Aircraft Post Crash Management. The panel noted that JSPC(W) conducted a crash rescue response exercise in Mar 2021 prior to the parachuting season to ensure familiarity with the procedures as mandated within the Unit SOPs. Exhibit 190 Exhibit 191

1.4.262. **Incident reporting process.** Following the immediate requirement to call the emergency services by dialling 999, the Unit's initial reporting process differed between the Unit SOP and DAM, with the SOP leaning towards British Skydiving being the primary point of contact rather that the MOD's Deputy Chief of Defence Staff Duty Officer (DCDSDO). The DCDSDO was key to the swift enablement of supporting functions and provided an ability to relieve the Unit of some of the callout procedures which would have distracted them from dealing with the incident. Exhibit 03 Exhibit 191 Exhibit 190

1.4.263. Whilst analysing the reporting requirements and processes, the panel discovered that this issue was not isolated to JSPC(W), with other AT centres also not clearly defining the DCDSDO as the primary point of contact post a major incident. The panel made an **Observation** that a delay to the correct reporting process could hinder the ability of the DCDSDO to offer immediate support and ensure that the correct personnel are aware of the incident.

Reporting

1.4.264. Following an incident there was a requirement to complete a Defence Air Safety Occurrence Report (DASOR) within the Air Safety Information Management System (ASIMS).[175] This was not completed for this incident due to conflicting advice by the MAA stating that this was not a requirement. Confusion existed between the MAA and single Service (sS) safety centres as to the reporting requirements and as such, the advice given was not coherent. The panel concluded that the ambiguity in reporting procedures for incidents relating Exhibit 192 Exhibit 359

[173] A metal container kept at the manifest area with all incident and emergency response documentation held within it.
[174] Annex B to Annex L of the WOTG DAM issue 7.
[175] A DASOR allowed Defence to investigate occurrences to identify lessons and trends in order to enhance aviation safety.

to non-military parachuting required resolving and was, therefore, an **Other Factor**.

1.4.265. **Recommendation. Director Military Aviation Authority should expand the use of the Air Safety Information Management System to include the reporting of Defence JSAT and sports parachuting incidents.**

Personnel tracking

Exhibit 01
Witness 09

1.4.266. Once it was clear that Sgt Fisk was missing, the evidence showed that it took 45 minutes to locate her, with the only method of potential communication being her personal mobile phone. Had she sustained survivable injuries, the time taken to start any medical intervention could have had a significant impact on a successful outcome. The panel could find no evidence that any risk assessment process had identified an inability to find a missing parachutist. As such, no consideration of the use of location aids was discussed within any emergency response plan. The lack of a risk assessment associated with an inability to locate a missing parachutist was considered an **Other Factor**.

1.4.267. **Recommendation. Deputy Commander Operations should convene a working group across Defence sports parachute associations, display teams and AT providers to mandate a risk assessment for an inability to locate a missing parachutist following an incident, in order to identify any risks to life and where appropriate provide suitable mitigations.**

Section summary

1.4.268. The panel identified numerous other factors and made recommendations within Section 2 that have the potential to enhance the safety of parachuting activity within MOD. The panel was also tasked to consider all other aspects of parachuting within Defence, its findings follow in Section 3.

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Section 3: Wider parachuting within Defence.

Sports parachuting within Defence

1.4.269. As part of the investigation the panel were tasked to look at all aspects of sports parachuting within Defence. The following areas were considered:

a. Governance.

b. Policy.

c. Assurance.

d. Training.

e. Reporting.

Governance

The CAA and British Skydiving

1.4.270. The CAA was the regulatory authority for sports parachuting in the UK, as defined in Civil Aviation Publication (CAP) 660. This document acknowledged British Skydiving as the National Governing Body for sports parachuting and stated that: Exhibit 07 Exhibit 193

> 'The British Skydiving Operations Manual, as amended, represents the accepted standard for sport parachuting in the United Kingdom (UK) and British Skydiving Parachute Training Organisations (PTOs) and Display Teams must adhere to the provisions and guidance in that manual in order to achieve an acceptable level of safety in the conduct of their operations'.

1.4.271. **The exposition and schedule of approval by the CAA.** In order to agree the boundaries of their jurisdiction, British Skydiving drafted an exposition and schedule between themselves and the CAA. The document's stated purpose was: Exhibit 08 Exhibit 194

> 'The purpose is to describe and define the responsibilities, control, and inspection procedures of British Skydiving, which assure compliance in terms of approval granted by the CAA'.

The exposition contained a copy of the 'terms of approval' as signed by the CAA, outlining the functions for which British Skydiving was approved to undertake.

1.4.272. **The memorandum of understanding between the CAA and the British Parachute Association.**[176] As part of the agreements outlined within the exposition and schedule, the CAA jointly signed a memorandum of understanding with the British Parachute Association. This set out an agreement Exhibit 195

[176] British Skydiving is the trading name of the British Parachute Association Ltd.

for the administration and oversight of sports parachuting operations conducted by British Skydiving affiliated PTOs.

Military use of sports parachuting

1.4.273. Fully described in Part 1.3 (Para 1.3.5), sports parachuting was categorised as below (Figure 1.4.49): Exhibit 196

a. JSAT - Courses and expeditions (including FD).

b. Sports parachute associations.

c. Sports parachute display teams.

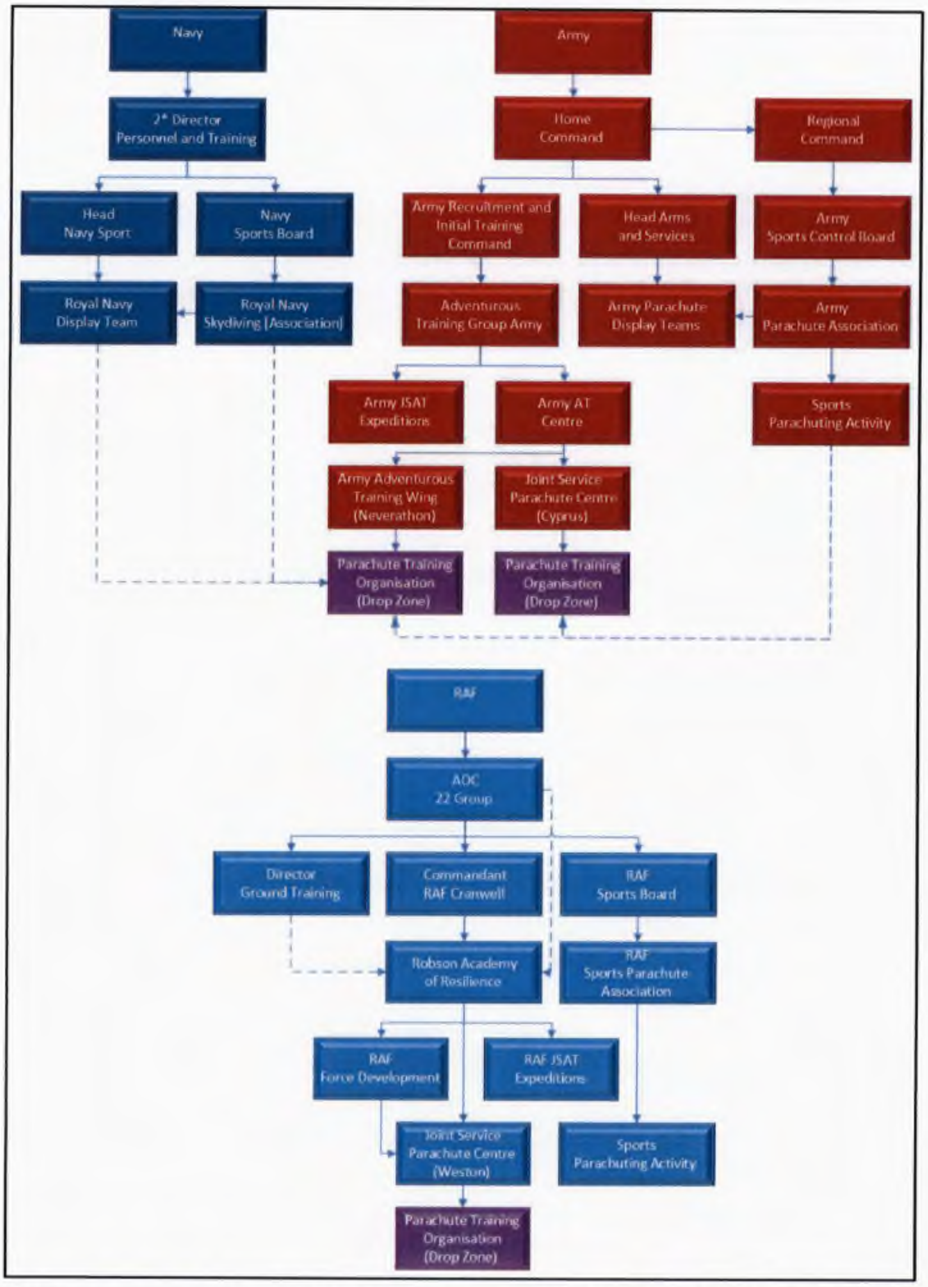

Figure 1.4.49 – Command structure of sports parachuting in Defence.

1.4.274. The panel identified several key organisations and positions that were responsible for the governance of JSAT parachuting activity (Figure 1.4.50): Exhibit 13

Exhibit 197

a. **Head Training, Education Skills, Recruiting and Resettlement (Hd TESRR).** Hd TESSR on behalf of Assistant Chief of Defence Staff (ACDS) Personnel Capability (Pers Cap), delegated the day-to-day coordination of Defence AT policy to the Chairman of the Joint Service Adventurous Training Steering Group (JSATSG). Hd TESSR was the author of the adventurous training regulations directed within JSP 419, Adventurous Training in the UK Armed Forces.

Exhibit 198

b. **The Joint Service Adventurous Training Steering Group (JSATSG).** JSATSG was the tri-service committee for AT in the UK Armed Forces. Its primary role was to develop AT policy to enable the JSAT Scheme to meet joint and single Service (sS) requirements.

c. **AOC No. 22 Gp RAF.** On behalf of the RAF, AOC No. 22 Gp was responsible, as the sS sponsor, for JSAT parachuting.

d. **The Robson Academy of Resilience (RAR).** As part of No. 22 Gp, the RAR was the lead for JSAT air activities within Defence, as well as being responsible for the delivery of all JSAT courses within the RAF AT centres. As the lead for JSAT parachuting it was responsible for publishing the JSAT POM (also see 1.4.227).

e. **Army Recruiting and Initial Training Command (ARITC).** ARITC were responsible for all recruiting, selection and basic training of soldiers, and the recruitment and selection of Army officers. In addition to these responsibilities, the Army's Adventurous Training Group formed under this 2* Command.

f. **Adventurous Training Group (Army) (ATG(A)).** On behalf of ARITC, the ATG(A) delivered the Army AT capability including JSAT parachuting at two Army led centres.

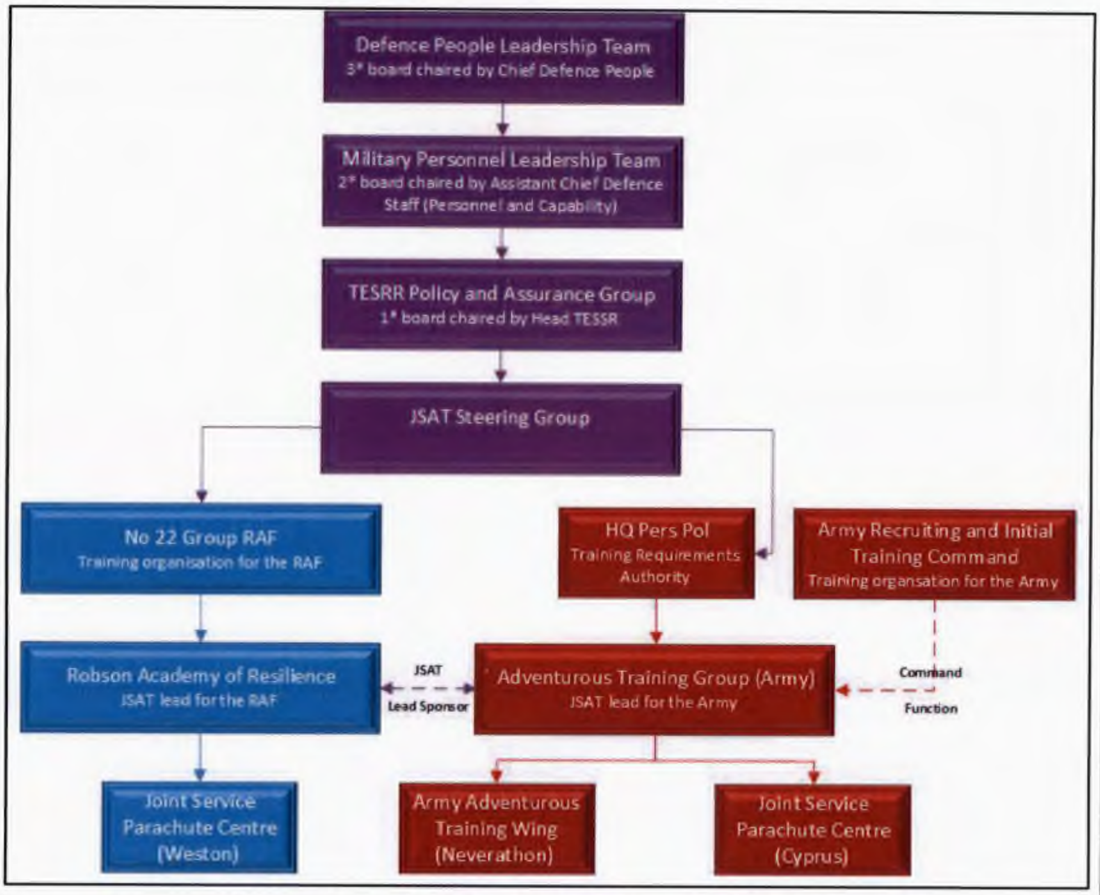

Figure 1.4.50 – Organisational structure for JSAT parachuting.

