



Service Inquiry

**SERVICE INQUIRY INTO THE FATAL DIVING
INCIDENT AT THE NATIONAL DIVING AND
ACTIVITY CENTRE, NEWPORT
ON 26 MARCH 2018.**

NSC/SI/01/18

NAVY COMMAND

PART 1.1 – COVERING NOTE.

NSC/SI/01/18

20 Feb 19

FLEET COMMANDER

SERVICE INQUIRY INVESTIGATION INTO THE FATAL DIVING INCIDENT AT THE NATIONAL DIVING AND ACTIVITY CENTRE, NEWPORT ON 26 MARCH 2018.

1. The Service Inquiry Panel assembled at Navy Safety Centre, HMS EXCELLENT on 26 Apr 18 for the purpose of investigating the death of 30122659 LCpl Partridge on 26 Mar 18 and to make recommendations in order to prevent recurrence. The Panel has concluded its inquiries and submits the finalised 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 Order and TORs	Part 2.2	List of Witnesses
Part 1.3	Narrative of Events	Part 2.3	Witness Statements
Part 1.4	Findings	Part 2.4	List of Attendees
Part 1.5	Recommendations	Part 2.5	List of Exhibits
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		Part 2.8	Annexes

President


Lt Col Army
President
Diving SI

Members


Lt Cdr RN
Technical Member


Warrant Officer Class 1
Diving SME Member

Part 1.1 – Glossary

1. Those technical elements listed below without an explanation here are explained in full when they are first used.

Abbreviation	Meaning
2PA	Second Party Audit
AAR	After Action Review
ACNS(T)	Assistant Chief of the Naval Staff (Training)
ACOP	Approved Code of Practise – HSE guidance document for diving.
AD2	Army Diver Class 2
ADDQUAL	Additional Qualification
ADSEL	Army Diver Selection Course
AET	Air Endurance Time
AP	Accountable Person
ALARP	As Low As Reasonably Practical
BCA	Buoyancy Control Aid
BCS	Buoyancy Control System
BFL	Babcock Flagship Limited
BR	Book of Reference
CASEVAC	Casualty Evacuation
Cat	Category
CO	Commanding Officer
CoC	Chain of Command
CODH	Commanding Officer Duty Holder
CONPLAN	Contingency Plan
COS	Chief of Staff
CP	Course Programme
CPR	Cardio-Pulmonary Resuscitation
CPS	Cylinder Pressure Sensor
CW	Collingwood – RN Base
DAIB	Defence Accident Investigation Board
DAP	Dive Amendment Process
DaWA	Diving at Work Act
DCOP	Defence Code of Practise
DDS	Defence Diving School
DDST	Defence Diving Standards Team (New name for DST)
DE&S	Defence Equipment and Support
DESN	Diving Equipment Safety Notice
DIF	Difficulty, Importance, Frequency (An element of the training needs analysis process.)
DMR	Defence Maritime Regulator
DO	Dive Officer
DPFT	Divers Physical Fitness Test
DPP	Dive Project Plan
DRS	Diver Recall Signal
DS	Dive Supervisor
DSAT	Defence Systems Approach to Training
DSM	Diving Safety Memorandum
DST	Diving Standards Team
DTG	Diver Training Group / Date Time Group
DTO	Dive Training Officer
DTTT	Defence Train the Trainer

OFFICIAL – SENSITIVE

DTWC	Diver's Through Water Communications
DU	Diver Unit
EC	Emergency Cylinder
EMA	Ear Microphone Assembly
EO	Enabling Objective (an articulation of something that needs to be taught)
EOP	Emergency Operating Procedure
FDS	Fleet Diving Squadron
FFM	Full Face Mask
FOAP(T)	Fleet Outsourcing Activities Programme (Training)
FOST	Flag Officer Sea Training
HAT	Harbour Acceptance Trials
HF	Human Factors
HMV	Half Mask Variant
HP	High Pressure
HQ	Headquarters
HSE	Health and Safety Executive
IAW	In Accordance With
IDT	Initial Diver Training
IN	Improvement Notice
INM	Institute of Naval Medicine
IP	Intermediate Pressure
IPCC	Intergovernmental Panel on Climate Change
ISpec	Instructional Specification (the old term of an LSpec – see below)
JNCO	Junior Non-Commissioned Officer
JSP	Joint Service Publication
KLP	Key Learning Point
KSA	Key Skills Analysis
KSE	Knowledge, Skills, Experience
LCpl	Lance Corporal
LED	Light Emitting Diode
LP	Low Pressure
LS	Lazy Shot
LSpec	Learning Specification (A forma part of the DSAT process. The document from which instructors are given all necessary information as a basis for their lesson plan).
LWC	Land Warfare Centre. The 2* organisation responsible for Initial and Subsequent trade training requirements.
MEOD(FP)	Maritime Explosives Ordnance Disposal (Force Protection)
ML	Modification Leaflet
MoC	Management of Change
MOP	Maintenance Operation Procedure
MTP	Multi-Terrain Pattern
MWS	Maritime Warfare School
NCHQ	Navy Command Headquarters
NDAC	National Diving and Activity Centre
NLIMS	Naval Lessons Identified Management System
NOTICAS	Notification of Casualty
NRV	Non-Return Valve
NSC	Naval Safety Centre
NSDSR	Naval Service Diving Safety Review
NSN	NATO Stock Number
NST	No Stop Time
ODH	Operational Duty Holder

OFFICIAL – SENSITIVE

OF	Officer
OiC DTG	Officer in Charge Diving Training Group
OPDEF	Operational Defect
PBAC	Portable Breathing Air Compressor
P-File	Personnel File
PMS	Planned Maintenance Schedule
POMA	Petty Officer Medical Assistant
PRV	Pressure Relief Valve
PS	Permanent Staff
PT	Physical Training
PTT	Press-To-Talk
Q&A	Question and answer
QA	Quality Assurance
QQ	QinetiQ
RABA	Rechargeable Air Breathing Apparatus
Recce	Reconnaissance
RHIB	Rigid Hulled Inflatable Boat
RN	Royal Navy
RXR	Repair by Replacement
S288	Dive record
SABA	Swimmers Air Breathing Apparatus
SCADE	Self-Contained Air Diving Equipment
SCUBA	Self-Contained Underwater Breathing Apparatus
SD	Standby Diver
SETT	Submarine Escape Training Tank
SI	Service Inquiry
SIC	Subject Indicator Code
SIM DECO	Simulated Decompression
SMART	Specific, Measurable, Action-orientated, Realistic, Time bound
SMDI	Senior Military Diving Instructor
SME	Subject Matter Expert
SoDD	Superintendent of Defence Diving (new name for SofD)
SofD	Superintendent of Diving
SOPs	Standard Operating Procedure
SQEP	Suitable, Qualified, Experienced Person
SSDD	Surface Ship Definition Database
SSR	Second Stage Regulator
SBA	Switch Block Assembly
TO	Training Objective (an articulation of something that needs to be taught)
TORs	Terms of Reference
TRiM	Trauma Risk Management
VOX	Voice Operated Transmission
WO	Warrant Officer

PART 1.2 – CONVENING ORDER AND TERMS OF REFERENCE



25 April 2018

SI President
SI Panel Members

SI Advisors

Copy to:

DPSO/CDS
MA/VCDS
Sec/1SL
MA/CGS
EA/2SL

MA/DCGS
MA/DG DSA
EA/FOST
EA/ACNS(Ships)
NSD

PCAP ACOS
CO 26 Eng Regt
Command Secretary
Finance Director (Navy)
Army Sec

NSC/SI/01/18 - CONVENING ORDER FOR THE SERVICE INQUIRY INTO THE FATAL DIVING ACCIDENT AT THE NATIONAL DIVING AND ACTIVITY CENTRE (NDAC), CHEPSTOW ON 26 MARCH 2018.

1. In accordance with Section 343 of Armed Forces Act 2006 and in accordance with JSP 832 – Guide to Service Inquiries (Issue 1.0 Oct 08), the Fleet Commander has elected to convene a Service Inquiry (SI).
2. The purpose of this SI is to investigate the circumstances surrounding the accident and to make recommendations in order to prevent recurrence.
3. The SI Panel will formally convene at Navy Command Headquarters, HMS EXCELLENT at 1100L on Thursday 26 April 2018.
4. The SI Panel comprises:

President: **Lieutenant Colonel** [REDACTED]
Members: **Lieutenant Commander** [REDACTED]
Warrant Officer 1 (Diver) [REDACTED]
5. The legal advisor to the SI is **Lieutenant Commander** [REDACTED] (Navy Legal Services) and technical investigation/inquiry support is to be provided by **Major** [REDACTED] (Navy Safety Centre). The Medical Officer qualified in Diving Medicine advising the panel is **Surgeon Commander** [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). It is to record all evidence and express opinions as directed in the TOR.

7. Attendance at the SI by advisors/observers is limited to the following:
██████████ (Institute of Naval Medicine) – unrestricted attendance.
Navy Safety Centre personnel in their capacity as advisors to the SI Panel – unrestricted attendance.
8. The SI Panel will work from HMS KING ALFRED, Whale Island.
9. Reasonable costs will be borne by the Navy Safety Centre under UIN N4194A.

Original Signed

B KEY CBE
Vice Admiral
Fleet Commander – Convening Authority

Annex:

- A. Terms of Reference for the Service Inquiry into the fatal diving accident at the National Diving and Activity Centre, Chepstow on 26 March 2018.