1.4.275. **JSAT parachuting sS sponsor.** Although the RAF were nominated as the sS sponsor for JSAT parachuting, JSP 419 was unclear as to the boundary of responsibility delegated to the role. Defence policy usually defines key language in the glossary or as an annex in the form of a terms of reference (TOR). However, the panel was unable to clearly determine the authority of the sponsor other than through inference within the regulations. The panel identified that whilst sS sponsors for AT were designated within JSP 419, the lack of clear guidance as to the duties and responsibilities for sS sponsors was unhelpful in identifying the sponsor's authority to direct activity. Exhibit 13 Exhibit 199 Exhibit 200

1.4.276. The panel concluded that the lack of clear guidance for the duties and responsibilities for sS AT sponsors was very likely to be the catalyst for observed differences between sS authorities in the delivery, assurance and risk analysis of the same activities. This was an **Other Factor**.

1.4.277. **Recommendation. Assistant Chief of Defence Staff (People Capability) should update Joint Service Publication 419, in order to provide direction and guidance on the duties and responsibilities of single Service sponsors for their delegated adventurous training activities.**

1.4.278. **JSAT expeditions.** Expeditions took place under the provisions made within JSP 419 and the JSAT POM. Approval was granted for parachuting expeditions through the submission of a JSAT Form Alpha (JSATFA), outlining the activity and planned programme. Technical approval was given by a Exhibit 201 technical authority (TA) against a list of requirements outlined within the JSAT POM. The technical authorities were listed as the OC JSPC(W) and the Commandant, Army Adventurous Training Air Wing, Netheravon.

1.4.279. Parachuting expeditions were led by a parachute lead instructor (PLI) whose responsibilities were outlined with the JSAT POM. If parachuting equipment other than that available from the JSAT equipment pool was to be used, then the responsibility for its assurance was delegated to the PLI. Exhibit 202 Exhibit 203

1.4.280. The requirements for approving expeditions were extensive, however, within the JSAT POM it was footnoted that: Exhibit 204 Exhibit 205

> 'It is recognised that the current JSATFA does not suit the technical complexity of a parachute expedition and it is hoped in time to issue a more comprehensive version specifically designed for the activity'.

This comment related to the inability to outline the full qualifications of instructors, and a separate process was, therefore, in place to pass this information. However, in scrutinising the full approval process, the panel noted that there was an accepted practice whereby the TA was not required to review the suitability of equipment used by an expedition if it was not issued by either Army Adventurous Training Air Wing Netheravon or JSPC(W). Whilst reviewing the authorisation process the panel found that the details of the equipment used on one expedition was not highlighted on the JSATFA. It transpired that in accordance with the JSAT POM, the requirement for assuring the suitability of equipment not issued by a JSAT parachuting centre was left to the PLI, a position that provided no independence within the assurance process. In addition, the panel also noted that no provision was made within the JSAT POM, for the use of individual unit-owned publicly-funded equipment outside of the AT equipment pool.

1.4.281. The panel concluded that the assurance process outlined within the JSAT POM was not robust and did not cater for all scenarios where the MOD holds a duty of care. It was, therefore, considered to be an **Other Factor.**

1.4.282. **Recommendation. Air Officer Commanding No. 22 Group should update the expedition assurance process within the Joint Service Adventurous Training Parachute Operating Manual, in order to ensure that it is suitable for all expedition scenarios.**

1.4.283. **Recommendation. The Chair of the Joint Services Adventurous Training Steering Group should update the Joint Service Publication 419 assurance procedures and documentation for Joint Service Adventurous Training expeditions, in order to ensure that they are suitable for all Joint Service Adventurous Training activities.**

1.4.284. **Sports parachuting associations.** Each of the Services had a sports parachuting association, governed by their respective sS authorities. The associations' objectives were to promote and support sports parachuting for active and retired military personnel, and consisted of the following:

a. Royal Navy Skydiving [Association].

b. Army Parachute Association (APA).

c. Royal Air Force Sports Parachute Association (RAFSPA).

1.4.285. **Sports parachute display teams.** Sports parachute teams operated within both the Army and the Royal Navy. These were publicly funded and governed through their respective sS authorities.[177] The full list of teams was:

a. Royal Navy:

(1) Royal Navy Raiders. Exhibit 207

b. Army:

(1) The Red Devils (Parachute Regiment). Exhibit 206

(2) The Tigers (Princess of Wales Royal Regiment).

(3) The Silver Stars (Royal Logistics Corps).

(4) The Lightning Bolts (Royal Electrical Mechanical Engineers).

Non-combat parachuting governance boards (NCPGB)

1.4.286. NCPGBs were established as a result of a fatal parachute incident at the Rhine Army Parachute Association, Bad Lippspringe, Germany in Sep 2015. That Inquiry identified inadequate assurance and regulation surrounding both association and display parachuting within Defence. As a result of this finding, and broader observations, the panel made several recommendations regarding the governance and assurance of AT, sports and display parachuting activity. This led to the formation of the NCPGB, chaired and managed by RAF No. 22 Gp. They were deemed to be the most appropriate organisation, due to their SQEP, as the sS sponsor for AT parachuting. This governance board provided the required coherence between the different organisations which had been identified as lacking by the Inquiry. Exhibit 13 Exhibit 208

[177] The RAF operated a military display team.

1.4.287. A total of three governance boards took place before it was noted in the minutes of the meeting that: Exhibit 208

a. 'Once the SI recommendations had been answered the NCP [non-combat parachute] body should be disbanded'.

b. 'There is no requirement for a centralised governance and regulatory board for the NCP community, but wider assurance was encouraged'.

c. The 'Community should work with each other to improve areas such as:

(1) Assurance.

(2) Safety assessments.

(3) SMS.

(4) Risk management.

(5) Reporting and analysis.

(6) Medical evacuation plans.

(7) Recognition and adherence to current regulations (eg confusion over on-duty status and insurance requirements)'.

1.4.288. No further governance boards took place after Oct 2019 and the proposed working group was never established. As a result, only JSAT parachuting had periodic working groups as part of the required military governance activity. The panel agreed that the intent to establish the NCPGB was limited to the requirement to close the Bad Lippspringe recommendations, and assessed that its disbandment, before the formation of the proposed alternative, was premature. Throughout the investigation the panel noted informal comments from all sports parachuting stakeholders within Defence, that the NCPGB had been extremely beneficial, and the lack of an alternative was unhelpful.

1.4.289. The panel noted that the differing approach to risk management by the various sports parachuting organisations within Defence, demonstrated how the lack of a governance board prevented coherence across the domains. As an example, there was a difference in opinion as to the use of camera jackets between AT and association activity following the accident at WOTG, as well as for the setting of AAD heights. Whilst this did not mean that either approach was incorrect, the lack of consistency could be seen as symptomatic of not having a harmonised governance structure. Exhibit 16 Exhibit 209 Exhibit 210 Exhibit 17

1.4.290. In the opinion of the panel, the removal of the governance board led to several incidents of difference in risk management and operating procedures amongst the parachuting user groups. Whilst the panel understood that the onus for the management of risk rested with the relevant sS authorities, the lack of coherence that this caused prevented Defence from demonstrating a unified approach to safety.

1.4.291. The MOD had a responsibility to fulfil the regulations of external government agencies such as the HSE, who do not differentiate between individual Defence organisations. The panel concluded that it was hard to defend any differences in operating procedures or risk management for highly desirable but non-essential outputs such as sports parachuting. The panel identified that sports parachuting, as a Sports England recognised high-risk activity, should be governed by a single board to manage and cohere the acceptable level of risk and operating procedures within Defence. This was an **Other Factor**. Exhibit 212 Exhibit 213

1.4.292. **Recommendation. The Armed Forces Sports Board should establish a requirement for an Armed Forces sports association for high-risk sports, in order to provide a coherent governance and safety management structure within Defence**.

The Adventurous Training Safety Regulator (ATSR)

1.4.293. The ATSR formed part of the Defence Land Safety Regulator (DLSR). From Apr 2016, the ATSR became responsible for the inspection and licencing of all MOD centres delivering Type 1, 2 and 4 JSAT activities.[178] The ATSR worked closely with the Adventure Activities Licencing Service and relevant National Governing Bodies to provide guidance and direction to the Defence community of adventurous training. The ATSR was staffed by adventurous training specialists with experience in the following disciplines: Exhibit 211

a. Policy and regulation.

b. Legislation compliance.

c. Inspectorate.

d. Environment.

e. Audit and inspection functions.

f. Enforcement.

1.4.294. The ATSR developed, maintained, and promulgated AT regulation, and enabled safety and environmental protection to be regulated for the ten core disciplines against DSA 03 ATSR DCoP (see Para 1.4.315) and JSP 419.[179] The ATSR's main function was to provide 3rd party assurance of JSAT centres, ensuring each of the centres and AT providers were safe to operate. This was Exhibit 13 Exhibit 214

[178] Type 1 (T1) - Phase 1 or Phase 2 training, Type 2 (T2) – Unit training and Type 4 (T4) – JSAT courses.
[179] Offshore sailing, sub aqua diving, canoeing/kayaking, caving, mountaineering, mountain biking, skiing, gliding, parachuting and paragliding.

achieved through an assurance inspection programmed at a periodicity determined by the risk associated with the activity provided by a centre.

1.4.295. Although AT parachuting was regulated through the ATSR, associations and display parachuting within Defence had no regulatory body to provide oversight. As AT used sports parachuting as a vehicle for its outputs, and as all sports parachuting activity attracted on-duty status, the panel concluded that all disciplines within the sport warranted similar regulatory oversight. The panel made an **Observation** that a single governance structure for sports parachuting within Defence would ensure coherence across all the Services.

'On Duty' status

1.4.296. On duty status was associated to all military sports parachuting activities and all three services had the same policy in place. As an example, the Army provided on duty status if the following conditions were met: Exhibit 215 Exhibit 216 Exhibit 217

a. When parachuting for sport, Army Queen's Regulation (QR) 14 provided the definition for 'Duty Status' as follows:

(1) The activity was compulsory as part of training or organised fitness programme.

(2) Service personnel were selected by a Service authority to represent a Service unit and training for the sport; or the activity included organised training for such teams.

(3) Service personnel taking part in sport authorised and supervised by a Service authority.

b. When participating in correctly authorised JSAT activities (as part of a formal expedition or on a recognised course at a JSAT Centre) Service personnel were considered to be 'On Duty'.

c. The Army Policy and Resources Committee agreed that Army sports parachute display teams' activity was core business and team members were therefore 'On Duty' when conducting, or training for a display.

1.4.297. **Duty of Care (DoC).** DoC existed as a concept of the relationship between the employer and employee. Individuals were owed, and owe, an obligation to ensure that they and others did not suffer any unnecessary and foreseeable harm; this applied to all service personnel whilst on duty. DoC and the surrounding responsibilities were governed under the HSWA. When sporting activity was authorised by the appropriate body, participants, both players and officials, were placed on duty and the MOD had a duty of care responsibility for that activity. Where regulations by sports NGBs did not mitigate the risk to life adequately or to the standard required by Defence regulation, sports associations were to establish their own risk management and assurance systems. Where sport was used for other on duty activity, such as AT, the appropriate AT command chain was required to fulfil this obligation. This was bolstered with the requirement that where Defence activity had the potential to Exhibit 218 Exhibit 219 Exhibit 220 Exhibit 221 Exhibit 222 generate a credible and reasonably foreseeable risk to life, and where legislation and DoC measures were insufficient to provide adequate mitigation, duty holding was to be implemented. If duty holding was required, these risk to life activities would be managed between three accountable duty holders.

1.4.298. **Duty holders.** Duty holders were empowered and formally appointed through a letter of delegation, which was required to be formally accepted, confirming the understanding of their duties and responsibilities as a duty holder. Duty holders were required to actively manage risk to life by mitigating the risk to a level that was considered ALARP and tolerable. When duty holding was implemented, it supplemented and enhanced the DoC arrangements already in place. In the case of risk to life activity within the RAR, the duty holder construct was as follows:

Exhibit 219
Exhibit 223
Exhibit 225
Exhibit 226

a. Senior Duty Holder (SDH) – Chief of the Air Staff (CAS).

b. Operational Duty Holder (ODH) – AOC No. 22 Gp.

c. Delivery Duty Holder (DDH) – Comdt RAR.

1.4.299. **DoC vs duty holding.** For JSAT and sports parachuting activity, DoC and duty holding was applied differently across the three Services. The Army viewed all AT, and their display parachuting, as a credible risk to life requiring a duty holding construct to manage, oversee, and mitigate the risk to ALARP and tolerable. The RAF considered AT manageable under DoC arrangements and the Navy viewed their display parachuting as only requiring a DoC arrangement. From an external agency point of view this would likely be considered as irregular in its overall management.

Exhibit 220
Exhibit 227
Exhibit 228
Exhibit 229
Exhibit 231

1.4.300. Whilst each risk holder was required to decide on the perception of risk, the panel noted that a non-coherent approach could cause confusion when personnel were working between AT centres or during pan-Defence activity such as during expeditions. The panel concluded that a single view on whether sports parachuting required duty holding was needed. Without it, there was a lack of clarity and coherence across Defence. This was an **Other Factor**.

1.4.301. **Recommendation. The Armed Forces Sports Board should mandate the requirement for a pan-Defence sports parachuting operations manual, in order to ensure coherence across all sports parachuting disciplines.**

1.4.302. **Letter of delegation.** The Chief of the Air Staff sent a letter to the Comdt RAR delegating responsibility to act as the functional safety DDH under the direction of the AOC No. 22 Gp. Within this letter, directed responsibilities were formally issued:

Exhibit 232

> 'Several endurance activities including survival and evasion trg, and specialist military training including some AT which present a credible and reasonably foreseeable RtL [risk to life]'.

1.4.303. The panel learned that the letter of delegation was never formally accepted, as the DDH was unclear on what was meant by the term 'some AT'. The issue was staffed back up the chain of command by the proposed DDH and remained unresolved at the time of the incident. A new version of the letter was noted as still containing the same functional safety DDH responsibility for 'some AT'. The panel agreed that the letter of delegation from the Chief of the Air Staff was ambiguous as it did not outline exactly what activities were being delegated as requiring duty holding. The panel considered the ambiguity within the letter of delegation to be an **Other Factor**. Exhibit 230 Exhibit 233 Witness 01

1.4.304. **Recommendation. The Chief of the Air Staff should clearly define what Royal Air Force adventurous training has been identified as requiring duty holding by the functional safety Delivery Duty Holder, in order to prevent ambiguity.**

Aviation safety vs functional safety

1.4.305. AP8000, the RAF's Safety and Environmental Management System (SEMS) outlined the management of AT and association sport, with both activities categorised as functional safety. Military parachuting was aligned to air safety due to its unique operational outputs (Figure 1.4.51). Exhibit 234 Exhibit 235

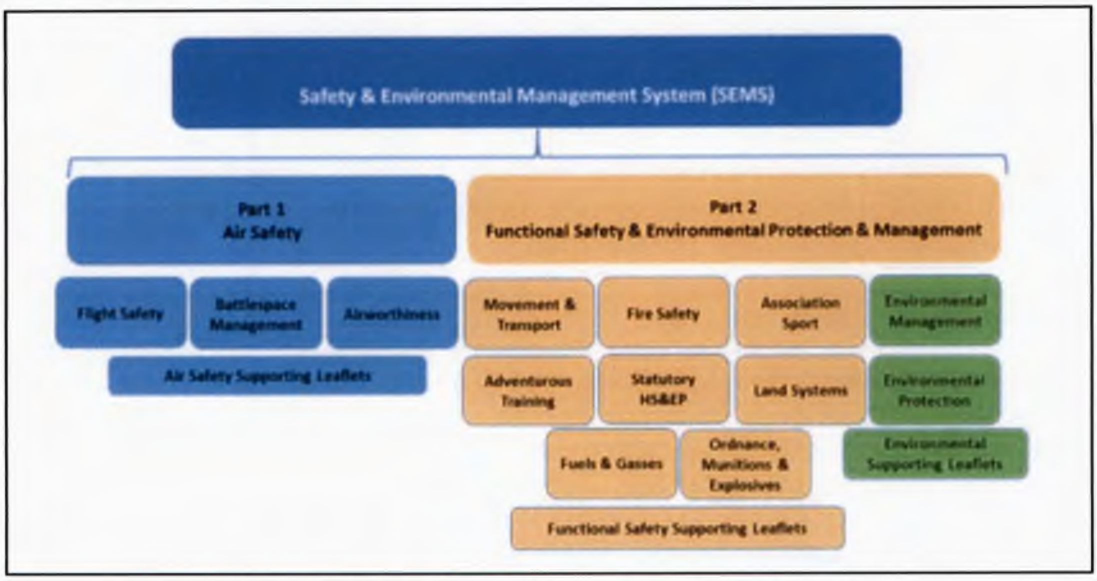

Figure 1.4.51 – Air safety vs functional safety.

1.4.306. The panel assessed the management of JSAT parachuting within the various levels of RAF safety publications to be contradictory. AP8000 and the No. 22 Gp Functional Safety Management Plan (FSMP) directed that all AT should be managed under functional safety, with no perception of additional safety or other factors that would require further mitigations. However, the JSAT air activities Air Safety Management Plan (ASMP) produced by No. 22 Gp, required the activity to be managed under elements of the air safety construct, due to the organisation identifying this as the safer way of managing JSAT parachuting safety. Exhibit 235 Exhibit 236 Exhibit 237 Exhibit 238 Exhibit 240 Exhibit 231

1.4.307. As a result of this, the panel identified that the RAR were not conducting risk assessments in line with AP8000 or JSAT policy. In addition, the organisation was using a modified version of the 'BowTie', which was self-generated with no official standing within safety policy. AP8000 described the BowTie as an analysis tool to identify hazards, barriers and mitigations, but it did not form a risk assessment alone. If used, it should have been used in its full form, or would lose its ability to analyse all aspects of the risk being presented. The ASMP was, therefore, at odds with how the safety process for AT was directed to be managed. In addition, the panel noted that by using a different model, the safety management approach was difficult to map across to other JSAT parachuting centres. Whilst the panel noted that the organisation was attempting to apply what they perceived to be the best model to manage the risk, the lack of associated policy and guidance hindered the ability for Defence to maintain a coherent approach to safety.

Exhibit 240
Exhibit 241
Exhibit 242
Exhibit 243
Exhibit 244
Exhibit 245
Exhibit 246
Exhibit 247
Exhibit 248

1.4.308. In conclusion, whilst the panel did not disagree with the use of air safety for JSAT air activities by the RAR, they believed that formal guidance should be directed within the relevant sS SEMS and JSAT policy to support this model. Due to the similarities in the activities and the crossover in lessons that could be identified across all parachuting disciplines, the panel assessed that it would be logical for the Military Aviation Authority (MAA), as the regulatory authority for military parachuting, to offer guidance on the appropriate safety model for sports and JSAT parachuting. The panel concluded that the lack of formal guidance within the relevant sS SEMS and JSAT policy was an **Other Factor**.

1.4.309. **Recommendation. The Inspector of Safety Royal Air Force should engage with the Military Aviation Authority and any other DSA regulator as required, in order to agree on the appropriate safety governance model for RAF sports parachuting and JSAT parachuting.**

Military parachuting (FE@R)

1.4.310. Military parachuting activity was conducted to train personnel in operational techniques to produce FE@R for front-line operations. This activity was governed by No. 2 Gp RAF as the ODH for all military parachuting within the MOD, and was regulated by the MAA.

The Military Aviation Authority

1.4.311. The MAA was responsible for the regulation, assurance, enforcement and certification of the Defence air environment, including the safe design and use of military air systems. Through independent audit, oversight and continuous surveillance, the MAA provided the Secretary of State for Defence, through the Director General (DG) Defence Safety Authority (DSA), the necessary assurance that the standards of air safety were being maintained in delivering operational capability. Military parachuting was referred to as FE@R parachuting which also encompassed Airborne Forces Equipment (AFE) and Aerial Delivery Equipment (ADE).

Exhibit 249
Exhibit 250
Exhibit 251

1.4.312. The MAA recognised and regulated FE@R parachuting due to its unique outputs for military use, with significant emphasis placed on the procurement and safety of AFE. Whilst sports parachuting was regulated through the CAA, there was significant crossover with military parachuting in the delivery of the activity, especially when utilising sports parachuting for training and currency purposes. The uniqueness of the MOD acting as an employer for sports parachuting led the panel to the conclusion that the MAA was likely to have been better placed to regulate all parachuting within Defence. The lack of regulation for sports parachuting within Defence was an **Other Factor**.

1.4.313. **Recommendation. Director General of the Defence Safety Authority should recommend the requirement for all sports parachuting within the armed forces to be internally regulated, in order to assure the safe provision of on duty parachuting activity.**

Policy

1.4.314. The actions of units within the MOD were governed by multiple levels of doctrine and policy. Whilst policy documents were not considered risk controls in themselves, they contained the direction and method by which risk controls were to be employed. The key policy documents pertinent to the occurrence event were:

1.4.315. **Internal documents.**

a. **Defence Safety Authority (DSA) publications**. DSA publications were the DSA's policy documentation set.

(1) DSA 01.1 was the amplification of the Secretary of State's Policy Statement for Health, Safety and Environmental Protection (HS&EP). Its purpose was to articulate the Secretary of State's requirements. It was supported by companion documents in the DSA 01 series: Exhibit 252

(a) DSA 01.2 – Implementation of Defence Policy for Health, Safety and Environmental Protection. Exhibit 253

(b) DSA 01.3 – DSA Regulatory Practices, Processes and Operating Procedures.

(c) DSA 01.4 – Glossary of terms and definitions for Defence Health, Safety and Environmental Protection.

(2) **Defence Safety Regulators.**[180] The Defence Regulators published their policies within the DSA's publication set.

(a) DSA 02 – Defence Land Safety Regulator (DLSR). Stipulated the Defence Codes of Practice (DCoP) for the land environment. Exhibit 214

[180] The Defence Safety Regulators are made up of Defence Fire Safety Regulator (DFSR), Defence Land Safety Regulator (DLSR), Defence Maritime Regulator (DMR), Defence Nuclear Safety Regulator (DNSR), Defence Ordinance, Munitions and Explosives (OME) Safety Regulator (DOSR) and the Military Aviation Authority (MAA).

(b) DSA 03 – Adventurous Training Safety Regulator (ATSR). DSA 03 was a subordinate document to DLSR's DSA 02, outlining the DCoP for adventurous training.

b. **Joint Service Publication (JSP)**. JSPs provided tri-Service policy on general subjects, unless parts were superseded by Defence Instructions and Notices (DIN) (see sub-Para c). They were the authoritative MOD policy on their respective subject.

(1) JSP 375 – Management of Health and Safety in Defence. Exhibit 179

(2) JSP 419 – Adventurous Training in the UK Armed Forces. Exhibit 13

(3) JSP 822 – Defence Direction and Guidance for Training and Education. Exhibit 254

(4) JSP 892 – Risk Management. Exhibit 255

(5) JSP 950 – Medical Policy. Exhibit 256

c. **Defence Instructions and Notices**. DINs were tri-Service policy usually on specific matters, therefore, not warranting a JSP. However, they were also used to elaborate or change policy that had yet to be amalgamated into a JSP.

d. **Single Service (sS) policy.** Where applicable, sS constructed their own policy or produced documents that elaborated on how tri-Service policy should be applied to Service specific matters.

(1) **The Queen's Regulations (QR).**[181] The highest level of regulation was set out in Queen's Regulations for the Royal Navy (RN), Army and Royal Air Force (RAF). Exhibit 257 Exhibit 258 Exhibit 344

(2) **Royal Navy (RN) and Royal Marines (RM) specific documentation.**

(a) **Books of Reference digital (BRd).** BRd's contained permanent orders specific to the RN and RM.

i. BRd10 – Navy Command Safety and Environmental Management System (NC SEMS). Exhibit 259

ii. BRd51 – Physical Development Manual. Exhibit 260

(b) **Royal Navy Temporary Memorandums (RNTMs).** RNTMs provided information on items which were either unsuitable for publication in higher orders due to the short-lived nature of the order or to supplement higher orders before formal update.

[181] At the time of the release of this report the Queen's Regulations were in the process of being replaced by the King's Regulations.

e. **Army specific documentation.**

(1) **Army Command Standing Orders (ACSO).** ACSOs contained permanent orders applicable to the Army.

(a) ACSO 1200 – Army Safety and Environmental Management System. Exhibit 261

(2) **Army General and Administrative Instruction (AGAI).** AGAIs existed to publish information of a permanent nature that was not appropriate for existing publications, such as ACSOs.

(3) **Army Briefing Note (ABN).** ABNs were designed to communicate timely and relevant information to all ranks within the chain of command.

f. **Royal Air Force (RAF) specific documentation.**

(1) **Air Publications (AP).** APs contained permanent orders specific to the RAF.

(a) AP3342 – Physical Education in the RAF.

i. Section 5 – Adventurous Training. Exhibit 239

ii. Section 6 – Military Parachuting. Exhibit 262

(b) AP3379 – RAF Manual of Training and Education. Exhibit 263

(c) AP8000 – Air TLB[182] Safety and Environmental Management System. Exhibit 264

(2) **RAF General and Administrative Instructions (GAI).** GAIs existed to publish information of a permanent nature that was not appropriate for existing publications, such as an AP. Exhibit 265

(a) GAI 1013 – Standing Parenting Procedures and Parenting Legend.

(3) **Internal Briefing Notes (IBN).** IBNs provided information on items which were either unsuitable for publication in higher orders due to the short lived nature of the order or to supplemented higher orders before formal update.

(a) IBN 16/21 – COVID-19 Guidance for the re-introduction of routine RAF fitness testing. Exhibit 266

(b) IBN 50/21 – COVID-19 Guidance for the reintroducing of Unit level Force Development activity. Exhibit 267

[182] Top Level Budget holders form the six financial areas within Defence – Head Office and Corporate Services, the four commands (Navy, Army, Royal Air Force and UK Strategic Command) and the Defence Infrastructure Organisation.

g. **Local orders.** Units produce local orders which directed how normal business and safety should have been carried out within the organisation.

(1) Standard Operating Procedures (SOP). Exhibit 03

(2) Unit Safety Management System (SMS). Exhibit 187

(3) Defence Aerodrome Manual (DAM). Exhibit 184

(4) Air Safety Management Plan (ASMP). Exhibit 237

h. **Miscellaneous activity specific orders.**

(1) JSAT Parachute Operating Manual. Exhibit 116

1.4.316. **External documents.**

a. Health and Safety at Work Act etc 1974. Exhibit 52

b. Civil Aviation Publication 660. Exhibit 07

c. British Skydiving Operating Manual. Exhibit 99

1.4.317. Throughout the investigation it was clear that the number of documents, that were required to be understood to enable day-to-day parachuting activity, was excessive. To fulfil the requirements for HS&EP alone there were at least four layers of legislation, regulation, orders and guidance. This was further complicated by differences in sS interpretation of higher-level regulation, leading to differences in allowable activity and perception of risk across the Top Level Budget holders (TLB).

1.4.318. Figure 1.4.52 shows the documentation required to be applied to JSAT parachuting activity. This does not include any additional advice notes, memoranda, or other parenting documents. It was the panel's opinion that it was extremely difficult to digest and analyse the detail, which, when combined with subtle differences between TLB terminology and intent, added to an already confusing picture. Many subordinate documents unnecessarily duplicated information, which increased the time taken to understand whether any changes had been made to higher orders, and which also had the potential to provide out-of-date information due to misaligned review periods. In addition, some subordinate documentation used a confusing mix of terminology, predominantly caused by a lack of direction in parent documents as to which terms should be utilised and how they should be interpreted.

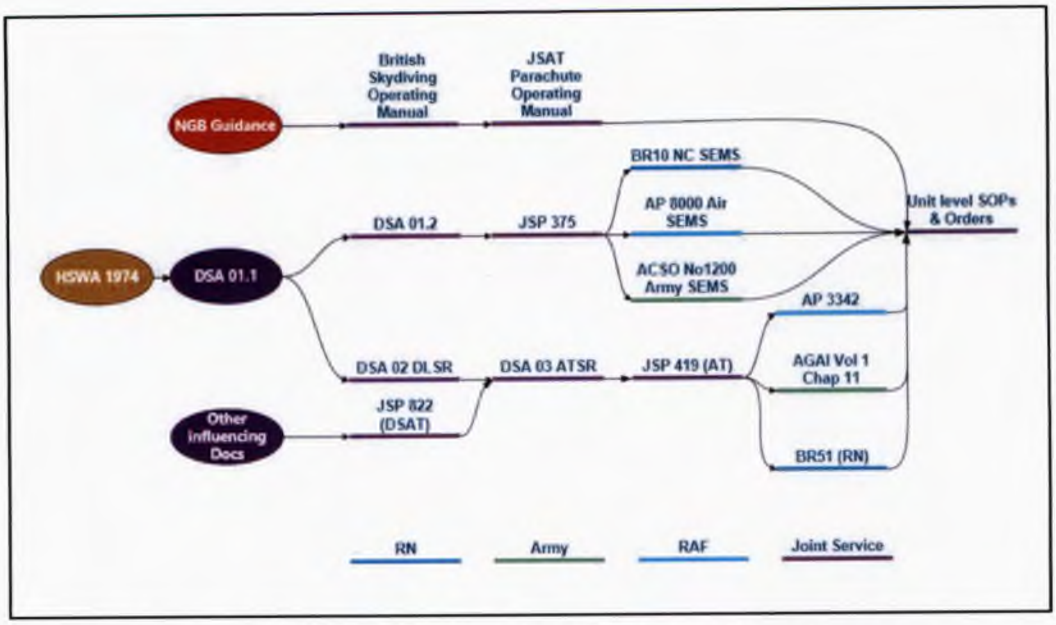

Figure 1.4.52 – JSAT parachuting policy documents.