**Annex A To
NSC/SI/01/18
Convening Order
Dated 25 April 2018**

TERMS OF REFERENCE FOR THE SERVICE INQUIRY INTO THE FATAL DIVING ACCIDENT AT THE NATIONAL DIVING AND ACTIVITY CENTRE (NDAC), CHEPSTOW ON 26 MARCH 2018.

1. As the nominated Inquiry Panel for the subject SI, you are to:
 - a. Determine the cause of the accident and examine any contributory, aggravating and other factors.
 - b. Investigate and comment on relevant fatigue implications of individuals involved in the activity and other stressors.
 - c. Ascertain whether personnel involved were acting in the normal course of their duties.
 - d. Examine safety procedures and processes for this dive, including orders, SOP's and instructions and any other relevant documents issued, for applicability, relevance and compliance.
 - e. Determine the serviceability state of all relevant equipment and maintenance schedules. Comment on whether these are appropriate and on any defects or deficiencies identified.
 - f. Establish the level of training, including familiarity with equipment and procedures, competencies, qualifications and currency of students and directing staff involved in the activity.
 - g. Identify if the levels of planning and preparation were commensurate with the activities' objectives.
 - h. Determine whether risk assessments were appropriate and considered at the correct level.
 - i. Review the levels of authority and supervision covering the task when the accident occurred – was the task appropriate and necessary as part of a graduated training progression?
 - j. Determine and comment on any broader organisational and/or resource factors at the Defence Diving School and NDAC. Within this consider and report on leadership, culture and reporting mechanisms for near misses and errors.
 - k. Investigate whether there have been similar related accidents and comment on whether lessons identified from these accidents have been learned.
 - l. Consider Defence and sS policy and practices alongside comparable civilian legislation and comment on whether military policy is sufficient and provides a safe system of training.
 - m. Report and make appropriate recommendations to the Fleet Commander by 5 July 2018.

2. The investigation should not seek to attribute blame and you should use JSP 832 Guide to Service Inquiries as a handrail for the conduct of your investigation.
3. During the course of your investigations, should you identify a potential conflict of interest between the Convening Authority and the Service Inquiry, you are to pause work and take advice from your Legal Advisor.

SECTION 1.3 - NARRATIVE OF EVENTS

Introduction

1.3.1. This Service Inquiry has been convened to establish the facts of the matter regarding the death of a soldier whilst on his Army Diver Class 2 (AD2) course. The SI TORs (see **Section 1.2**) also required the Panel to review the wider management of diving. The following narrative aims to offer the report reader a broad context against which the main body of the report is based.

1.3.2. The Army Diver Class 2 (AD2) course is a seven-week long package run by the Diving Training Group, at the Defence Diving School (DDS) in Portsmouth. The first two weeks deliver the Military Diver First Aid Course, with the following five weeks being the SCUBA practical phase. Weeks 1 to 5 referred to in this report relate to the practical SCUBA phase and are aligned to the Course Programme. At the time of the event the aim of the course was to train novice officers and soldiers in the use of Swimmers Air Breathing Apparatus (SABA) Mod 1 diving equipment and in techniques that will allow them to operate at depths of up to 30m¹. The majority of students will not have dived before and the AD2 course is the lowest level SABA diving course followed by Army Diver Class 1 (AD1) and eventually the Army Dive Supervisor (ADS).

1.3.3. On 26 Mar 18 (Monday of the fifth and final week of the practical SCUBA phase) the instructors and students travelled to the National Diving and Activity Centre (NDAC), near Chepstow, to undertake a series of deep dives leading to their final qualifying dive on Wednesday 28 Mar 18. The NDAC three day package is the routine culmination phase of the AD2 course with three progressive (in terms of complexity and depth) days of diving. LCpl Partridge died during the first dive of the NDAC package.

Events on 26 Mar 18

1.3.4. The students were picked up by minibus from the DDS accommodation and left for NDAC at 0530hrs. On arrival at NDAC students were given breakfast followed by a tour of the site before unloading equipment and preparing the dive site. This included preparing the SABA equipment and the necessary support and medical equipment, including a safety boat. The photograph at Figure 1.3.1 was taken by the police investigation team post incident and gives a clear indication of what the dive team would have seen on the Monday morning as they approached the dive site. The point where the divers entered the water and buoy attached to the helicopter are marked.

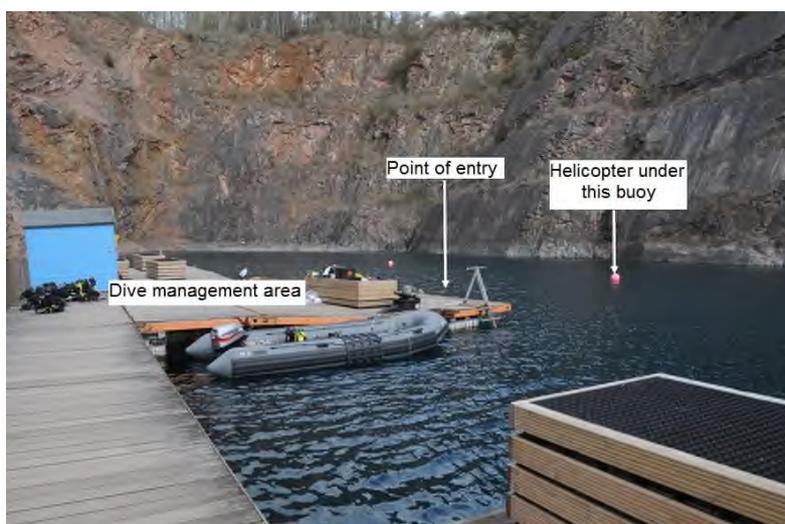


Figure. 1.3.1 Site of 26 Mar 18 Dive at NDAC

¹ The maximum depth to which the SABA MOD 1 equipment is certified to.

1.3.5. The course then moved to a classroom adjacent to the main NDAC car park and the Senior Military Diving Instructor (SMDI 1) (who was acting as the Diving Supervisor (DS) on this dive) delivered the general and detailed Dive Briefs. The briefs were completed by 1020hrs and the students and staff moved to the diving jetty where LCpl Partridge and Diver 2 prepared themselves for the first dive of the day. They both carried out the necessary pre-dive checks of their equipment (known as “MOP 2 Checks”²) and confirmed their main and bailout cylinder pressures to the DS before entering the water. An Emergency Operating Procedure (EOP) Casualty Evacuation (CASEVAC) drill was conducted, with LCpl Partridge acting as the casualty. Once the drill was complete LCpl Partridge conducted another pre-dive check and report before being directed to re-enter the water. Diver 2 had remained in the water but was “on air” and was not using air from his cylinders.

1.3.6. The aim of the dive, as briefed to the students, was for the first two divers to take a ‘distance line’, from the bottom of the ‘Shot Rope’ and attach it to a submerged Wessex helicopter, see Figure 1.3.2 below. The other students would then follow the ‘distance line’ and conduct a recce of the helicopter. The task for the first pair was expected to take approximately 10 minutes though no set time was given.

1.3.7. Each diver was attached to a ‘lifeline’ which is a light rope used to pass simple, pre-planned signals and allows the surface to monitor where the divers are. After conducting the necessary surface checks the first pair descended the ‘Shot Rope’. Once on the bottom both divers conducted their seven point checks prior to Diver 2 attempting to send a ‘Bottom Report’ to the surface via the Divers Through Water Communications (DTWC) system. The pair then began their task of attaching one end of the ‘distance line’ to the shot rope sinker before heading out to attach the other end to the helicopter, a distance of 17.7m. This was not a ‘buddy’ dive as each diver had their own lifeline and they were not physically attached to each other though there was an assumption that the pair would remain together throughout the dive. There was no instructor presence in the water.

² Diver pre-use equipment checks.

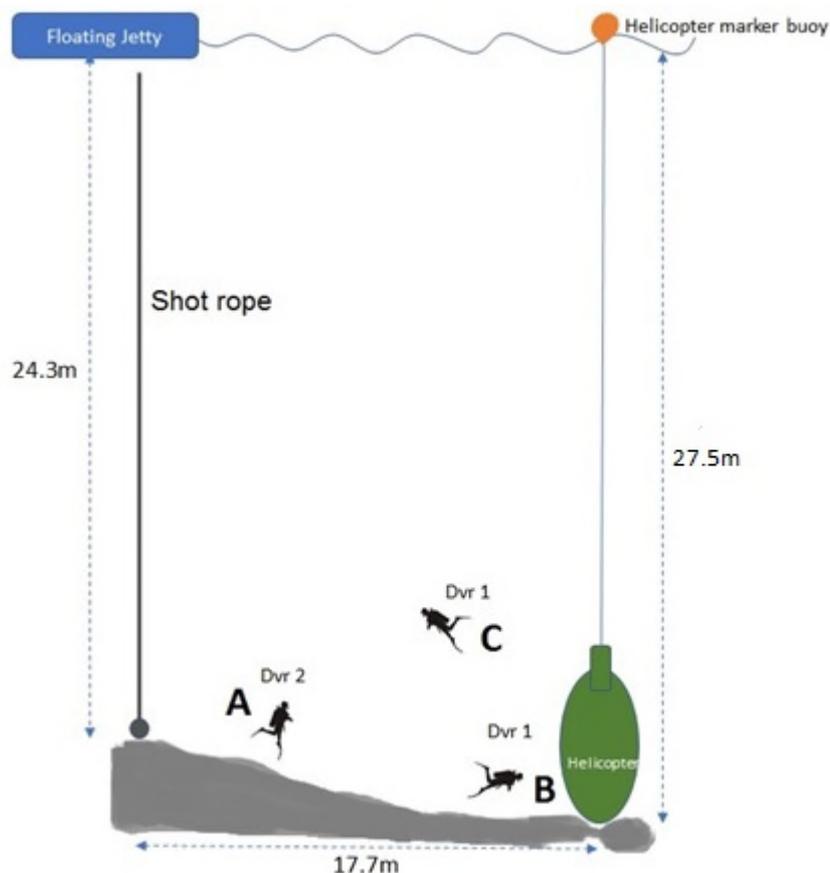


Figure.1.3.2 NDAC Dive Profile 26 Mar 18

1.3.8. This is a task which is routinely completed by AD2 students, though normally on the Tuesday having had an additional, simpler dive to complete on the Monday. On this occasion the task became significantly more complicated soon after the dive began. The 'distance line' provided was three times longer than required (53m) and comprised of two ropes tied together. Almost immediately the Distance Line became tangled around the joint. At this point the student Divers took the decision that Diver 2 would remain near the shot rope to untangle the line (position A in Figure. 1.3.2) and pay it out as LCpl Partridge swam towards the helicopter. Whilst visibility was good Diver 2 lost sight of LCpl Partridge before he reached the helicopter. Had the line not been tangled then both divers would have swum out to the helicopter together as per the dive brief. Visibility at 24m depth was approximately 10-15m, which is considered to have been good by Defence Maritime Regulator (DMR) Subject Matter Experts (SME).