1.4.319. The panel noted that at the time of the accident, Defence was in the process of a change, with HS&EP taking over the health, safety and environmental policy leadership responsibilities, leading to a protracted period of document 'churn'. The panel believed this highly likely to have exacerbated some of the issues identified above.

1.4.320. The panel considered that the number of regulatory and subordinate orders were excessive and, in many cases, verbose. This could have caused confusion at all levels, especially when working across TLBs where simplification would have benefited all users, ensuring that the intent of legislation, regulation and orders was clear and unambiguous. The panel's overall assessment was that many higher-level orders were written in a way that was extremely likely to lay the foundations for divergence through misinterpretation, particularly when passing decision making to lower formations. The panel concluded that the complexity and ambiguity of many high-level orders was an **Other Factor**.

1.4.321. **Recommendation. The Vice Chief of Defence Staff should direct a review into the simplification of policy documentation where the activity is not unique to one stakeholder, in order to minimise the potential for divergence between Top Level Budget holders.**

Assurance

1.4.322. **COVID 19 Pandemic.** The panel noted that all planned assurance activity around the time of the accident had been affected by restrictions caused by the COVID 19 Pandemic.

Assurance of JSAT parachuting

1.4.323. Assurance was an essential part of checking the performance of units and ensuring HS&EP was compliant with MOD policy. This was achieved through monitoring, reviewing, auditing and inspecting the four elements of the SSW and SST. These assurance activities were conducted at three levels to provide oversight of all risk management and to satisfy activity regulators that the surrounding policy and legislation was being complied with. The three levels for RAF JSAT parachuting were: Exhibit 252 Exhibit 214

a. Level 1 or 1st Party Assurance (1PA). 1PA was carried out periodically by an individual within the JSPC(W) as an internal assurance of the Unit's activity.

b. Level 2 or 2nd Party Assurance (2PA). 2PA for JSAT parachuting was carried out by the RAR's Safety, Assurance and Training (SAT) Wing, who were outside of the immediate line management chain but still within the organisation. 2PA was required to provide a degree of independence and an ability to confirm the effectiveness of level one assurance.

c. Level 3 or 3rd Party Assurance (3PA). 3PA was an independent assessment of JSAT parachuting and was conducted by the ATSR as the Defence AT regulator, and British Skydiving as the National Governing Body (NGB) for sports parachuting.

1.4.324. **Difference in assurance language.** The RN and RAF used 1/2/3PA to describe the difference in assurance levels, compared to the Army who used 1st, 2nd and 3rd Lines of Defence Assurance (LoDA).[183] The ATSR DCoP specifically referred to both of these methods in its requirement for JSAT providers to satisfy the assurance needs of Defence AT. Exhibit 214

1.4.325. **1st Party Assurance**. In order to meet the standards required of a SSW and SST, the JSPC(W) incorporated several management systems that were encompassed within 1PA.

a. JSPC(W) PTO monthly internal audit. Exhibit 187

b. JSPC(W) weekly Safety Training and Instructor Review (STIR). Exhibit 268

c. JSPC(W) SHEF management. Exhibit 269

1.4.326. **2nd Party Assurance.** 2PA of RAF WOTG was broken into several functional areas. The RAR's SAT Wing were responsible for assuring the delivery functions of the Unit, with No. 2 Gp conducting the aerodrome assurance and the parenting unit (RAF Brize Norton) covering wider assurance of areas such as fire, fuels and HS&EP. Exhibit 270 Exhibit 271 Exhibit 185

1.4.327. **3rd Party Assurance.** 3PA was conducted at RAF WOTG by the ATSR as the licensee for AT, and British Skydiving as the NGB and licensee for the Exhibit 272 Exhibit 273

[183] These are defined differently from those stated within Health Safety & Environmental Protection (HS&EP) Function Operating Model.

PTO. As the site had been recently upgraded to a military aerodrome, the MAA were required to conduct routine 3PA activity, although as the change was very recent no MAA 3PA inspections had taken place at the time of the accident.

1.4.328. **JSPC(W) 1PA monthly internal audit.** JSPC(W) conducted an internal audit of the PTO's SMS via a review of the SOPs. Every month an area within the SOPs was designated for audit by a delegated instructor. After each monthly audit a short report was produced, with the findings presented to the CI and OC for corrective action. These reports were placed within a folder that required regular review by the JSPC(W) staff, with a signature required to prove that they had been read and understood. Exhibit 187

1.4.329. The panel **Observed** that the SOPs had not been signed as being read and understood by some staff members. In addition, the monthly SMS, routine signatory sheets and several reports impounded during the investigation were not completed in accordance with the SOPs. Of note, this had not been identified during the last 2PA activity. The panel concluded that the internal 1PA activity at JSPC(W) did not meet the required standards with regards to periodic managerial checks and that the 2PA audits were not robust in their inspections. This was considered an **Other Factor**. Exhibit 274 Exhibit 187

1.4.330. **JSPC(W) 1PA STIR.** JSPC(W) conducted a weekly STIR. This was recorded and documented for auditing purposes and used as a tool for both 1PA and continuous improvement. The STIR record of decisions contained the attendance, agenda, areas for recommendations and corrective actions, which should have been closed with the addition of closing comments by the CI and OC. However, the records of decisions, viewed by the panel, showed that this was often not completed. As the STIR meetings intent was to improve safety, the panel concluded that the lapses in administration of the record of decisions meant that there was no formal feedback as to how issues should be dealt with, and as such, was an **Other Factor**. Exhibit 268 Exhibit 275

1.4.331. **Recommendation. Air Officer Commanding No. 22 Group should direct an audit of the Joint Service Parachute Centre (Weston), in order to assure the Centre's 1st party assurance activities.**

1.4.332. The RAR's SAT Wing conducted a 2PA audit of JSPC(W) several weeks prior to the accident. The audit was carried out on behalf of Comdt RAR in their role as the sS AT Inspectorate, with a focus on safety management. Additionally, it was intended to support the preparation of a planned external 3PA audit by the ATSR in early Sep 2021. Exhibit 270 Exhibit 271

1.4.333. Whilst the RAR's SAT Wing audit met its objectives, the panel's view was that as it only focussed on the delivery functions, it lacked an ability to assess the wider functional requirements that were required to run the Unit. The audit did recommend that due to the distractions caused by the need for the staff to fulfil secondary duties to run the facility, funding for a facilities manager should be explored to reduce the workload on the Centre's instructional staff. However, no assessment as to whether there were any deficiencies within the functional administration of the site were made. The panel noted that the RAR's SAT Wing 2PA report was written by exception, with areas of concern mentioned and with Exhibit 271 no consideration given of 'good practice'. The report, therefore, lacked the ability to give an overview of where good practice was observed or provide a general understanding of how the Centre was performing.

1.4.334. It was also noted that a member of the auditing team, was routinely located at JSPC(W). The TORs for this position directed that when requested they were able to 'stand in' for the CI and assist with the output of JSAT parachuting and the Eagles Schemes. Whilst the location of this position did provide a level of oversight, the panel assessed it as very likely that the required level of separation described within policy was compromised, with the potential loss of an unbiased approach to assurance. Exhibit 271 Exhibit 214 Exhibit 276 Exhibit 77

1.4.335. The panel concluded that the lack of wider assurance activity at RAF WOTG meant that whilst it was likely that the chain of command had assurance of delivery outputs, they were very likely to only receive a limited view on the effective management of the site and, as such, this was an **Other Factor.** The recommendation for a dedicated facilities manager to enhance the management of all functional areas at RAF WOTG was noted as an **Observation** by the panel. The panel also made the **Observation** that an organisational safety assessment into the resourcing at the Unit would likely help identify conflicts between the required roles within the organisation.

1.4.336. **Recommendation. Air Officer Commanding No. 22 Group should ensure the 2nd party assurance process encompasses all functional areas for subordinate formations, in order to assure the management of units under their command.**

1.4.337. **Understanding of assurance levels.** DSA 01.2 Defence SEMS, directed that DSA regulators should undertake 3PA, TLBs with an SDH/ODH should undertake 2PA, and HoE, DDH and commanding officers complete 1PA. Exhibit 278

1.4.338. The RAR's SAT Wing were required to conduct 2PA audits of RAF AT deliverables. From a policy point of view, Comdt RAR operating at the DDH level and as Commanding Officer of the Academy would have been considered as 1PA authority, with 2PA falling under AOC No. 22 Gp as the ODH. Whilst this was understood by the RAR, the structure of No. 22 Gp at the time did not lend itself towards the RAR's SAT Wing sitting outside of the organisation. It was, therefore, agreed by No. 22 Gp that this arrangement was the best alternative to meet the requirement. Exhibit 279

1.4.339. The panel noted that at the time of the accident, 2PA of RAF AT activity was not being achieved in accordance with Defence safety policy. An AT Inspectorate organisation was being formed with the intention of conducting unit based assurance. However, it was unclear as to whether this role would be widened to cover all aspects of RAF AT. The lack of independence of 2PA for RAF AT was considered to be an **Other Factor**.

1.4.340. **Recommendation. Air Officer Commanding No. 22 Group should ensure the allocation of an independent 2nd party assurance provider for Royal Air Force adventurous training.**

Aerodrome assurance

1.4.341. RAF WOTG had recently been changed from a DZ to an official government aerodrome as defined in the Air Navigation Order, and as such fell under the regulatory responsibility and authority of the MAA. 2PA had been conducted by No. 2 Gp Danger Area Airspace Manager (DAAM) to assure regulatory adherence. Exhibit 184 Exhibit 280

1.4.342. The panel noted that the airfield manager role for RAF WOTG had been delegated to OC JSPC(W). At the time of the accident, the officer commanding was neither qualified nor experienced for that role. This had been highlighted in the previous RAR SAT Wing 2PA report. The Report recommended that support for this position should be staffed through RAF Brize Norton to assist with the management of the aerodrome. Additionally, the aerodrome operator position was held by the Officer Commanding Specialist Training Wing within the RAR and, whilst they were qualified for the role, the position was not tied to this level of SQEP. However, an organisational change was in the process of being implemented to achieve an enduring solution for the aerodrome operator role. The panel also identified that No. 2 Gp were the primary user of the RAF WOTG aerodrome in their role as the delivery agent for military FE@R parachute training. The panel concluded that the aerodrome operator and manager positions were likely not best placed within the RAR without suitable resourcing. Due to the complexity of the usage of RAF WOTG, it was the panel's view that Chief of the Air Staff should decide which organisation was best resourced to manage the RAF WOTG aerodrome. The lack of SQEP to manage the RAF WOTG aerodrome was considered an **Other Factor**. Exhibit 280 Exhibit 270

1.4.343. **Recommendation. Chief of the Air Staff should decide which organisation is best resourced to manage the RAF WOTG aerodrome.**

Adventurous Training Safety Regulator

1.4.344. The ATSR was mandated to conduct 3PA and licencing of all Defence AT centres. It achieved this by regulating JSPC(W) delivery of training against the DSA and subordinate regulations. If regulatory compliance was met, the ATSR would issue a licence to deliver AT for a period determined by the risk associated with the activity provided by a centre.

1.4.345. The AT licence for WOTG was due to expire in Sep 2021 and a re-visit had been planned for the week following the accident. The previous ATSR inspection in 2019 took place six weeks prior to a British Skydiving 3PA inspection. The ATSR explained that, whilst they were able to conduct 3PA of general AT activity, they were not scaled for subject matter experts (SME) in all AT disciplines, including areas such as parachuting. As such, they often had to request additional SME support to assure these specialist activities.

1.4.346. The observations made by the 2019 ATSR report included inconsistencies of JSPC(W) instructor monitoring, including missing signatures and inaccuracies within the associated forms. Another observation noted confusion over the periodic evaluation of instructors and the frequency at which they were being conducted. An action plan, in the form of an email, was produced by Officer Commanding JSPC(W) following the ATSR report which Exhibit 272 Exhibit 273 Exhibit 281 Exhibit 282 Exhibit 283 outlined the plan for resolution of these observations. However, the 2PA conducted by the RAR's SAT Wing in Aug 2021 observed similar findings. The panel made an **Observation** that it was only after the RAR's SAT Wing audit that the ATSR observations were formally recorded within the Centre's Quality Improvement Plan. As a result, this noncompliance remained unresolved for two years after its original identification.

1.4.347. The panel also made an **Observation** that as both the ATSR and British Skydiving have licencing requirements, a collaborative approach to 3PA would ensure adequate SQEP, provide mutual assurance of each other's processes, and prevent undue duplication of effort.

British Skydiving 3PA

1.4.348. In order to licence RAF WOTG as an authorised British Skydiving PTO and DZ, British Skydiving routinely carried out audits, with the last visit prior to the accident being in Oct 2019. In conversation with the panel, the ATSR discussed witnessing a British Skydiving audit at the Army Adventurous Training Air Wing at Netheravon in 2018, in which they described them as 'very detailed'. The panel reviewed the previous British Skydiving audit report and noted that whilst the ATSR could confirm that the visits were very comprehensive, their report was a short one-and-a-half-page document, with minimal detail. Recommendations were presented in order to improve the management of the PTO, but no detail of good practice was mentioned. Exhibit 08 Exhibit 272

1.4.349. As the NGB, British Skydiving was considered the SME organisation for sports parachuting activity. However, the panel **Observed** that the lack of reporting of good practice, alongside any observations and recommendations, prevented the ability for PTOs to share information that would enhance the safety of the sport.

Assurance of AT parachuting expeditions

1.4.350. The planning for AT parachuting expeditions was assured through the JSAT Form Alpha process, in accordance with the JSAT POM (Para 1.4.278), prior to an expedition's departure. However, whilst there was provision for remote assurance of expeditions within JSP 419, it did not stipulate when this should take place or what kind of assurance was appropriate, particularly for those activities classified as higher-risk. Overall, the guidance was found to very limited for an activity that by its nature was conducted outside of the JSAT training centres and normally led by individuals who are not full time JSAT staff. The panel concluded that the lack of direction for the level of assurance that should be conducted during JSAT expeditions was an **Other Factor**. Exhibit 205 Exhibit 284 Exhibit 285 Exhibit 13

1.4.351. **Recommendation. Director Defence Land Safety Regulator should stipulate the level of assurance required for high-risk adventurous training activities.**

Assurance of military sports display and associations parachuting

1.4.352. In order to understand wider assurance of other parachuting activity the panel also looked at military sports display teams and sports parachuting associations. The overall theme of assurance for both display and association parachuting, was that 1PA and 2PA were carried out in accordance with their respective sS SEMS and assurance policies. However, due to a lack of an appointed Defence regulator, 3PA was not being conducted by the MOD. British Skydiving only provided 3PA to PTO's and, as such, to the panel's knowledge, the only sS association that received this level of assurance was the Army Parachute Association due to its management role at the Netheravon DZ. Exhibit 14 Exhibit 286 Exhibit 287

1.4.353. The panel concluded that whilst these activities were purely governed by BSOM rules, they were being conducted by Service personnel with on duty status but with less assurance and governance than for extremely similar activities such as JSAT sports parachuting. As an employer, the MOD had a duty of care to ensure that all parachuting activity was assured at all levels. As such, the lack of an appointed Defence regulator and subsequent 3PA to assure a safe operating environment was considered to be an **Other Factor**. See recommendation at Para 1.4.313.

Safety, Health, Environment and Fire (SHEF)

1.4.354. For JSPC(W) to meet the legislation laid out in the HSWA and through the Defence policy and guidance set out in JSP 375, the Officer Commanding RRC(W) was responsible for the SHEF management on behalf of the HoE (Comdt RAR). For RAF WOTG, the SHEF management system was parented by RAF Brize Norton, with two instructors within JSPC(W) responsible for the day-to-day management and control measures, and were required to fulfil the following roles:

a. Wing/Squadron SHEF manager.

b. Deputy Wing/Squadron SHEF manager.

c. Health and Safety representative.

d. Deputy Health and Safety representative.

e. Environmental Protection representative.

f. Fire representative.

g. Deputy fire representative.

h. Building custodian.

i. Deputy building custodian.

1.4.355. **Audits.** The Centre routinely conducted its own internal six-monthly SHEF audits, with a report submitted to the RAF Brize Norton Safety, Health, and Environmental protection (SHE) department for review. Periodic external Exhibit 20 Exhibit 264 Exhibit 269

SHE audits should then have been conducted by RAF Brize Norton's SHE department. However, there was no evidence of any audit after May 2018. The panel made an **Observation** that the RAF Brize Norton SHE manual contained a training matrix outlining the required courses to fulfil the required SHEF roles. However, they could find no evidence of the completion of courses for the SHEF Manager, H&S representative, Environmental Protection representative or Fire representative for JSPC(W). The panel noted that the WOTG staff were attempting to fulfil these duties to the best of their ability. Exhibit 288 Exhibit 345

1.4.356. **Risk assessments.** The panel noted that, although risk assessments had been completed for the specific environment associated with the delivery of JSAT parachuting, the only H&S risk assessments for the workplace found by the panel, uploaded onto the WOTG online filing system, were still named and dated under the previous owner. The last review of these was in Feb 2019. However, this was likely caused due to the nature of the remote handover between the senior staff during the COVID 19 Pandemic. Exhibit 289 Exhibit 290

1.4.357. **Parenting.** During the investigation, the panel visited the UK and Cyprus based ATG(A) JSAT parachuting centres. It was noted that these centres used the SQEP from their parenting units to manage their SHEF responsibilities. This had significantly less impact on the primary duties of the staff, allowing for a greater focus on the training outputs. However, the panel noted that at the time of the accident RAF Brize Norton was responsible for 234 dependant units, presenting them with a significant management burden. Exhibit 291

1.4.358. The panel concluded that all these factors were symptomatic of a unit that was displaced from its chain of command and had a devolved parenting agreement with a third party. Many of the staff, including the Officer Commanding and CI, changed over during the COVID 19 Pandemic, which, due to the restrictions imposed, meant that the handovers were conducted remotely. This, along with several breaks away from the Unit's location due to lockdowns, was very likely to prevent the staff from setting a routine to capture all of the requirements for the effective management of the Centre. Following the removal of COVID restrictions, the Centre was heavily focused on regaining currency and the safe delivery of its key training outputs, having had no personnel on site for significant periods of time over the previous year. This was very likely to have led to the lack of familiarity with secondary tasks, which in the panel's view would have exacerbated the situation. The requirement for an assured re-opening plan for the overall management of remote units after significant periods away from their workplace was an **Observation**. The lack of training for functional safety related secondary roles at RAF WOTG was considered an **Other Factor**.

1.4.359. **Recommendation. Air Officer Commanding No. 22 Group should direct an organisational safety assessment to review the levels of resource at Royal Air Force Weston on the Green, in order to ensure the adequate provision of personnel to fulfil all managerial and instructional functions.**

Training

Defence Systems Approach to Training

1.4.360. JSP 822, Defence Direction and Guidance for Training and Education, was the authoritative policy that directed and guided Defence individual and collective learning (training and education), to ensure it was appropriate, efficient, effective and most importantly safe. Underpinning all training and education activities was the Defence Systems Approach to Training (DSAT). It was the system that must be used by those who are involved in the analysis, design, delivery, assurance, management and governance of Defence training and education (Figure 1.4.53). Exhibit 292

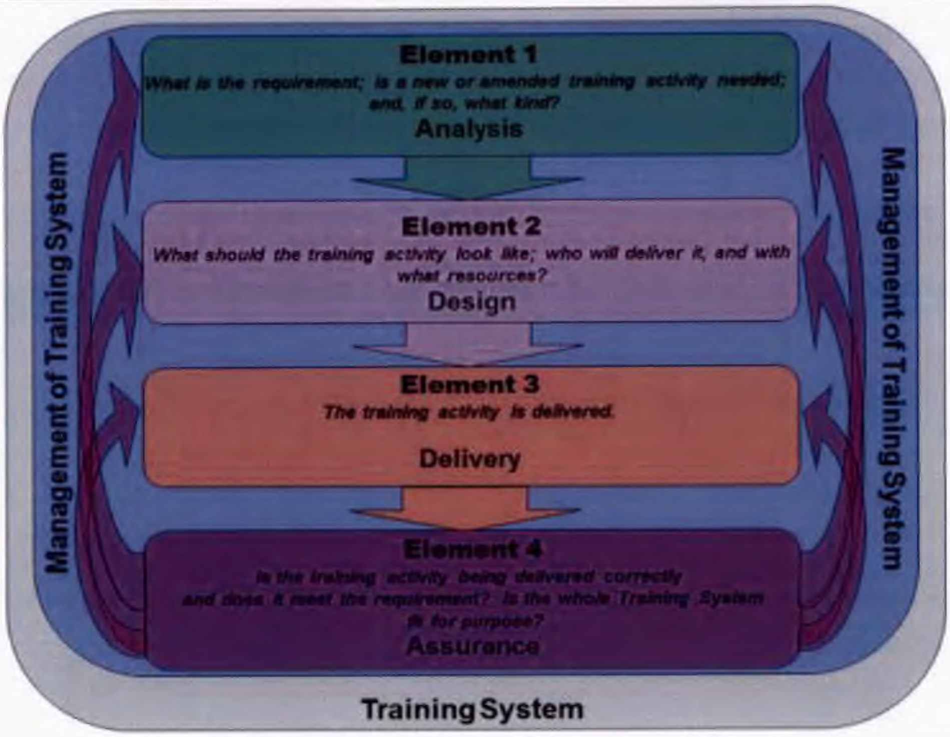

Figure 1.4.53 – DSAT process.

1.4.361. **Training requirements authority (TRA).** The TRA represented the end-user and was the ultimate authority for the derivation and maintenance of the Role Performance Statement.[184] The TRA was responsible for the evaluation of the effect of the training in achieving the Role Performance Statement wherever the training was delivered. Examples of the types of roles undertaken on behalf of the TRA were, needs analyst, external evaluator, and senior responsible owner. The TRA for JSAT parachuting was the JSAT Steering Group. Exhibit 293

1.4.362. **Training delivery authority (TDA).** The TDA was distinct from the TRA and was the organisation responsible for training delivery, but not always for the conduct of the actual training itself. Examples of the types of roles associated Exhibit 294

[184] An RPS was a detailed statement of the task/sub-task required to be undertaken by an individual to achieve the desired performance in role. It articulated the performance, conditions and standards expected within that role.

with the TDA were, designer, 2nd party auditor or inspector, and training line of development owner. The TDA for JSAT parachuting within the RAF was Comdt RAR.

1.4.363. **Training provider (TP).** The TP was the training school, college, organisation, establishment, unit or group that delivered the training. Examples of the types of roles associated with the TP were, defence trainer, training support staff, internal evaluator, and 1st party auditors. The TP for JSAT parachuting within the RAF was the Robson Academy of Resilience (RAR). Exhibit 295

1.4.364. Within this training governance structure Comdt RAR was directly involved in the decision making of all three of these positions. As the RAF OF5 representative on the JSAT Steering Group (TRA), the Comdt RAR was also the TDA for RAF JSAT parachuting, and sat as the senior officer within the training providing unit.[185] This made the Comdt RAR responsible for all four elements involved in this training system (Figure 1.4.53). In comparison, Figure 1.4.54 shows the Army's AT governance structure which demonstrated suitable separation between each of the authorities and the training provider. Exhibit 296 Exhibit 297

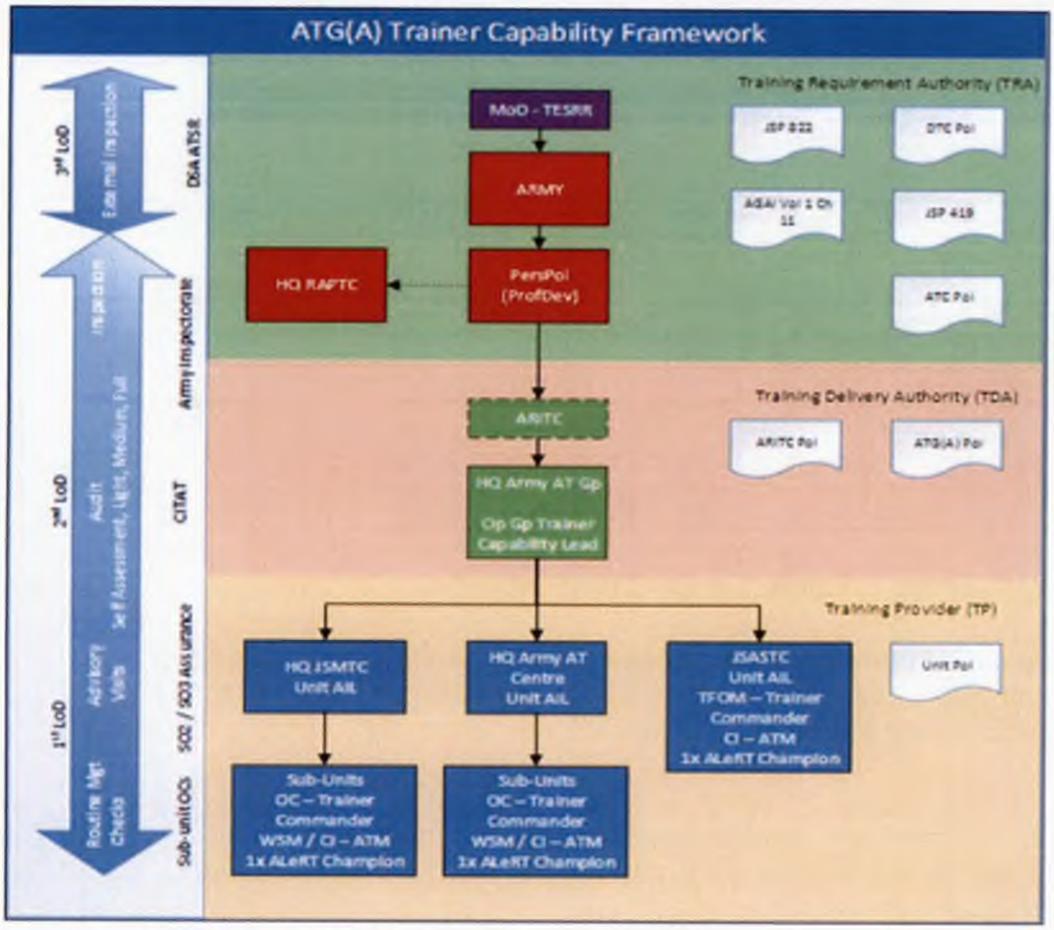

Figure 1.4.54 – ATG(A) Trainer Capability Framework.

[185] NATO maintains a 'standard rank scale' in an attempt to match every member country's military rank to corresponding ranks used by the other members. There are two scales, though not all member countries use all the points on the NATO scales and some have more than one rank at some points. OF1 - OF10 (bottom to top) are used for officers. In the RAF, OF5 was the rank of group captain.

1.4.365. The panel made an **Observation** that insufficient separation and independence was built into the RAR training structure. This could be viewed as the organisation marking their own homework.