1.3.9. At two points in the dive LCpl Partridge asked for the attendant to adjust the tension on his lifeline using DTWC demonstrating that there was occasional 1-way voice communication available. However, both the student managing the surface set of the DTWC and Diver 2 testified they did not have effective voice communications throughout the dive. After approximately 10 mins of bottom time, the DS told the surface DTWC operator to instruct both divers to end the dive and return to the shot rope. No voice response was heard from either diver so, in accordance with the direction given to them by the DS, both attendants gave the signal to return to shot via each of their respective lifelines. Diver 2 correctly acknowledged the signal via his lifeline however there was no coherent response received from LCpl Partridge.

1.3.10. Towards the end of dive Diver 2's Cylinder Pressure Sensor (CPS) warning light came on indicating that there was c.55 bar of pressure left in his main cylinder. He waited at the bottom of the shot rope until he saw LCpl Partridge returning from the helicopter. LCpl Partridge appeared to be slightly above Diver 2 finning towards the jetty (at point C on Fig. 1.3.2 above). Using hand signals Diver 2 indicated to LCpl Partridge that his CPS had activated and that he was returning to

the surface. Diver 2 was unable to confirm whether his signal was seen. Diver 2 then turned to face the shot rope and ascended to the surface. It was subsequently confirmed by NDAC staff that LCpl Partridge was successful in attaching the distance line to the helicopter.

1.3.11. When he reached the surface Diver 2 removed his face mask and was asked by the DS where LCpl Partridge was. He replied that he had seen him swimming back towards the jetty. The DS then instructed LCpl Partridge's Attendant (Student 5) to give the lifeline a hard pull, however no response was received. The DS then took the lifeline from the attendant and repeated the signal, again no response was received.

1.3.12. At that point the DS ordered the Standby Diver into the water. The Standby Diver found LCpl Partridge at approximately 24m depth some 2-4 m out from the jetty, static and on his back with his face mask removed. The Standby Diver tried to inflate LCpl Partridge's Buoyancy Control Aid (BCA) but with no effect but found there was no air left in LCpl Partridge's main cylinder. The Standby Diver then inflated his own BCA and swam to the surface with LCpl Partridge. Once on the surface, LCpl Partridge was recovered to the jetty via the safety boat where first aid was initiated and the emergency services called.

1.3.13. There were three in date and qualified military medics on the instructional staff who began delivering CPR and other appropriate first aid actions. The DS established communication with the ambulance service as this was being conducted. The Air Ambulance paramedics were the first of the emergency services on the scene and took over from the DDS staff. The students and staff were then moved to the NDAC classroom. For the remainder of the day the staff and students were kept on site, mostly in the NDAC café area which overlooked the diving pontoon and, for several hours, LCpl Partridge's body. As soon as HQ DDS were informed of the incident the DDS Chief of Staff (COS) drove to NDAC as the lead J1/Pers officer. No accident log was generated.

1.3.14. The Defence Accident Investigation Board (DAIB) was informed of the accident at 1258hrs on 26 Mar by CO DDS. A team of three DAIB accident investigators deployed to the scene on 26 Mar arriving at approximately 1630hrs. Additionally, a team of three personnel from the DMR deployed in support of the DAIB investigation to provide diving SME advice. The students and staff of the course were kept at the NDAC location for the following 24hrs as interviews with the police, DAIB and Health & Safety Executive (HSE) were conducted. When finally released the following day, the students packed up the DDS equipment and returned to Portsmouth.

Events After the Incident

1.3.15. DMR stopped all SABA Mod 1 diving across the military pending trials on the equipment to establish if there was an equipment failure. Once released by the police, LCpl Partridge's diving equipment was handed to QinetiQ for independent testing. The trials confirmed the equipment operated as expected. On receipt of the QinetiQ report, DMR gave permission for diving using SABA Mod 1 equipment to recommence.

1.3.16. The police handed investigation responsibility over to the HSE on the 26th March having decided this was more appropriately managed through the Diving at Work Act (DaWA) rather than through any criminal proceedings. The HSE investigation continues at the time of writing.

1.3.17. The Service Inquiry Panel was formally stood-up on 26th Apr 18.

1.3.18. On 7 June 18 SABA Mod 1 diving was stopped when Diving Safety Memorandum (DSM) 05/18 was issued by Navy Command Head Quarters (NCHQ). The decision to stop diving using SABA Mod 1 equipment was not related in any way to the LCpl Partridge case. The decision to stop diving was caused by a separate fault found with the 'knurled nut' found on the Full-Face Mask (FFM). Subsequently DSM 06/18 was issued which allowed units which gained Operating Duty Holder (ODH) approval, to dive SABA Half-Mask Variant (HMV) to maintain operational capability.

1.3.19. The Panel have been assured all AD2 courses were cancelled until further notice as the ODH will not grant dispensation for Army novices to dive using the HMV. As a result, the issues identified in the Analysis and Findings 1.4 section are not carrying current risk.

1.3.20. All the immediate personnel management actions expected of a unit in such situations were conducted appropriately such as issuing NOTICAS, notification of NoK and delivery of TRiM. The Army's Bereavement Aftercare Cell (BAS) remain in contact with the family.

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Summary

Table of Accident Factors Identified

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PART 1.4 – ANALYSIS AND FINDINGS.

Part 1.4 Structure

1.4.1. Part 1.4 of the report is split into the following sections:

- a. Methodology – A brief outline of accident factors and probability terms used. The section also lists the evidence available and issues considered by the Panel.
- b. Equipment – A brief introduction to the SABA equipment to enable the reader to understand the main analysis and findings 1.4 section.
- c. Factors Identified – The main analysis and findings section containing the observation, discussion and conclusion/recommendation relating to the identified accident factors.

1.4.2. The Panel has drawn conclusions and made recommendations throughout the report but a summary of Accident Factors is included at the end of Part 1.4 (Table 1.4.4). All recommendations are captured in Part 1.5. of the report. A glossary of terms and abbreviations used can be found at Part 1.1.

Methodology

1.4.3. Few go to work to cause an accident deliberately, yet error is a very normal by-product of human performance. Accordingly, this report aims to identify lessons to improve and assure Health, Safety and Environmental Protection (HSEP). Once identified each accident factor is mapped to the four elements of the Resilience Model.

Resilience Model¹.

1.4.4. The Model provides a macro view of the overarching vision to reduce risk and avoid harm across the whole force. It can be used in safety planning and, as in this case, occurrence investigations. The model is taken from the new BRd 10, owned by Naval Safety Centre, which builds on James Reason's barrier method² to control hazards in the workplace using four strategic control pillars:

- a. **Organisational Factors.** These relate to management structures, allocation of resources and risk-based decisions impacting HSEP performance.
- b. **Competence.** An expansion to the commonly used concept of SQEP (which is explained below).
- c. **Unsafe Conditions/Acts.** This refers to the physical working environment and unsafe acts relates to the actions of individual and teams.
- d. **Local Conditions.** This refers to measures such as leadership, supervision, orders, routines and processes.

1.4.5. Competency. The HSE describes competence as the combination of training, skills, experience and knowledge that a person has, and their ability to apply them to perform a task safely. Other factors, such as behaviour and physical ability, can also affect someone's competence. The competence model is a development of the Suitably Qualified and Experienced Personnel (SQEP) term widely used in Defence which includes the need to be *current* in the type of employment, any immediate physical or mental limitations and physiological or psychological factors and the ability to recognise and respond effectively to safety risks or issues. Anyone managing Defence activity must specify the level of competence required for persons involved in that activity and ensure that anyone working in their AoR is competent to undertake the activities required safely.

Accident Factors.

1.4.6. Once an Accident Factor had been determined it was assigned to one of the following categories:

- a. **Causal Factor.** Causal factors are those factors that, in isolation or in combination with other factors and contextual details led directly to the accident. Therefore, if a causal factor is removed from the accident sequence, the accident would not have occurred.
- b. **Contributory Factor.** Contributory factors are those factors that made the accident more likely to happen. That is, they did not directly cause the accident, therefore if a contributory factor is removed from the accident sequence, the accident may still have occurred.
- c. **Aggravating Factor.** Aggravating factors are those factors that made the final outcome of an accident worse. However, aggravating factors do not cause or contribute to

¹ BRd 10. Navy Command Safety and Environmental Management System (NC SEMS)

² James T. Reason. Managing the risks of organizational accidents. Aldershot: Ashgate, 1997.

an accident, that is, in the absence of the aggravating factor. the accident would have still occurred.

d. **Other Factor.** Other factors are those factors that, whilst they played no part in the accident in question, 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 worthy of note to improve working practices that the SI Panel discovered during their investigation, but that do not relate directly to the accident being investigated.