1.4.366. **Management of the Training System (MTS).** In order to meet the high standards required for training in Defence the four elements of the DSAT process must be governed, managed and assured throughout the process. This was collectively known as the MTS. In order to achieve this system within the RAR, the delivery of JSAT and FD training was carried out in accordance with the RAR's Resilience Wing Training Directive and the Training Quality Manual (TQM). Exhibit 281 Exhibit 298 Exhibit 299

1.4.367. Shortly after the accident at WOTG, JSPC(W) was moved from the Resilience Wing to the Specialist Training Wing (STW). The move had been planned ahead of the accident and was motivated by a desire to ensure the correct level of SQEP at the OF4[186] level for the oversight of JSAT air activities. However, it was noted that the move was against the direction previously given by the Director Ground Training (DGT) and it was advised to Comdt RAR that all RRCs were better aligned under the Resilience Wing to provide standardisation across all AT centres delivering JSAT and FD training. Exhibit 300 Exhibit 301

1.4.368. Despite moving JSPC(W) to be under the command of the Officer Commanding STW, the Unit was also required to be managed under the Resilience Wing MTS and Customer Executive Board (CEB).[187] As the Officer Commanding STW Wing was from an air specialisation background they were qualified in aerodrome management and air safety. However, the post was not tied to this specialisation and, as such, the underpinning reasons for the move were not enduring. The panel agreed with the DGT's comments; grouping all RRCs under the same command was very likely to be the most beneficial to the overall management of the centres. Exhibit 301

1.4.369. **Defence Trainer Capability (DTC).** The DTC was introduced in 2014 to professionalise the training cadre and was designed to assure that Defence trainers, trainer supervisors and training managers were suitably qualified and experienced. It outlined the requirement for a professional development pathway to continuously meet the required quality standard and competence and, attracted externally recognised national qualifications. In order to assure the process, there was a policy for instructors to receive a six-monthly observation to ensure that their instructional competence and training delivery met the required standard. To achieve this, a supervisor was to have held a Defence Training Supervisor Level 1 foundation qualification. Exhibit 302

1.4.370. The panel determined that the JSPC(W) instructors were correctly qualified to deliver training as Defence Trainers. However, it was noted that the six-monthly instructor observations were not always being carried out. When they were conducted, it was discovered that the supervisor did not hold this competency on their record. In addition, the TORs for other staff at RRC(W) and JSPC(W) did not require them to be qualified as Defence Trainer Managers. As Exhibit 303 Exhibit 304 Exhibit 305 Exhibit 306 Exhibit 307 Exhibit 308

[186] In the RAF OF4 is the rank of Wing Commander.

[187] JSP 822 - For all training, CEBs are formed as part of the MTS and are specific to the needs of that Training System. The general purpose of a CEB is to provide a mechanism for stakeholders to develop the scale and content of training to match the required Defence outputs within the available resources, and in accordance with relevant Defence and sS policies.

such, no local management of the training policy assurance was being undertaken. The panel concluded that the lack of consistency in six-monthly observations and the lack of qualifications to supervise them within JSPC(W), was an **Other Factor**. The panel also made an **Observation** that the TORs for RRC(W) and JSPC(W) staff did not contain the requirement for them to be Defence Trainer Managers.

1.4.371. **Recommendation. The Commandant, Robson Academy of Resilience, should update all Robson Resilience Centre (Weston) and Joint Service Parachute Centre (Weston) terms of reference, in order to ensure compliance with the Defence Trainer Capability requirements.**

JSAT parachuting courseware

1.4.372. The delivery of training for JSAT parachuting by JSPC(W) instructors was conducted through lesson plans produced by the Centre using the guidance within the British Skydiving training manuals. Throughout the inquiry, the panel could find no evidence that the lessons generated in accordance with the NGB guidance had been subject to any form of analysis or design in order to align with the DSAT principles. Exhibit 309 Exhibit 310 Exhibit 311

1.4.373. Within JSP 419, responsibilities were directed to sS authorities to ensure that the four elements of DSAT set out in JSP 822, analysis, design, delivery and assurance, were applied to their respective AT courses. Training Authorisation Documents had been produced for all associated JSAT parachuting courses within JSPC(W).[188] However, the key elements within these documents detailing who was responsible for the management of specific areas, such as training courseware, were marked non-applicable. In addition, the panel discovered that a lack of regulatory enforcement of DSAT, by internal and external assurance auditors / regulators, continued to allow this non-conformance to remain unresolved. Exhibit 312 Exhibit 313

1.4.374. The panel assessed that the lack of training analysis, or design, applied to JSAT parachuting by the TRA and TDA, left JSPC(W) unregulated against all the elements of DSAT or any alternative means of compliance, as required in JSP 419, JSP 822 and AP8000. The lack of training analysis and design was an **Other Factor**. Exhibit 13 Exhibit 254 Exhibit 264

1.4.375. **Recommendation. The Chair of the Joint Service Adventurous Training Steering Group should stipulate the terms of reference for both the single Service Training Delivery Authorities and lead sponsors for sports parachuting.**

[188] JSP 822 – 'The authoritative and auditable document used by the CEB for the management of all Elements and stages of the DSAT process. The importance of the TrAD [Training Authorisation Document] cannot be over-emphasised, it is the document which defines who is responsible for what during the life of a training activity. Essentially, it is the signed contract between the TRA, TDA and Training Provider and is a key document in the holding to account process. Every training activity across Defence must have a related TrAD [Training Authorisation Document]. There are no exceptions'.

1.4.376. **Recommendation. Assistant Chief of Defence Staff (People Capability) should mandate the assurance of the Defence Systems Approach to Training process for National Governing Body regulated adventurous training within Joint Service Publication 419.**

Training assurance

1.4.377. The first training assurance advisory visit at JSPC(W) was conducted in Sep 2017, with a follow-on visit taking place in Jun 2018. A 2nd Party Training Quality Audit was provisionally scheduled by the Central Training School – Assurance Wing (CTS-AW) in Sep 2019. However, this did not take place due a pause of these activities as a result of limited staffing levels and availability. Resumption of these assurance visits was planned for late 2022. Exhibit 314 Exhibit 315 Exhibit 332 Exhibit 342

1.4.378. This pause in assurance was contrary to the direction issued to Comdt CTS by AOC No. 22 Gp in Apr 2021. The directive stated the requirement for '2nd Party Training Quality Audits (SPTQA) of all Phase 1 and 2 ground training delivery units and the External Validation (ExVal) of the courses they deliver. This was to include training delivery at Robson Academy of Resilience. Exhibit 316

1.4.379. The panel did not find any evidence of an ExVal taking place for Ex EAGLES DARE as delivered at JSPC(W). This requirement was set in the RAR's Resilience Wing Quality Training Manual and stated that, 'No. 22 Gp CTS-AW should conduct external validation under the auspices of routine 2PA evaluation visits'. As described previously in Para 1.4.377 the CTS 2PA Audits had not been carried out since 2018, creating a gap in external training evaluation of over three years at the time of the accident. Exhibit 316

1.4.380. The panel made the **Observation** that the lack of scheduled 2PA for the training delivery at JSPC(W) meant that the training provider would remain unassured in its ability to evaluate continuous improvement and alignment to DSAT policy and guidance.

Reporting

Reporting of Injuries, Diseases, and Dangerous Occurrences (RIDDOR)

1.4.381. RIDDOR defined the injuries to civilian employees and incidents leading to the hospitalisation or death of members of the public which were reportable to the HSE. Equivalent injuries and diseases to on duty Armed Forces personnel were not reportable under RIDDOR. However, the MOD had undertaken to notify any work-related death, major injury, disease or dangerous occurrence to the HSE as if they were RIDDOR reportable. Certain, defined dangerous occurrences were also reportable. In the case of a fatality within the defined geographic limits of Great Britain, the HSE expected the commanding officer / HoE, or other responsible person within the relevant command, to notify the HSE within the time periods laid down in the RIDDOR regulations. Exhibit 317 Exhibit 318

1.4.382. **Occurrence reporting.** Within Defence the DSA set out a requirement for TLBs to manage safety through a SEMS. DSA 01 gave a guidance at Para 01.2.2 (3) that, for a SEMS to meet the regulatory requirement for reporting, the document should: Exhibit 319

> 'Set out the arrangements for reporting and managing HS&EP events (eg accidents or environmental incidents).'

1.4.383. At the time of the accident, Defence reporting systems were in the process of evolving to become more streamlined. For functional safety, which also included RIDDOR, there were several routes to reporting occurrences:

a. **Defence Unified Reporting and Lessons System (DURALS).** DURALS was a new occurrence reporting web-based portal, designed to become Defence's primary functional safety reporting system. The Army was the principal user during the implementation phase.

b. **Navy Lessons and Information Management System (NLIMS).** The RN's functional safety reporting tool.

c. **Functional Safety Information Management System (FSIMS).** The RAF's functional safety reporting tool.

Air Safety

1.4.384. Air safety occurrences were reported via the MAA Defence Air Safety Occurrence Reports (DASOR) through the Air Safety Information Management System (ASIMS). DASORs required an occurrence manager to manage the report and ensure that all incidents were investigated, with the outcome resulting in managed recommendations to help prevent recurrence. For JSAT parachuting activity, a member of the RAR's SAT Wing acted as the occurrence manager for all DASORs. Exhibit 285 Exhibit 320

1.4.385. **Lessons identified and the reporting process.** Defence recognised the need to share reports in a way that ensured identifiable lessons were captured in order to provide an ability to conduct trend analysis. This allowed mitigations to be implemented into policy to help prevent recurrence. With Defence becoming more integrated across the Services, the panel considered that until a single system was identified and adopted across all domains, important lessons would continue to be missed, and was an **Other Factor**.

1.4.386. **DASORs.** The panel understood that aviation reports would continue to be reported via a separate system. This was primarily due to the system being long established and very comprehensive in its reporting needs, which were unique to the air environment.

1.4.387. **RIDDOR reporting.** Single Service (sS) safety centres were responsible for ensuring that RIDDOR was reported in accordance with the MOU between the MOD and the HSE. This system was in place. However, aviation incidents reported via DASOR required injuries occurring during aviation activity to be captured within ASIMS. The panel made an **Observation** that not all sS safety centres routinely reviewed ASIMS reports. Therefore, the requirement to ensure that RIDDOR was captured rested with the report initiator dual reporting via the appropriate sS functional safety reporting system. Not only did this increase the administrative burden but ASIMS did not flag it as a requirement. As such it was easily missed.

Parachuting incident reporting

1.4.388. As an activity regulated by the MAA, military FE@R parachuting was reported via DASORs for all incidents and near misses. The panel determined that this reporting process was well-founded and robust in its management. However, the MAA did not monitor any JSAT parachuting reports as they did not regulate the activity, with disagreement between themselves and the JSAT organisations as to whether ASIMS should be used. The JSPC(W) ASMP required reports to be submitted via ASIMS, following the direction set out in the RAF SEMS (AP8000). This meant that JSAT personnel were correctly reporting in accordance with policy. However, due to a lack of oversight, the quality of any follow-on investigation was generally lacking, with very few DASORs investigated to a level that would lead to any form of meaningful recommendation or identification of the true cause of an incident. The panel noted that in addition to the in-service reporting requirements, British Skydiving also had a reporting system that was required to be completed by affiliated PTO's for UK-based sport parachuting incidents and accidents.

1.4.389. The panel concluded that with the numerous SEMS and reporting systems in place within Defence, it was unclear as to how robust the reporting system was and whether all risks and lessons were able to be managed effectively. Whilst the majority of RIDDOR reporting appeared to be in place, there was still potential for it to be missed, for example, when reports were submitted through ASIMS. The potential for mandatory RIDDOR reporting to be missed was an **Other Factor**. Whilst the additional reporting to British Skydiving as the NGB added to the list of reporting requirements, the necessity to inform them was understood. The panel considered this to be **not a factor**.

1.4.390. **Recommendation. Director Military Aviation Authority should ensure reporters using the Air Safety Information Management System are aware that additional functional safety reports are required, in order to ensure statutory Reporting of Injuries, Diseases, and Dangerous Occurrences.**

1.4.391. **Recommendation. Director Military Aviation Authority should direct a review of the Air Safety Information Management System to identify whether reports can be linked into a single pan-Defence reporting system.**

1.4.392. **Recommendation. Director Health Safety and Environmental Protection should direct all Safety and Environmental Management Systems to be updated to ensure that it is clear as to how Reporting of Injuries, Diseases, and Dangerous Occurrences should be conducted and which reporting system should be used.**

1.4.393. **Recommendation. Director Health Safety and Environmental Protection should own and lead the implementation of a common safety reporting system for the whole of Defence.**

Section summary

1.4.394. The analysis within Section 3 found several other factors that have the potential to enhance the safety of the wider parachuting activity within Defence. A summary of findings, listing all of the factors identified by the panel follows this section, with all recommendations consolidated into a list at Part 1.5.

Summary of Findings

Causal Factor(s)

1.4.395. The Panel identified two causal factors which, in isolation or in combination with other factors and contextual details, led directly to the accident.

a. It was the opinion of the panel that the turbulent wake created by Sgt Fisk's freefall position was a **Causal Factor.** 1.4.115

b. The panel concluded that the malformed RPC was a **Causal Factor**. 1.4.121

Contributory Factors

1.4.396. The Panel identified four contributory factors that may have made the accident more likely.

a. The panel concluded that Sgt Fisk's inability to deploy the main pilot chute was a **Contributory Factor**. 1.4.53

b. Therefore, on the basis that spring extractor hesitation was about as likely as not to have occurred, the panel assessed it to be a probable **Contributory Factor**. 1.4.116

c. The panel concluded that the installation of the maximum permitted canopy sizes within a parachute container was very likely to affect the force required to extract the free-bag, which, when combined with an RPC malfunction was considered to be a **Contributory Factor**. 1.4.135

d. The camera jacket may not have led directly to the accident, but the fact that it had not been formally risk assessed undermined the overall safety assessment of the activity and was, therefore, deemed a **Contributory Factor**. 1.4.194

Aggravating Factors

1.4.397. The Panel identified that there was one aggravating factor that made the outcome worse.

a. The panel concluded that the increased likelihood of interaction between the RPC top cap and reserve container flaps following a total malfunction, had the potential to reduce the overall performance of the RPC's function and was, therefore, considered an **Aggravating Factor** 1.4.103

Other Factors

1.4.398. The Panel identified 46 other factors that, whilst not causal or contributory in the accident, may cause or contribute to a future accident.

a. The panel concluded that whilst the use of audible altimeters was not directed within the BSOM or JSAT POM for use by camera operators, the publication of a wider policy surrounding the use of audible altimeters for Defence sports parachuting would enhance safety, and as such was an **Other Factor**.	1.4.38
b. The panel considered the lack of clarity in both British Skydiving and JSAT documentation as to when 'one further attempt' to locate the BOC toggle should or should not be made before initiating the EP, as an **Other Factor**.	1.4.58
c. The panel concluded that the absence of clear direction for a minimum reserve deployment within either the BSOM or JSAT POM was an **Other Factor**.	1.4.61
d. The fact that Sgt Fisk did complete the EP meant that startle and surprise was not a contributory factor, but the panel considered the possibility that it could affect the conduct of a parachutist's drills as an **Other Factor**.	1.4.69
e. The panel concluded that the absence of a requirement for experienced British Skydiving licensed parachutists to carry out regular EP currency training was very likely to lead to skill-fade and was therefore an **Other Factor**.	1.4.73
f. It was the panel's opinion that both British Skydiving and JSAT documentation lacked clarity in the definitions of 'minimum canopy opening height' and the height by which an EP should be initiated for deploying the reserve parachute and as such was an **Other Factor**.	1.4.79
g. Although it was not a contributory factor, the panel considered the lack of EP currency training very likely to exacerbate any potential effects of startle or surprise and was, therefore, considered to be an **Other Factor**.	1.4.80
h. There was no reason for most JSAT parachuting disciplines to require the AAD to be set at its minima as a standard and considered this to be an **Other Factor**.	1.4.91
i. The panel concluded that the local topography surrounding a DZ could reduce the AAD cutter activation height below the manufacturers' recommended minima and considered this to be an **Other Factor**.	1.4.92
j. Allowing temporary modifications to the parachute system without a formal guidance or assessment had the potential to degrade the safe	1.4.110

operating parameters of the system and was, therefore, an **Other Factor**.

k. The lack of guidance within training documentation on the actions that should be conducted following a spring extractor hesitation was considered to be an **Other Factor**. 1.4.117

l. The panel concluded that the local purchase procedures for equipment used for high-risk activity were not robust and as such this was an **Other Factor**. 1.4.145

m. The panel concluded that the lack of clarity in the regulations for parachutists' emergency parachutes within the PPE regulations was an **Other Factor**. 1.4.150

n. The panel found no evidence to suggest that equipment tested under the requirements set in TSO C23-d would have prevented authorisation under the latest order. However, as the manufacturer was not required to state that the equipment was still being manufactured to a previous standard, or whether any gap analysis had been undertaken, it was considered to be an **Other Factor**. 1.4.160

o. In the view of the panel, TS-135 should be updated to reflect the changes within the TSO as a minimum, in order to prevent any potential misinterpretation. As such, the panel considered this to be an **Other Factor**. 1.4.161

p. Where terms such as 'interference' or 'proper function' were used, they should be accompanied with a clarification note as to the pass or fail criteria for the requirement, the panel considered this to be an **Other Factor**. 1.4.161

q. The panel concluded that the intent of the recommendation for six-monthly reserve parachute packing assurance checks remained valid for this inquiry and should be widened to include all Defence sports parachuting activity, and, as such, was an **Other Factor.** 1.4.176

r. The panel concluded that British Skydiving should specifically stipulate the documentation to be followed for rigging practices, in order to provide a standard to be used across the sport. This was considered to be an **Other Factor**. 1.4.180

s. Where rigging equipment and tooling had not been specifically recommended by the manufacturer, a lack of formal assessment for suitability and risk against damaging parachute assembly components was an **Other Factor**. 1.4.180

t. The lack of clear direction within British Skydiving procedures and operating manuals regarding the calibration of pull-force measuring equipment was considered to be an **Other Factor**. 1.4.180

u. It was very likely that sufficient evidence was available to achieve an approval for chartering the aircraft for sports parachuting activity in accordance with RA1240. However, the lack of a formally approved safety assessment was considered an **Other Factor**.	1.4.199
v. The out-of-date Jump Pilot Manual was likely to cause confusion and should either be updated or included within the BSOM. As such, the panel considered this to be an **Other Factor**.	1.4.203
w. The panel concluded that the review process for parachuting operating manuals and orders was not aligned and could lead to out-of-date information being presented and followed; this was, therefore, an **Other Factor**.	1.4.246
x. A review of the meteorological limitations used, against those mandated for military parachuting, would remove any ambiguity in Defence sports parachuting operating limits and was, therefore, an **Other Factor**.	1.4.259
y. The panel concluded that the ambiguity in reporting procedures for incidents relating to non-military parachuting required resolving and was, therefore, an **Other Factor**.	1.4.264
z. The lack of a risk assessment associated with an inability to locate a missing parachutist was considered an **Other Factor**.	1.4.266
aa. The panel concluded that the lack of clear guidance for the duties and responsibilities for sS AT sponsors was very likely to be the catalyst for observed differences between sS authorities in the delivery, assurance and risk analysis of the same activities. This was an **Other Factor**.	1.4.276
bb. The panel concluded that the assurance process outlined within the JSAT POM was not robust and did not cater for all scenarios where the MOD holds a duty of care. It was, therefore, considered to be an **Other Factor.**	1.4.281
cc. The panel identified that sports parachuting, as a Sports England recognised high-risk activity, should be governed by a single board to manage and cohere the acceptable level of risk and operating procedures within Defence. This was an **Other Factor**.	1.4.291
dd. The panel concluded that a single view on whether sports parachuting required duty holding was needed. Without it, there was a lack of clarity and coherence across Defence. This was an **Other Factor**.	1.4.300
ee. The panel agreed that the letter of delegation from AOC No. 22 Gp was ambiguous as it did not outline exactly what activities were being	1.4.303

delegated as requiring duty holding. The panel considered the ambiguity within the letter of delegation to be an **Other Factor**.

ff. Due to the similarities in the activities and the crossover in lessons that could be identified across all parachuting disciplines, the panel assessed that it would be logical for the Military Aviation Authority (MAA), as the regulatory authority for military parachuting, to offer guidance on the appropriate safety model for sports and JSAT parachuting. The panel concluded that the lack of formal guidance within the relevant sS SEMS and JSAT policy was an **Other Factor.** 1.4.308

gg. The uniqueness of the MOD acting as an employer for sports parachuting led the panel to the conclusion that the MAA was likely to have been better placed to regulate all parachuting within Defence. The lack of regulation for sports parachuting within Defence was an **Other Factor.** 1.4.312

hh. The panel's overall assessment was that many higher-level orders were written in a way that was extremely likely to lay the foundations for divergence through misinterpretation, particularly when passing decision making to lower formations. The panel concluded that the complexity and ambiguity of many high-level orders was an **Other Factor**. 1.4.320

ii. The panel concluded that the internal 1PA activity at JSPC(W) did not meet the required standards with regards to periodic managerial checks and that the 2PA audits were not robust in their inspections. This was considered an **Other Factor**. 1.4.329

jj. As the STIR meetings intent was to improve safety, the panel concluded that the lapses in administration of the record of decisions meant that there was no formal feedback as to how issues should be dealt with, and as such, was an **Other Factor**. 1.4.330

kk. The panel concluded that the lack of wider assurance activity at RAF WOTG meant that whilst it was likely that the chain of command had assurance of delivery outputs, they were very likely to only receive a limited view on the effective management of the site and, as such, this was an **Other Factor.** 1.4.335

ll. The lack of independence of 2PA for RAF AT was considered to be an **Other Factor**. 1.4.339

mm. The lack of SQEP to manage the RAF WOTG aerodrome was considered an **Other Factor**. 1.4.342

nn. The panel concluded that the lack of direction for the level of assurance that should be conducted during JSAT expeditions was an **Other Factor**.

oo. As an employer, the MOD had a duty of care to ensure that all parachuting activity was assured at all levels. As such, the lack of an 1.4.353

appointed Defence regulator and subsequent 3PA to assure a safe operating environment was considered to be an **Other Factor**.

pp. The lack of training for functional safety related secondary roles at RAF WOTG was considered an **Other Factor**. 1.4.358

qq. The panel concluded that the lack of consistency in six-monthly observations and the lack of qualifications to supervise them within JSPC(W), was an **Other Factor**. 1.4.370

rr. The panel assessed that the lack of training analysis, or design, applied to JSAT parachuting by the TRA and TDA, left JSPC(W) unregulated against all the elements of DSAT or any alternative means of compliance, as required in JSP 419, JSP 822 and AP8000. The lack of training analysis and design was an **Other Factor**. 1.4.374

ss. With Defence becoming more integrated across the Services, the panel considered that until a single system was identified and adopted across all domains, important lessons would continue to be missed, and was an **Other Factor**. 1.4.385

tt. Whilst the majority of RIDDOR reporting appeared to be in place, there was still potential for it to be missed, for example, when reports were submitted through ASIMS. The potential for mandatory RIDDOR reporting to be missed was an **Other Factor**. 1.4.389

Observations

1.4.399. The Panel made 28 observations.

a. The panel made an **Observation** that RPC interactions with the parachute container were more likely to occur during reserve deployment in which the main was still within the container. 1.4.101.a

b. The panel made an **Observation** that the parachute container configuration (i.e. main and reserve canopies in or out of the container) may significantly affect the performance of the RPC. 1.4.101.b

c. The panel made an **Observation** that the reduced velocity of an RPC when deployed in a total malfunction scenario could significantly affect the overall performance of the RPC. 1.4.101.c

d. However, the panel made an **Observation** that when ancillary equipment such as a camera jacket was being used, a scenario may exist where a malformed RPC could have insufficient force to disconnect the Skyhook. 1.4.131

e. The scene presented by the NPAS helicopter video and the TVP photographs would, in isolation, have led the panel to a different conclusion to the accident sequence observed through analysis of Sgt Fisk's GoPro™ footage. The panel made an **Observation** that without 1.4.139

this footage and digital data for post-accident analysis, it would not have been possible to determine how and when the reserve parachute was activated, or observe the evident malfunction of the RPC.

f. The panel **Observed** that there was no evidence of a definition of a complex system within Defence publications. 1.4.144

g. The panel made an **Observation** that the assurance of the rigger revalidation process did not appear to be sufficiently robust. 1.4.170

h. The panel made an **Observation** that United States rigger qualifications were controlled by the FAA with each rigger being issued a nationally recognised licence. This system provided a more formal standing and created a regulated system with external validation. 1.4.173

i. The panel, therefore, made the **Observation** that a CAA endorsed qualification process along with formal and independent assurance would enhance the standing of these qualifications to the benefit of the sport. 1.4.174

j. The panel made an **Observation** that British Skydiving had no formal qualification associated with the camera operator proficiency. 1.4.213

k. The panel acknowledged that her PJI logbook was the definitive record for her military qualification status, but made an **Observation** that all PJIs should have their role related competencies on the JPA system. 1.4.217

l. The panel made an **Observation** that JSPC(W) needed to decide what records it was required to hold and update their orders accordingly. 1.4.221

m. The panel made an **Observation** that depending on which organisation's intranet front-page was accessed, the associated link to the JSAT POM could lead you to a different version. 1.4.242

n. The panel made an **Observation** that the JSPC(W) SOPs did not align with the BSOM requirements for PTO equipment packing records. 1.4.246

o. The panel made an **Observation** that a delay to the correct reporting process could hinder the ability of the DCDSDO to offer immediate support and ensure that the correct personnel are aware of the incident. 1.4.263

p. The panel made an **Observation** that a single governance structure for sports parachuting within Defence would ensure coherence across all the Services. 1.4.295

q. The panel **Observed** that the SOPs had not been signed as being read and understood by some staff members. 1.4.329

r. The recommendation for a dedicated facilities manager to enhance the management of all functional areas at RAF WOTG was noted as an **Observation** by the panel.	1.4.335
s. The panel also made the **Observation** that an organisational safety assessment into the resourcing at the Unit would likely help identify conflicts between the required roles within the organisation.	1.4.335
t. The panel made an **Observation** that it was only after the RAR's SAT Wing audit that the ATSR observations were formally recorded within the Centre's Quality Improvement Plan.	1.4.346
u. The panel also made an **Observation** that as both the ATSR and British Skydiving have licencing requirements, a collaborative approach to 3PA would ensure adequate SQEP, provide mutual assurance of each other's processes, and prevent undue duplication of effort.	1.4.347
v. The panel **Observed** that the lack of reporting of good practice, alongside any observations and recommendations, prevented the ability for PTOs to share information that would enhance the safety of the sport.	1.4.349
w. The panel made an **Observation** that the RAF Brize Norton SHE manual contained a training matrix outlining the required courses to fulfil the required SHEF roles. However, they could find no evidence of the completion of courses for the SHEF Manager, H&S representative, Environmental Protection representative or Fire representative for JSPC(W).	1.4.355
x. The requirement for an assured re-opening plan for the overall management of remote units after significant periods away from their workplace was an **Observation**.	1.4.358
y. The panel made an **Observation** that insufficient separation and independence was built into the RAR training structure. This could be viewed as the organisation marking their own homework.	1.4.365
z. The panel also made an **Observation** that the TORs for RRC(W) and JSPC(W) staff did not contain the requirement for them to be Defence Trainer Managers.	1.4.370
aa. The panel made the **Observation** that the lack of scheduled 2PA for the training delivery at JSPC(W) meant that the training provider would remain unassured in its ability to evaluate continuous improvement and alignment to DSAT policy and guidance.	1.4.380
bb. The panel made an **Observation** that not all sS safety centres routinely reviewed ASIMS reports. Therefore, the requirement to ensure that RIDDOR was captured rested with the report initiator dual reporting via the appropriate sS functional safety reporting system.	1.4.387

PART 1.5

Recommendations

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PART 1.5 – Recommendations

1.5.1. **Introduction.** Several recommendations made as part of this inquiry have crossover into other operating authority's domains, the panel have therefore highlighted these in Part 1.5 with a statement that AOC No. 22 Gp should convene a working group in order to cohere the response. The following recommendations are made in order to enhance Defence Safety:

1.5.2. **Vice Chief of Defence Staff should:**

a. Direct a review into the simplification of policy documentation where the activity is not unique to one stakeholder, in order to minimise the potential for divergence between Top Level Budget holders. 1.4.321

1.5.3. **Chief of the Air Staff should:**

a. Decide which organisation is best resourced to manage the RAF WOTG aerodrome. 1.4.343

1.5.4. **Director General of the Defence Safety Authority should:**

a. Recommend the requirement for all sports parachuting within the armed forces to be internally regulated, in order to assure the safe provision of on duty parachuting activity. 1.4.313

1.5.5. **Deputy Commander Operations should:**

a. Convene a working group across Defence sports parachute associations, display teams and AT providers to:

(1) Produce the policy for the use and configuration of audible altimeters for sports parachuting. 1.4.39

(2) Define the minimum height at which 'one further attempt' to deploy a sports parachutist's main pilot chute should not be made before initiating the emergency procedure. 1.4.59

(3) Define the minimum height that a parachutist must be under a fully developed main canopy, in order to standardise the guidance within Defence. 1.4.62

(4) Incorporate a brief on startle and surprise into sports parachuting lesson plans. 1.4.70

(5) Define the currency requirements for emergency procedure practice drills, in order to mitigate the risks of skill fade. 1.4.74

(6) Define the minimum height that a parachutist must have initiated the emergency procedures to deploy their reserve parachute, in order to standardise the guidance within Defence. 1.4.81