1.4.7. Due to the nature of this accident Human Factors are essential to understanding why it occurred and the involvement of the Institute of Naval Medicine(INM) HF Team and their resulting report (N48) has been critical to the analysis of events leading up and on the 26 Mar 18. The Panel has focused on establishing the facts of the matter, what occurred, and what led to these events. In so doing the Panel has made recommendations that put in place control measures which should prevent recurrence.

Probabilistic Language.

1.4.8. The probability terminology detailed below in Figure 1.4.0 clarifies the terms used in this report to communicate the degree of certainty 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 and has been used in other service inquiries through 2018.

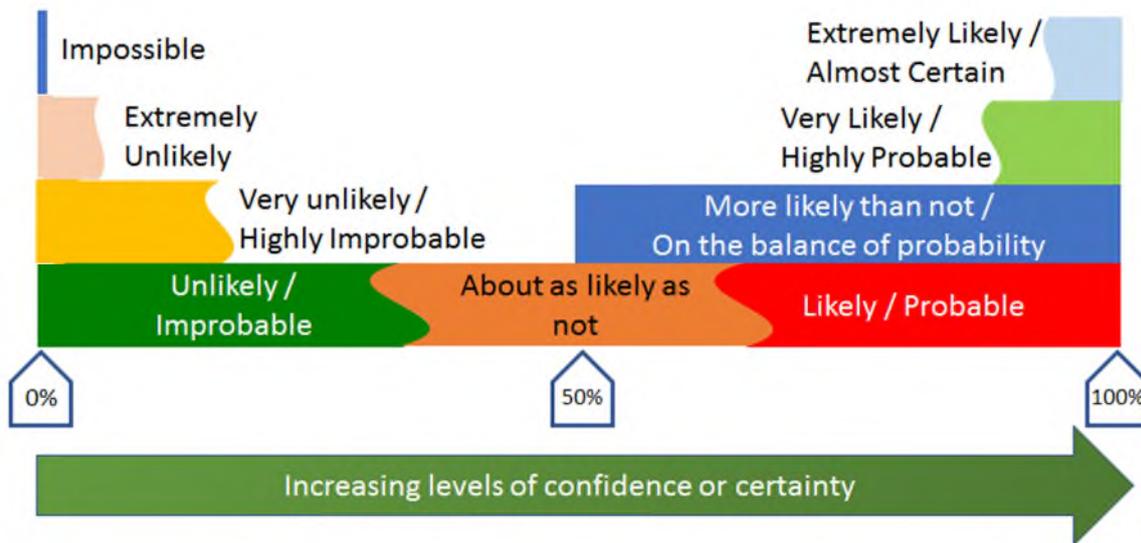


Figure 1.4.0 Probability Language used.

Available Evidence

1.4.9. The Panel had access to the following evidence:

- a. DAIB Triage Report
- b. DAIB Deployment Record
- c. Police SOCO photos
- d. Post Mortem Report dated 7 Nov 18
- e. Interviews with DDS staff and students; DMR staff; MWS Trg QA staff; DE&S staff; RN Snr User; Army Diving OF5 SME;

- f. Archived DDS AD2 Course documentation.
- g. AD2 1703 Course documentation, inc P-Files
- h. Key Defence Diving documentation inc: DCOP series; BR 2800 series of documents;
- i. SABA Mod 1 Safety Documentation
- j. NLIMS (historical lessons archive)
- k. DMR issued diving safety documentation inc; DSMs
- l. QinetiQ equipment analysis reports conducted on behalf of HSE
- m. Relevant standing orders
- n. HF Report written by INM HF staff.
- o. Pelly Report
- p. 2022 data base
- q. MWS audit reports
- r. FTC Dive Team Recce Report

Evidence Not Available to the Panel

1.1.10. No evidence was withheld from the Panel and all involved parties provided as much support as was requested. The only documents not accessible to the Panel were historical reports of past incidents which is an issue discussed below in the Post Event section (page 1.4.39).

Issues Considered by the Panel.

1.4.11. The Panel analysed the following key issues:

- a. The Swimmer Air Breathing Apparatus (SABA) Mod 1³ equipment and its key ancillaries.
- b. Course design and training documentation of the AD2 course.
- c. The Army Diver Class 2 (AD2) course.
- d. The period leading up to the occurrence, including the planning and preparation for the final week of the course.
- e. The day of the occurrence and the dive.
- f. Immediate actions in response to the occurrence.
- g. The organisation and management of military diving.

³ A specific form of Self-Contained Air Diving Equipment (SCADE). SCADE is more commonly known by its sport diving label – SCUBA.

Introduction to Key Equipment Elements

1.4.12. SABA Mod 1 Overview. The purpose of the SABA equipment is to provide the diver with a self-contained, open-circuit breathing air supply, for use to a maximum depth of 30 m. It is used by several UK military diving communities and has five variants. The following section focuses on the SABA Mod 1 variant, as seen in Figure 1.4.1, which is the principal variant in use across the Services and as used throughout the AD2 course. Whilst there are other components to the SABA Mod 1 the sections below outline the key elements identified through the Service Inquiry (SI) in order to provide the necessary context for the main body of the report.

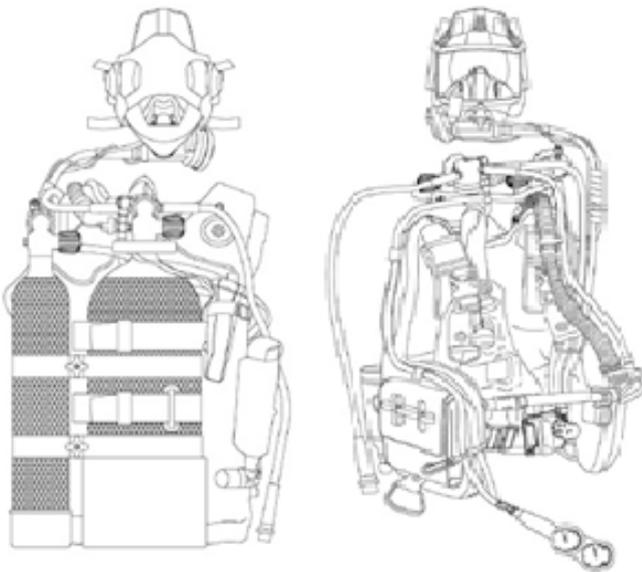


Figure. 1.4.1 Front and rear view of the complete SABA Mod 1 set.



Figure 1.4.2 The BCA

1.4.13. The Buoyancy Control Aid (BCA). The BCA (see Figure 1.4.2) is an inflatable jacket with a rigid plastic backplate, waist strap and a pair of nylon webbing bands to hold the cylinders. It is the core around which the SABA system is assembled and provides divers with buoyancy and can assist ascent in an emergency. The BCA draws air from the main cylinder when required to increase buoyancy and has dump valves to release excess air to reduce buoyancy.

1.4.14. Main and Bailout Cylinders. SABA Mod 1 is fitted with a pair of air cylinders, with a default size of 12.2 and 3 litres for the main and bailout respectively, as was used by LCpl Partridge on 26 Mar 18. The cylinders are shown in Figure 1.4.3 with a cylinder valve fitted. This connects to the first stage regulators discussed in paragraph 1.4.18.



Figure. 1.4.3 – Main and bailout SABA cylinders

1.4.15. First Stage Regulators. A first-stage regulator is screwed into each cylinder valve, see Figure 1.4.4. They reduce the high-pressure air (up to 232 bar) held within the cylinders to an intermediate pressure (IP) of around 9.5 bar which the switch block and mask mounted, second stage regulator can safely manage. The first stage regulator also supplies the dry suit and BCA inflation valves with intermediate pressure air.



Figure. 1.4.4 – The first stage regulators fitted to the main and bailout cylinders (left) and in isolation (right)

1.4.16. Switch Block Assembly. Fitted to the waistband on the left side of the BCA, the Switch Block Assembly (SBA) shown in Figure 1.4.5 receives air through intermediate hoses from both the main and bailout cylinders. The SBA supplies air to the second stage regulator located on the front of the Full-Face Mask (FFM); it is a diver activated hand wheel valve which switches the air supply from the main cylinder only (when fully closed) to both the main and bailout cylinders (fully open).



Figure. 1.4.5 – Switch block assembly

1.4.17. Gauge Console Assembly. Figure 1.4.6 shows the gauge console which provides the diver with the only formal measure of the remaining air within the main and bailout cylinders. The bailout cylinder gauge is mounted into the console nearest the hoses and proud of the main cylinder gauge.



Figure. 1.4.6 - Gauge Console Assembly

1.4.18. Full Face Mask(FFM), Second Stage Regulator(SSR) and Cylinder Pressure Sensor(CPS). The SABA Mod 1 system used on the AD2 course is equipped with a FFM, which houses the SSR, Diver’s Through Water Communications (DTWC) speech module and the CPS. The SSR converts the IP air from the first stage regulator to a pressure that matches that of the surrounding water allowing the diver to breathe. It also vents exhaled gas to the surrounding water. The CPS indicator illuminates with a bright red flashing light when the main cylinder pressure falls to approximately 55 bar; it will then extinguish at 15 bar to conserve battery life. As can be seen in Figure 1.4.7 the CPS is located only 6cm away from the diver’s eye, in a prominent position and, for the duration it is activated, it is extremely unlikely to be missed due to a blind spot.



Figure. 1.4.7 – Full Face Mask with CPS, SSR and DTWC highlighted

1.4.19. Diver’s Through Water Communications (DTWC). DTWC was designed for a service life of fifteen years, having been brought into service in Feb 02. The purpose of the DTWC equipment is to enable divers to have clear, two-way, voice communications with a supervisor on the surface and other divers. DTWC is a broadcast system (everyone hears all transmissions) designed to have a range of 1000 m in benign environmental conditions. The DTWC equipment is only compatible with a Full-Face Mask (FFM) and the DTWC components used by the diver are shown in Figure 1.4.8.



Figure. 1.4.8 – DTWC diver equipment

1.4.20. Emergency Cylinder(EC). The EC, circled in Figure 1.4.9, is a 0.4l cylinder which provides a diver with an alternative direct feed air supply to the BCA jacket if the main air supply becomes exhausted or it suffers a catastrophic failure. It holds only enough air to fully inflate the BCA at 30m and cannot be used as a source of breathing air.



Figure 1.4.9 – Emergency Cylinder fitted to the lower right-hand side of the BCA jacket

Factors Considered**Medical Requirements and Tracking.**

1.4.21. LCpl Partridge. LCpl Partridge was thought of as an extremely fit and active individual by both his unit and the DDS staff. He completed his basic training at Bassingbourn in Cambridgeshire, where he was awarded the prize for Fittest Recruit, before completing Phase 2 training as a Military Engineer (Driver) in Apr 11. He was a regular in the Regiment's gym and had represented the Regimental Rugby Team and the Army as part of the Under 23 Army Football squad. He held an in-date military standard diving medical as listed in BRd 1750A and passed the day one INM approved AD2 Diver Physical Fitness Assessment which, consequently, resulted in a reasonable belief that he was fit enough to complete the course.

Witnesses
1, 2, 3, 12,
14, 16, 31.

N52

1.4.22. However, his medical records show that he had collapsed twice after endurance events on his pre-All Arms Commando Course (which he passed). After the course he was seen by a cardiologist who identified no specific concerns but gave some advice regarding hydration and suggested that he increase his endurance training and reduce weight training to lose some upper body mass. The Panel also established that he failed to complete the circuits on the last day of his Army Diver Selection course (ADSEL) in late 2017 having driven himself to exhaustion during the early laps. During week three of the AD2 course he was also directed not to continue the Chesil Beach run by the instructing staff as he had a grey complexion and was struggling to speak. For each of these cases LCpl Partridge had pressed on to the point of collapse.

SI Panel
Med Advisor

N5
N38

Witnesses
13, 14, 18

1.4.23. Medical Screening. The fact he is known to have failed to complete four endurance events over several years does not, in itself, suggest that there was an underlying issue. However, the fact several of these failures were not captured prevented either the medical staff or the chain of command spotting and investigating any potential trends. In particular, the two cases where LCpl Partridge came off DDS managed physical training events (on two separate courses) within a 4mth period were not reported or recorded by medical staff. That there was no process in place which required instructional staff to seek medical advice is seen as a gap which should be addressed. Had both of the DDS managed cases been captured and considered by a medical practitioner it is possible that LCpl Partridge would have been pulled off the course during week three pending further medical assessment. The Panel believe reporting and tracking of such matters needs reviewing with the inclusion of the medic at DDS who can assess if there is a need to elevate on medical grounds. Whilst the recommendation below requires non-medical staff to initiate the procedure it is to ensure an informed medical decision can be made having assessed medical records and any possible trends. The lack of a reporting and tracking system is seen as a **Contributory Factor**.

Witnesses 2,
24, 25

N38

Recommendation R1. MWS to develop an auditable process which ensures failures (either failure to complete endurance aspects or to start or complete dives) are scrutinised by the DO, Medic and OIC DTG weekly to identify any potential medical issues.

1.4.24. Post Mortem. A post mortem was conducted on 3 Apr 18 and the report was released on 7 Nov 18 (delay being due to the pathologist being taken ill) which **identified Sudden Death in Adults as the cause of death**. The report and supporting letters seen by the Panel also identified that LCpl Partridge had an anomalous coronary artery. This condition means LCpl Partridge's right

N60

N80

coronary artery did not join the heart at the same point as usual and has been shown to lead to circulation problems when exercising. The letter from St George’s University Hospital to the pathologist evidences that such a heart condition is extremely hard to identify and notes even ECG and exercise testing may not reveal the anomaly.

N81

1.4.25. Dive Medical. Discussions with the INM Diving Medical specialist have indicated that only a MRI scan or similar would conclusively identify such an anomaly. Such scans are not part of the current dive medicals required by either the military or civilian diving authorities. The current military dive medical is one of the most stringent in Defence alongside pilot assessments and is aligned to current practice across the UK diving industry. That LCpl Partridge was passed fit against those standards is thought to be appropriate. Whilst the medical standards are not thought to be an accident factor, had LCpl Partridge’s heart anomaly been identified he would not have been deemed fit to dive against the current standards. Accordingly, the Panel find that this is an **Other Factor** and recommend that the current diving medical assessment is reviewed to ensure all reasonable measures are captured.

N38, N37,

N83

Recommendation R2. INM to confirm that the current diving medical assessment is Fit for Purpose.

1.4.26. Physical Requirements / Fatigue. The Panel agree with the findings of the INM report that whilst it is difficult to ascertain whether fatigue played a role in this incident the course could reasonably be expected to induce fatigue in both staff and students, at least at some points in the AD2 course. However, the Panel found no evidence to suggest that the physical requirements of the course are inappropriate for students who are fit and healthy enough to attend the course. Short, sharp PT efforts are still used, such as “In and Outs” (repeated entry and exits from the water) to focus students but all students that commented they do not think it is excessive. The Panel believe that the physical demands placed on the students throughout the course are appropriate.

N48e

Witnesses
11-20

1.4.27. However, the post mortem has shown that LCpl Partridge had an undiagnosed heart anomaly which is linked to sudden death in adults when exercising. The Panel believe that, due to presence of the heart anomaly, it is likely that any strenuous exercise could have triggered the sudden death. Accordingly, the Panel find it is likely that the exertion of the dive and the stressful environment was a **contributory factor**.

N14j

AD2 Course 1703.

1.4.28. The AD2 course is the entry level SCADE diving course for all Army Divers. No prior diving experience is required less that gained on the five-day Army Diver Selection Course (ADSEL) also run at DDS. The students mustered on course number AD2 1703 on 26 February 2018 having completed the two-week diving first aid course beforehand. Whilst much of the course was delivered at the DDS site on Horsea Island, Portsmouth the students were accommodated at HMS COLLINGWOOD (CW) (approx. 20min drive from DDS). The Course Programme (CP) provides the full details of not only the planned activities but also the risk assessments and names of all staff involved

N2
Witnesses
11-20

PROGRAMME OUTLINE

WEEK 1	WEEK 2	WEEK 3
<p>HORSEA ISLAND BASIC SKILLS</p> <p>Day 1 DPFT, opening address, health and safety at work brief, QC brief, diving regs, diving physics & properties of gases theory, draw equip, dress a diver, intro intro diving physics, scuba theory, cage handover.</p> <p>Day 2 Diving illnesses, identify SABA MOD1 and DTWC, SABA MOD 1 before use routine, knots & signals, dress a diver, charge diving cylinder, basic drills, after use routine.</p> <p>Day 3 Wet PT, emergency drills, emergency drills assessment</p> <p>Day 4 Rigging a safety boat, manual dexterity & hand tools.</p> <p>Day 5 PT duathlon, intro decompression methods and tables, course photo, weekly reports, PBAC(d), ramset bolt gun, cage hand over. AD Lifeline Signals Final Exam WA 03 Logbook Lesson.</p>	<p>HORSEA ISLAND HARD FINN</p> <p>Day 1 Squad Run, Seabed searches, Circular searches Tidal systems, underwater recovery methods, understand deco regs, Fast water search, night dive, dive period.</p> <p>Day 2 Body Search & Recovery, Circular and Grid searches, Dive searches, Stay at DDS.</p> <p>Day 3 Mud run, Hard Fin, Night dive Hard Fin. Stay at DDS.</p> <p>Day 4, Squad Run, Compass Theory, Compass swimming.</p> <p>Day 5. Weekly feedback. UWFT Assessment PA 07.</p>	<p>WEYMOUTH FAST WATER</p> <p>Day 1 Fast Water Searches schemes dive period, towed search, dive period.</p> <p>Day 2 PT, Fast Water Searches Single line jackstay, Night dive.</p> <p>Day 3 Fast Water Searches, Logbooks/revision.</p> <p>Day 4 River recce theory and practical, Fast Water Dives, PT endurance run & load stores.</p> <p>Day 5 Return to DDS.</p>
WEEK 4	WEEK 5	
<p>HORSEA ISLAND</p> <p>Day 1 Wet PT, Underwater Demolitions.</p> <p>Day 2 Live Underwater Demolitions, Night dive marked swimming in pairs, long jackstay.</p> <p>Day 3 Boat dive, Simulated Decompression Exercise Wet PT.</p> <p>Day 4 SETT, AD2 Progress exam.</p> <p>Day 5 Outside agency recovery/buoyancy Load for NDAC.</p>	<p>HORSEA ISLAND / NDAC DEEP DIVING/TEST WEEK</p> <p>Day 1 Deep diving period, Final exam revision/Logbook. PBAC(D) assessments PA-05.</p> <p>Day 2 Deep diving period, Standby Diver drill. Final exam revision.</p> <p>Day 3. Deep diving period, AD2 FINAL Written Exam (WA-04) and resit signals exam return to DDS.</p> <p>Day 4, Cage maint, PCD, Records/Pay, and Post Incident Procedures.</p> <p>Day 5 Presentations, SMDI disposal.</p>	