(7) Define the automatic activation device minimum height settings for each parachuting discipline, in order to mitigate the risks associated with low level malfunctions.	1.4.93
(8) Define the procedures for the setting of the automatic activation device height settings in order to mitigate the risks of uneven topography around drop zones.	1.4.94
(9) Define how camera jackets are attached to either parachute systems or clothing.	1.4.111
(10) Develop a risk assessment or safety case to assess the required drills, procedures or mitigations against reserve pilot chute hesitation.	1.4.118
(11) Introduce six-monthly assurance checks of reserve parachute packing for sports parachute systems.	1.4.177
(12) Provide direction for the use and fitment of ancillary equipment for sports parachuting, in order to ensure that any identified risk remains ALARP and tolerable.	1.4.195
(13) Ensure awareness of the requirement to comply with the requirements for chartering of aircraft within Regulatory Article 1240 for the purposes of sports parachuting.	1.4.200
(14) Define the meteorological limitations to be used for Joint Service Adventurous Training parachuting activity.	1.4.260
(15) Mandate a risk assessment for an inability to locate a missing parachutist following an incident, in order to identify any risks to life and where appropriate provide suitable mitigations.	1.4.267
1.5.6. **Director Health Safety and Environmental Protection should:**	
a. Define the policy for when a safety case is required for locally procured equipment that is intended for high-risk activities.	1.4.146
b. Direct all Safety and Environmental Management Systems to be updated to ensure that it is clear as to how Reporting of Injuries, Diseases, and Dangerous Occurrences should be conducted and which reporting system should be used.	1.4.392
c. Own and lead the implementation of a common safety reporting system for the whole of Defence.	1.4.393
1.5.7. **Assistant Chief of Defence Staff (People Capability) should:**	
a. Update Joint Service Publication 419, in order to provide direction and guidance on the duties and responsibilities of single Service sponsors for their delegated adventurous training activities.	1.4.277

	b. Mandate the assurance of the Defence Systems Approach to Training process for National Governing Body regulated adventurous training within Joint Service Publication 419.	1.4.376
1.5.8.	**Director Military Aviation Authority should:**	
	a. Expand the use of the Air Safety Information Management System to include the reporting of Defence JSAT and sports parachuting incidents.	1.4.265
	b. Ensure reporters using the Air Safety Information Management System are aware that additional functional safety reports are required, in order to ensure statutory Reporting of Injuries, Diseases, and Dangerous Occurrences.	1.4.390
	c. Direct a review of the Air Safety Information Management System to identify whether reports can be linked into a single pan-Defence reporting system.	1.4.391
1.5.9.	**Air Officer Commanding No. 22 Group should:**	
	a. Lead an urgent review of the emergency procedures for a parachuting total malfunction, in order to ensure that the risk associated with this malfunction remains As Low as Reasonably Practicable and tolerable.[189]	1.4.104
	b. Include the link between the size of main and reserve canopies and parachute containers, and the extraction force required to deploy them, within their risk assessments and equipment safety cases.	1.4.136
	c. Align the amendment cycle for the JSAT Parachute Operating Manual and standard operating procedures with the relevant higher-level policy and documentation.	1.4.247
	d. Update the expedition assurance process within the Joint Service Adventurous Training Parachute Operating Manual, in order to ensure that it is suitable for all expedition scenarios.	1.4.282
	e. Clearly define what Royal Air Force adventurous training has been identified as requiring duty holding by the functional safety Delivery Duty Holder, in order to prevent ambiguity.	1.4.304
	f. Direct an audit of the Joint Service Parachute Centre (Weston), in order to assure the Centre's 1st party assurance activities.	1.4.331
	g. Ensure the 2nd party assurance process encompasses all functional areas for subordinate formations, in order to assure the management of units under their command.	1.4.336

[189] Recommendation duplicated from the SI Urgent Safety Advice

h. Ensure the allocation of an independent 2nd party assurance provider for Royal Air Force adventurous training. 1.4.340

i. Direct an organisational safety assessment to review the levels of resource at Royal Air Force Weston on the Green, in order to ensure the adequate provision of personnel to fulfil all managerial and instructional functions. 1.4.359

1.5.10. **The Air Officer Commanding No. 1 Group in consultation with Air Officer Commanding No. 22 Group should:**

a. Direct a study to determine the effects of turbulent wake created by a parachutist in all equipment configurations, in order to identify any associated risk. 1.4.112

1.5.11. **The Inspector of Safety RAF should:**

a. The Inspector of Safety Royal Air Force should engage with the Military Aviation Authority and any other DSA regulator as required, in order to agree on the appropriate safety governance model for RAF sports parachuting and JSAT parachuting. 1.4.309

1.5.12. **Director Defence Land Safety Regulator should:**

a. Stipulate the level of assurance required for high-risk adventurous training activities. 1.4.351

1.5.13. **The Armed Forces Sports Board should:**

a. Establish a requirement for an Armed Forces sports association for high-risk sports, in order to provide a coherent governance and safety management structure within Defence. 1.4.292

b. Mandate the requirement for a pan-Defence sports parachuting operations manual, in order to ensure coherence across all sports parachuting disciplines. 1.4.301

1.5.14. **The Commandant, Robson Academy of Resilience should:**

a. Update all Robson Resilience Centre (Weston) and Joint Service Parachute Centre (Weston) terms of reference, in order to ensure compliance with the Defence Trainer Capability requirements. 1.4.371

1.5.15. **As the Training Requirements Authority, the Chair of the Joint Service Adventurous Training Steering Group should:**

a. Update the Joint Service Publication 419 assurance procedures and documentation for Joint Service Adventurous Training expeditions, in order to ensure that they are suitable for all Joint Service Adventurous Training activities. 1.4.283

b. Stipulate the terms of reference for both the single Service Training Delivery Authorities and lead sponsors for sports parachuting.	1.4.376
1.5.16. **The Director of the Office for Product Safety and Standards should:**	
a. Engage with the Director of the Health and Safety Executive, in regard to clarifying the status of emergency parachutes within the guidance surrounding the relevant PPE regulations, including those made under the Health and Safety at Work etc Act 1974.	1.4.151
1.5.17. **The Civil Aviation Authority Director General Aviation should:**	
a. Coordinate with the Federal Aviation Authority to request an update to Technical Standard 135 by the Parachute Industries Association, in order to ensure clarity of the requirements of the standard.	1.4.162
b. Coordinate with the Federal Aviation Authority to either, request an update to the Federal Aviation Authority Technical Standard Order C23f, or consider the issue of a UK Technical Standard Order Authorisation (UKTSOA) to require parachute assembly manufacturers to provide evidence of gap analysis of safety critical parachuting equipment manufactured under obsolete standards.	1.4.163
1.5.18. **British Skydiving should:**	
a. Stipulate the documentation to be followed for rigging procedures against a recognised standard.	1.4.181
b. Stipulate an authorised tools list for rigging purposes, including the calibration requirements for pull force measuring equipment, in order to minimise the risk of damage to parachute systems and ensure accurate pull force test results.	1.4.182
c. Review and update the Jump Pilot Manual, in order to ensure the information provided is in accordance with current regulation and policy.	1.4.204

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PART 1.6

Convening Authority Comments

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PART 1.6 – CONVENING AUTHORITY COMMENTS

Introduction

1.6.1. This service inquiry (SI) was convened on 13 September 2021 to investigate the circumstances surrounding the death of Sergeant (Sgt) Rachel Fisk, a Royal Air Force parachute jump instructor at Royal Air Force Weston on the Green. In addition, the convening authority expanded the SI panel's terms of reference to examine a broader view on the safety of parachuting governance within Defence.

1.6.2. The SI panel has submitted its report to me after 16 months of detailed evidence gathering, interviews and analysis. It has produced a comprehensive report and I agree with both the findings and the recommendations. It was the panel's opinion that the combination of turbulent wake[190] and its interaction with the reserve pilot chute[191], resulted in a malformation of that pilot chute. Based on the available evidence, despite completion of the correct emergency drills, the malfunction presented to Sgt Fisk was assessed as being irrecoverable.

Urgent Safety Advice

1.6.3. During the investigation, the panel identified the potential for the reserve parachute system to behave in a different manner, depending on whether it was released post a main canopy deployment or when dealing with a 'total malfunction' with the main canopy still in the parachute container.[192] The panel assessed that this change in performance combined with a parachutist's turbulent wake could lead to a malformation of the reserve pilot chute. In addition, when combined with ancillary equipment such as a camera jacket, the effects of turbulent wake were assessed as likely to be exacerbated. The panel issued Urgent Safety Advice to confirm that the safety cases and risk assessments in use in Defence sufficiently considered the risks associated with these findings.

Analysis of the evidence

1.6.4. It is of significant note that the only reason that the panel was able to make its conclusions as stated within the report was due to the data extracted from various digital data sources, including the GoPro™ camera worn by Sgt Fisk during the descent. Without this information it would have been solely reliant on the imagery captured at the scene post the accident. The panel acknowledged that it would likely have made very different conclusions based on this information alone. However, the panel stopped short of recommending that all parachutists should ordinarily wear such devices due to the additional training requirements that would be required for some of these items.

1.6.5. The cumulative effect of several individual factors created an unintended and difficult set of circumstances to predict and overcome. But, as ancillary data was not available for previous parachuting accidents, it was impossible for the panel to understand whether similar factors had been complicit in the outcome of any other serious injury or death. This inquiry has highlighted the challenges of post-accident analysis for parachuting accidents and the multitude of interactions and factors that need to be considered. Where information has been gleaned using new or novel evidence gathering and analysis

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[190] Turbulent wake is the turbulent air (low pressure) immediately above the position of the descending parachutist.
[191] There are two parachutes in the pack – main and reserve pilot chutes.
[192] A total malfunction is identified as the inability to deploy a main parachute canopy.

techniques, they will be discussed with the regulator, external safety agencies and the national governing body, to assist in any future investigations.

1.6.6. Whilst the use of the Graphical Data Analysis System was routine within Defence for aviation accidents, its use by the panel for parachuting was innovative. The tenacity of the panel and the Defence Accident Investigation Branch (DAIB) in developing this approach, along with the high-speed digital video assessments of similar parachute systems was a critical element in testing many of the theories posed throughout the investigation. These analytical approaches have been captured as lessons identified for future investigations.

Employer responsibilities

1.6.7. Defence has a responsibility to ensure the overall safety of its employees when carrying out any activity, including participation in authorised sports. Whilst this could be seen as an additional layer of bureaucracy for a like-for-like activity, it is acknowledged that this is an appropriate legal requirement for an organisation that employs the person, provides the equipment, and conducts the activity. Whilst the MOD always works hard to fulfil this requirement, the report highlights the need to be more coherent in our approach as an organisation, particularly for sports and adventurous training, and work has already begun to rectify this.

Equipment

1.6.8. Equipment was a key focus throughout the investigation. Whilst no single item was identified as being at fault, the lack of a requirement within Defence for the provision of a safety case for sports parachuting equipment is significantly at odds with the military equipment procurement process. Whilst it was accepted by the panel that this was no different to any sports parachutist operating at a civilian parachute training organisation, as an employer, the Ministry of Defence (MOD) has additional responsibilities to its employees.

1.6.9. I am in no doubt that the application of a robust safety case would have highlighted the authorisations and standards associated with the equipment. As these standards are self-regulated by industry, it is incumbent on Defence to ensure that their application is understood and identify whether mitigations are required to ensure the safety of its use. I have been assured that work is already underway to update the affected publications to ensure that these requirements are clear and unambiguous.

Policy and governance

1.6.10. A common theme throughout the investigation was the difference between the single Services' interpretation of policy and the provision of governance and assurance for sports related[193] parachuting activities. The catalyst for this was determined to be due to top level policy delegating the responsibility for individual commands to decide on their safety models and processes, leading to divergence from each other for non-operational activities that had the same output. Whilst this did not make the activity unsafe, it had the potential to cause confusion, and inhibited a collaborative approach to decision making when conducting joint activities. In addition, the panel considered many documents to be ambiguous, with the ability to misinterpret the intent of the policy maker. This point has been accepted, Defence is adopting a plain language policy, therefore, revisions to these

[193] Joint Services Adventurous Training parachuting uses sports parachuting as the basis of its activity.

policy documents should ensure that policy statements are coherent and able to be understood at every level.

1.6.11. The panel also opined that for non-operational focussed joint activity such as Joint Service Adventurous Training and sports, a single unambiguous set of policies and a harmonised governance structure should be implemented, where possible. In addition, top level policy should provide sufficient guidance to prevent the need to interpret or embellish on its requirements if there is no reason to do so. By operating with "one voice", there are clear benefits to the safety, cost effectiveness, ease of management and ability to provide a coherent structure, without the need to diverge between organisations.

Assurance

1.6.12. Assurance is mandated for all activity within Defence; however, the investigation demonstrated a difference in its application across the single Services for the same activity types. Director Health Safety and Environmental Policy has recently introduced the new Joint Service Publication 815 – Defence Safety Management System, which outlines the future assurance construct to be adopted throughout Defence. Whilst the new policy does not directly stipulate a requirement to coordinate across organisational boundaries, Defence is taking steps to cohere risk management and assurance practices for parachuting activity. Work needs to be done to broaden this approach to other activities, a matter that should be a focus of future Defence safety strategies.

Conclusion

1.6.13. I have reviewed the SI report and am content that this accident has been investigated, analysed, and reported on rigorously and accurately. I did not deem the character or reputation of anyone involved in the accident investigated to be directly affected by the findings, however, there are areas that can be improved with immediate effect to ensure the safety of our employees. I am assured that the internal recommendations contained within it have been, or will be, implemented to reduce the likelihood of a similar occurrence in the future. I am aware that the Defence parachuting community is already looking at ways to coordinate its policies and practices to enhance its ability to provide a safe and coherent working environment.

1.6.14. This SI has identified factors that directly relate to Defence parachuting, however, there are recommendations that are also applicable to other government departments, the parachuting industry, international civilian sports parachuting organisations and other activity within the MOD. It is, therefore, imperative that this SI report is made available to all audiences, including the sharing of its conclusions with international sports parachuting national governing bodies. This should aim to further strengthen our collective learning and collaborative operations, to raise awareness and mitigate further occurrences. Where recommendations external to the MOD have been made, the DAIB will work with affected agencies and organisations to enable their implementation.

1.6.15. On behalf of the Defence Safety Authority, I offer my sincere condolences to Sgt Rachel Fisk's family, friends and loved ones.

S J Shell CB OBE MA
Air Marshal
Director General Defence Safety Authority

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