N2

Figure 1.4.10 – AD2 1703 Course Programme

1.4.29. Figure 1.4.10 above offers an outline of the key events of the course. Of the scheduled 27 diving periods students complete during the course, the first 19 dive periods take place in less than 10m of water, dive period number 20 is scheduled for 15m, dive number 21 to 30m (in the SETT facility) and one deep (21-30m) dive each day at NDAC during Week Five (Mon – Wed). In practical terms the students do have a stepped increase in depth to allow the body to adapt to prevent Nitrogen Narcosis however each student only experiences two dives deeper than 10m before arriving at NDAC. In the case of LCpl Partridge, the record of dives (Form 288d) shows that he completed 31 individual dives totalling 1059 minutes at an average (mean) maximum depth of 7.6m. Of the 1059 minutes only 27mins (2.5%) were deeper than 9m. (see para 1.4.39 below)

N2

N1d

1.4.30. The CP is compiled by DDS staff based on course documentation designed by Babcock Flagship Limited Fleet Outsourcing Activities Programme (Training) (BFL). The allocated instructional team are given the programme to review several weeks before the course and ensure all resources are in place. The CP forms part of the Dive Project Plan and includes not only the detailed daily programme but also the risk assessments and identifies the staff involved. The CP is formally signed off once the Diving Officer (DO) and Senior Military Dive

N2

Instructor (SMDI) are content all is in accordance with the BFL course documentation, DCOP 20 and the relevant BRDs and is appropriately resourced. The CP for this specific course was signed off on 19 Feb 18.

N2

Course Design.

<p>1.4.31. The above Course Programme (CP) was designed by Babcock Flagship Ltd (BFL) based on the Role Performance Statement owned by Capability Ground Manoeuvre (Cap GM) and prepared by the Royal Engineer’s Training and Development Team. BFL are contracted to design the course programme in accordance with JSP 822⁴ and are supervised/managed by Flag Officer Sea Training (FOST). Interviews with the FOST Assurance Team and a review of the most recent second Party Audit report highlighted a list of both Non-Conformities and Observations for Improvement. Whilst dated 29 May 17 several of the findings of the audit report can still be clearly identified in the AD2 course documentation such as:</p>	<p>Witness 28, 29, N71</p>
<p>a. “Poorly written documentation was sighted that demonstrates a lack of internal QA applied to the outputs of trg design” BFL2PA Report 29 May 17 Annex A</p> <p>b. “Evidence suggests that some designers lack experience and understanding about the application of DSAT training design processes.” BFL2PA Report 29 May 17 Annex B.</p>	
<p>1.4.32. During interview the author of the BFL 2 PA Report added that the current Learning Specifications (LSpecs) used were in his opinion “Insufficient to deliver from” and that “Instructors press on when documents are not in date or of are not good enough”. As an example, the Key Learning Points (KLPs) for the scheduled dive, titled “<i>Dive 19 - Simulated In-water Decompression</i>”, were simply to:</p>	<p>Witness 29 N3a, 3d, 3e</p>
<p>a. “KLP. 1. Dive Brief”</p> <p>b. “KLP. 2. Decompression Drills”</p>	
<p>1.4.33. No further information is given in the LSpec specified by the course programme. JSP 822 explains the requirement for a KLP to state the necessary outcome as either knowledge or skill. KLPs are usually centred around a verb which confirms what the student should be able to do or know at the end of the learning event.</p>	<p>N50e</p>
<p>1.4.34. None of the practical LSpecs included in this course programme meet these JSP 822 requirements. The quality of the LSpecs is poor both in terms of diligence, accuracy of included information and in the quality of direction to the instructional staff. The first aspect has been identified and reported by the ACNS(T) assurance process and appears to be a systematic issue for BFL FOAP(T). As noted in their 2nd Party Audit Report dated 29 May 17, “poorly written documentation was sighted that demonstrates a lack of internal verification...poorly developed technical content, for example relating to Training Objectives, conditions and standards can dilute the value of well written Role PSs or completely misalign with the original requirement”. Based on the AD2 course material reviewed, the Panel wholly endorse the May 17 reports findings. The Panel find that the failure to address issues raised by 2nd Party Audits as an Other Factor.</p>	<p>N2 N71</p>
<p>Recommendation R3. MWS to action the recommendations from the May 17 2nd Party Audit Report</p>	

⁴ JSP 822. Defence Systems Approach to Training.

Recommendation R4. MWS implement a quality assurance mechanism which ensures new course material from BFL is fit for purpose before being accepted into use.

1.4.35. However, the findings of this SI go further having seen significant evidence that the practical/dive LSpecs are woefully short on technical (diving) information for the instructional staff. The near complete lack of direction and guidance on, for example, the Dive 19 LSpec results in the instructors having the latitude to conduct any dive at a depth of 21-24m which has a dive brief and decompression drills. This is only the 3rd dive below 9m and whilst the other two dives did include simulated decompression stops there was no systemic, designed tuition focusing the students on the implications of depth. The Panel find the lack of detail in the practical LSpecs to be a **Contributory Factor**.

N3a, N3e
Witness 2

Recommendation R5. MWS to re-write all AD2 course lessons to ensure the Dive Supervisor has sufficient information to base his lesson on.

Recommendation R6. MWS to re-write all AD2 Course KLPs to ensure they are written iaw JSP 822 and with a diving effect focus.

1.4.36. The Panel recognise that the theoretical implications of depth are taught on the course and that instructors add additional comments or advice to students reminding them of having less time at depth. However, as currently designed and delivered, the course does not allow the student to gain a personal, practical understanding of the extent depth affects their diving. There is no systematic review of how much air they have consumed through a dive, at any depth. Dives and their corresponding dive briefs are task focused with the student's focus anywhere other than on their air consumption, until their CPS activates. The only exception to this is when they are swimming to CPS intentionally as they see who can swim the longest on a cylinder of air.

Witness 11,
15, 16, 19

N48c

Recommendation R7. MWS to enhance air consumption awareness during training serials by increasing the frequency of gauge checks.

1.4.37. That the students check their gauges every 10mins, as taught and required by policy, is not in doubt. However, for the first 19 dives this is in shallow water and their focus is not on consumption rates but whether they have reached the end of the dive. As all dives, until week 4, are in shallow water the students have developed muscle and mental memory of capability where a cylinder will last for between 30 and 50mins. Due to the shallow depth, gauge checks on a more frequent basis will show very little change and the novice diver focuses on other, non-diving tasks given, such as using a compass board or the tools necessary to get the job done. Beyond Ex Hard Finn in week 2 the Panel found that there is a shift in focus from delivering a competent diver to developing an underwater engineer. Whilst conducting dives and so increasing knowledge, skills and experience (KSE) the students clearly focus on the military activity being taught from this point forward. The overarching focus on military task (in general through the course and within the dive brief on 26 Mar 18) rather than diving aptitude is considered a **contributory factor** by the Panel.

Witnesses
11-20
N2

1.4.38. The Panel found that the course does not adequately prepare the novice to dive safely below 10m. The course is structured in such a way that it gives the students insufficient experience below 10m or 20m and the dives are focused on military tasks beyond Week Two. In the main instructors deliver the course as designed and whilst there are delivery observations noted below this is principally a course design flaw. The implications of continuing a dive beyond CPS

N1d

N48c

activation is significantly different when at 27m than at 6m. At 6m from the point of activation the main cylinder would continue to provide breathable air for c.7min 30sec whilst at 27m this would be only c.3mins 10secs. Interviews with the students demonstrated most did not appreciate the magnitude of this reduction in available time. Only those with prior, sport diving experience were able to offer confident and accurate answers in this area. The Panel believe it is extremely likely that LCpl Partridge made mistake⁵ due to an inadequate level of ability and knowledge compounded by a lack of experience at depth. The Panel found that poor course design **contributory factors** to his death.

N62

Witnesses
11-20

1.4.39. During interviews the Panel were informed that DDS were designing a training package which would focus solely on diving capability leading to a formal qualified diver status. A second phase would then consolidate the delivered diving KSE and add on the military task elements. The Panel believe this is the correct approach though emphasise the need to increase the time spent between 10 and 30m, the current 2% of dive time below 9m is inadequate. Whilst the Panel strongly support the shift to a novice phase one followed by the military task phase two element, the course design should not be owned by DDS staff who do not have the necessary DSAT experience.

Witness 21,
22, 23

Recommendation R8. MWS to redesign the course to develop trainees as a competent diver (to 30m) before delivering the military task element.

1.4.40. To facilitate this the Panel believe the following recommendation is appropriate:

Recommendation R9. MWS to re-design the course to increase instructor covered diving experience for the trainees between 10-30 m.

Assessment Strategy / Assessment Specification

1.4.41. The Assessment Strategy and Assessment Specification are included in the course folder. As written they offer a formative assessment approach with no structured summative standards or tests designed. At the end of each week the students are given a debrief which covers progress however beyond the first week these assessments are primarily informed by observations by surface based instructors. As such they are unable to actually see the diver, what they are doing or assess their diving specific ability.

N2, N3j
Witnesses
1, 2, 11-20
N5

1.4.42. The Assessment Strategy employed encourages rote learning, particularly with the theory aspects. As concluded in the INM Report "...there is room for improvement in relation to opportunities for deep learning for the students on the AD2 course". The mid-course written theory assessment is designed as a "formative assessment" meaning it should be part of the learning process. However, the majority of the paper involves closed questions with a right or wrong answer. There is little opportunity for the student to expand on an answer or explain their working. Therefore, the only feedback they are able to get is a tick or cross. The information it offers the instructors is limited to what the student got right or wrong rather than helping them understand where the student requires additional support. There is clearly a requirement for summative assessment to ensure the students 'know' the necessary material but improved formative assessment will increase the degree of 'deep' learning. The Panel find the poor quality of the assessment strategy to be a **Contributory Factor**.

N3j
N48f
N3j

⁵ A mistake is defined as a deficiency in judgement and/or failing to formulate the right plan based on flawed knowledge and/or incorrect comprehension of rules. As used by all recent Defence Safety Authority SIs.

Recommendation R10. MWS to expand the assessment process to include summative assessments and improved formative assessments.

1.4.43. Both the SI interviews and the training documentation confirm that no systematic After Action Review (AAR) takes place. If a post dive debrief does take place it is focused on the task or administration aspects rather than on diving skills. Equally there is no system by which divers under training can share their learning points or reinforce their experience underwater. By the end of Week one students are diving without a member of staff routinely in the water with them. From Week two students are principally diving in pairs so it is unlikely that the whole course will experience the same learning event on a given dive. This is further exacerbated when pairs are given different tasks to complete, as was the case on 26 Mar 18.

Witnesses
1, 3, 6, 11-
20
N48f

Witness 2,
14, 20

1.4.44. Whilst the degree to which the course can be delivered in a learner centric manner is limited by safety measures (it would be unsafe to allow true experiential learning) the implementation of After Action Reviews (AAR) would significantly improve the consolidation of learning. The Panel find the lack of AARs to be an **Other Factor**. As noted in the INM report an AAR should encompass the following aspects:

N48d

- a. Involve active self-learning.
- b. Have a developmental intent (not administrative).
- c. Focus on specific events.
- d. Be informed by multiple sources.

Recommendation R11. MWS to instigate After Action Reviews after all dive training serials.

Dive Management.

1.4.45. Evidence gathered when discussing the Dive Brief highlighted that the dive duration was never formally set or calculated (to do so is not a policy requirement). Witnesses recall a mention of the dive taking around ten minutes but this was clearly not a set duration. At interview the DS confirmed that he was content to allow the students to go beyond this time as they are the ones managing the task and know when it is complete. He explained that he was content with this approach as he knew the No-Stop Time⁶ was 18mins at the given depth. In addition, the students knew that they were to surface if their CPS activated. In his mind the students were appropriately protected from Nitrogen Narcosis and running out of air. However, neither he nor the students had any idea as to at what point their CPS would activate, when they should expect their main cylinder to be empty or when both cylinders would be empty.

Witness 2,
18

Witness 2,

1.4.46. HSE identified that the Air Endurance Calculation lesson (ADS LSpec 34) had unintentionally dropped out of the Army Dive Supervisor course and DDS could not prove that SMDI 1 had been taught how to do this⁷. Full details can be found in BR2806 but when air diving using the normal 12.2L Main Cylinder it is almost impossible for a novice diver to reach the No-Stop point. Figure 1.4.11 below taken from BR2807 clearly shows the air consumption curve for SCADE diving against the No-Stop curve. Certainly, novice (AD2) divers with their relative lack of endurance would be working nearer the red 40L/min curve than the blue 25L/min curve will always run out of air before reaching this point. It must also be pointed out that while the above remains correct, the graph below (the one all DS have access to) is incorrect. The NST line (in black) should be further to the left bringing the NST closer to the Air Endurance Lines in blue and red. Since the occurrence DDS have issued new documentation which accurately captures both the NST and AET enabling the DS to calculate dive duration appropriately.

N75

N12b

Witness 23

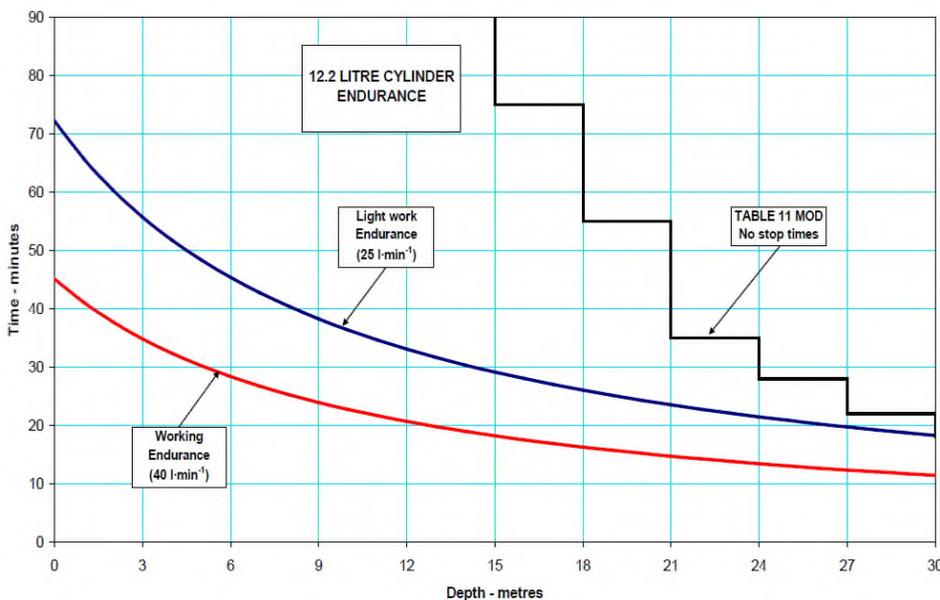


Figure 1.4.11

N12b

⁶ A No-Stop Time (NST) is the point at which, for a given dive depth and duration, decompression stops are required.

⁷ As a consequence, all Army SABA diving was suspended on 17 Oct 18 until all Army dive teams could evidence that their DS had completed the necessary remedial training.

1.4.47. Had the AET been calculated for this dive, the SMDI would have known that LCpl Partridge's CPS would have activated around 10 minutes into the dive and would not have allowed him to continue to dive for a further 6 minutes before dispatching the standby diver. This is therefore found to be **a contributory factor** in the death of LCpl Partridge. To address this students and DS should be able to calculate an estimate of their AET prior to entering the water. Since the occurrence DDS have produced a simple graph which would provide the necessary information and which students could use to do this.

Witness 23

Recommendation R12: CO DDS to ensure students report Air Endurance Times to the Dive Supervisor prior to the start of all training dives.

1.4.48. CPS Activation. The Panel found that many Army divers are currently briefed to return to shot on CPS activation and it was certainly the case throughout this AD2 course. Whilst this makes sense when operating close to the Shot Rope the length of time it would take a diver, especially a novice diver, to swim back to the Shot and then ascend at the appropriate rate, risks exhausting the main cylinder completely. In the case of this dive ascending at the prescribed rate of 1 in 4 from the Shot would take 1min 36secs. It would take about a minute to swim back to the Shot so with around 3mins of air remaining in the main cylinder (from CPS activation at that depth) there is only a 20secs buffer of air remaining. The RN are trained to surface immediately using the shortest (if safe) route to the surface and are trained to surface straight up through the column of water. From the helicopter a vertical ascent would have taken 1min 48sec offering a much larger buffer. The AD2 course does not train the Army divers to do this.

Witness 2,
3, 4, 7Witness 6,
9, 21, 25

1.4.49. Diver 2 confirmed that when last seen alive LCpl Partridge was swimming as though following his life line at a diagonal angle back to the surface (at point C shown on Fig. 1.4.12 below). This is not as the dive brief directed nor following the shortest route to the surface. Considering that it is almost certain that at this point LCpl Partridge's CPS had already activated it shows he probably realised he did not have sufficient air remaining to return to shot and then surface. In following the Life Line route to the surface it demonstrates that LCpl Partridge may have been trying to do the most sensible thing, shorten the route to the surface, having not been taught to ascend away from the shot line.

1.4.50. The Navy Senior Operator and other diving technical experts interviewed are of the opinion that returning to shot on CPS activation is at times an unsafe action, such as when at a distance from the Shot Rope. It was noted that the safety case for the SABA equipment does not allow for this course of action and the Statement of User Requirement (SUR) for both the current and pending SCADE equipment is based on an assumed shortest route exit. Given the Panel found that LCpl Partridge swam beyond CPS activation changes to actions on CPS activation would not, singularly, affect the outcome of this dive but the Panel do consider variation to actions on CPS an **Other Factor**. The Panel believe the following two recommendations would make ending a dive due to CPS activation safer.

Witness 21,
22, 26, 27

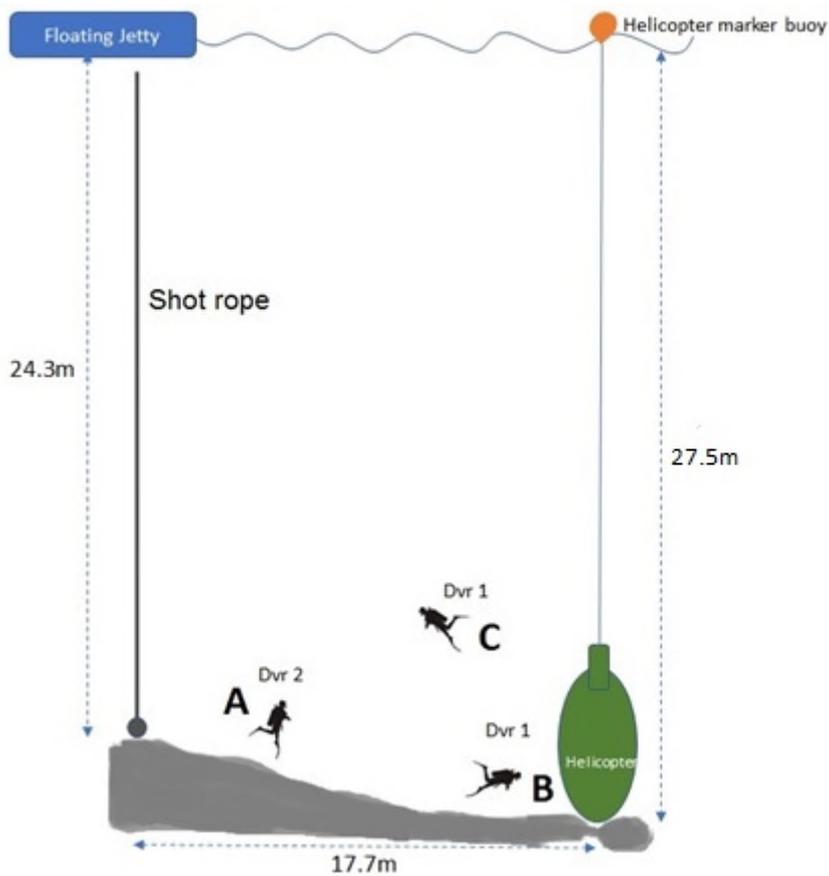


Figure. 1.4.12 NDAC Dive Profile 26 Mar 18

Recommendation R13: ACNS(SHIPS) is to ensure that a pan Defence procedure is adopted for actions on CPS activation.

Recommendation R14: LWC to review the RPS to ensure AD2 divers are required to conduct a controlled ascent away from a shot rope prior to diving below 9 metres.

1.4.51. In addition, much of the diving in Weeks 1 and 2 of the AD2 course aims to improve diver endurance (the length of time an amount of air can support a diver underwater). As the diver improves they aim to maintain neutral buoyancy without constant inflation and deflation of the Buoyancy Control Aid. The default means of assessing how a diver is improving their endurance is to direct them to swim until their CPS activates at 55 Bar. Given the same starting cylinder pressure, improved endurance/diving technique will see the diver swim at a given depth for longer before the CPS activates. This approach, swim to CPS activation, appears to be a regular means of managing AD2 dives at DDS. All students are therefore routinely swimming to the point where the CPS activates. Neither BR2807 nor the SABA Mod 1 Safety Case support the use of CPS as a means of managing a dive and at interview DE&S staff confirmed it should be used as a last resort rather than a routine dive management tool.

Witness 1, 3,6, 12, 14, 16, 20.

N48g

N66b, N12b

1.4.52. Diving to CPS activation removes the necessity for the novice diver to monitor their gauges as they are able to concentrate on swimming in the most conservative manner possible. The practice, which is prohibited by both the Senior Operator and BR2806, emphasises the dependence on procedural safety rather than a diver managing their own dive. Were the practice to be changed to “swim until your gauge reads 60 Bar” (or other value) it would, in the Panel’s

Witness 21, 22, N10

opinion, encourage accurate monitoring of the gauges. Diving to CPS activation as a planned control is seen as a **contributory factor**.

Recommendation R15. MWS is to cease the practise of deliberately diving to CPS activation.

1.4.53. Only during the “fast Water” phase (week 3) of the AD2 course are students required to monitor cylinder pressures on completion of a dive. During this phase the student’s complete multiple short duration dives and remaining cylinder pressure is checked before they re-enter the water. For all other dives there is no requirement to check cylinder pressure so students do not develop an understanding of their own air consumption. Were students required to routinely record air consumption across the whole depth range (0-30m) or cylinder pressures on “on completion of a dive” students would consolidate theory lessons on air consumption and the effects of depth. The Panel find that the lack of exit cylinder pressure reading to be an **Other Factor**.

N2,
Witness 3

Recommendation R16. MWS to amend the post dive procedures to include discussion of remaining cylinder pressure at the end of every training dive.

1.4.54. Training Venues. The AD2 course takes place across a number of dive sites. Horsea Island is an ideal venue for the novice to begin their diving career or indeed those returning for continuation training. However, it is too shallow to ensure AD2 divers are suitably qualified and experienced to dive the SABA equipment across the 0-30m range. The current five scheduled ‘deep dive’ periods are not thought to be sufficient, regardless of venue, and additional deep dives should be included in the course. The SETT is an ideal facility as an introduction to depth and the Harbour provides a local introduction to tidal waters when appropriately scheduled in the dive sequence. NDAC provides a dive site with full range of necessary resources where the risk is as low as reasonably practicable. The NDAC site is not considered a factor in this occurrence.

N2

1.4.55. Course Management. DDS was served with an Improvement Notice in June 2016 by DMR relating to insufficient training manpower supporting Army diver training. The resulting review by MWS restructured DDS to a single OF3 appointment (OiC DTG) sitting above the six DOs. This is a unique position when mapped to the DCOP which is essentially an “overseeing Diving Officer”. OiC DTG essentially shares the DO responsibilities as described in DCOP 20 and has the final word on Dive Project Plan matters. Whilst this does provide a career diver to oversee both Navy and Army diver training teams it has doubled the workload on a single appointment with no redundancy. The appointment must be manned by a Navy diver as Army divers are not SQEP in the full range of diving equipment used. The rationale for the single position is to ensure the required standard is maintained across all six instructor teams and best practice between the two services can be shared. This is well founded but in the Panel’s view the increase in the workload is too great for and overburdens the incumbent.

N20a
Witness 23,
25

1.4.56. To adequately assure the safe delivery of all six training programmes the OiC DTG must be in too many places at once. As described by the current OiC DTG the role is “...*split between safety focused and making sure that the training that’s being delivered is appropriate for the trainees’ development*”. To ensure this is completed to the required standard at any one time the incumbent is required to assess quality of delivery, ensure safe application of practices and protocols, that learning is student centred (through coaching and mentoring), that short notice changes to the Dive Project Plans are considered and processed appropriately. Courses could be in three or more locations on any given date and

Witness 25

H3Tp47A

N23b

with the incumbent required to be on call for six separate courses. The scope of this SI has not allowed a full role analysis to be conducted however there is sufficient evidence to suggest that the current Job Specification for the OiC DTG is too large for a single occupant. Additional support mechanisms have been put in place, such as site visits conducted by the CO and the Warrant Officer Training Assurance and a monthly meeting which discusses emerging trends and issues, however the responsibility for what was previously two wings now rests with a single accountable individual. As such the Panel find the over-burdening of the OiC DTG post to be an **Other Factor**.

Recommendation R17. MWS conduct a role analysis of the OiC Diving Training Group role to ensure all safety critical activity can be conducted and that manpower capacity meets that requirement.

1.4.57. Deviation Policy/process. One of the principal functions of the OiC DTG, management of the dive deviation process as articulated in DDS SOP 21. The Panel have identified numerous events over different courses and training teams where dives have been changed without an auditable trail and possibly without authority.

N23b

N2, N1d,
N6, N6a

1.4.58. The scheduled Dive-19 serial for 26th March 2018 was omitted and the deeper and more complex dive of LSpec Dive-20 was conducted. The DS confirmed during his interview that the decision to omit Dive 19 was taken on the morning of the dive based on the students having conducted two build-up dives. The course Dive Project Plan contains a pen amendment by SMDI 1 altering the depth of the Monday dive to 24-30m. The justification given is ‘2 x previous build dives’ referring to the deep dives previously conducted in week 4 in the harbour and the SETT, to 21m and 30m respectively. There is no other information noted, such as who authorised the change nor does it note the change in task or LSpec used.

N2
Witness 2,
11-20

N2

1.4.59. The scheduled Monday dive (Dive 19) should have been focused on conducting simulated decompression (SIM DECO) with the students remaining in the area of the Shot. However, the task briefed and attempted by LCpl Partridge and Diver 2 matched that of Dive 20, thereby omitting one of the Dive Project Plan dives and bringing the Tuesday serial forward to the Monday. This change in task complexity and the omitted SIM DECO practice was not captured in the Dive Project Plan amendment. The Panel find that replacing it with Dive 20, removed an important stepping stone in the student’s learning. Considering the conducted dive was the first dive at depth where the students left the shot, they were navigating to an objective they could not see at a venue they did not know and they were laying a Jack Stay/Distance Line for the first time the Panel find that omitting Dive 19 was a **Contributory Factor**.

N2, N3d,
N3b

Witness 2,
11-20

Recommendation R18. CO DDS to ensure all scheduled dives are completed in accordance with the course Dive Project Plan.

1.4.60. The DS does not have the authority to amend a Dive Project Plan without authorisation of the DO or OiC TSG. Should the Plan need to be altered the Dive Amendment Process (DAP) is laid out in DDS Standard Operating Procedure (SOP) 21:

N23b

Course programmes (Diving Project Plan) are to be authorised by the OiC Diving Training Group (OiC DTG) as designated by the CODH. Any deviation from course programmes in terms of content, timing and presentation are to be authorised by the OiC DTG. Minor time changes

within the daily training schedule to account for weather, resources and logistics is to be authorised by the Course Diving Officer. All changes are to be amended in red pen within programmes with DTG² and authorising officer referral details; this provides a clear Management of Change (MoC) for audit.

1.4.61. In this case there were changes to the DPP/CP noted in red pen and the authorising officer given as SMDI 1 (as DS), no DTG was annotated nor were all the changes noted. The DS stated that he tried to phone the DO and spoke to someone (he can't remember who) at DDS. Both the Diving Officer (DO) and the OiC DTG have stated on record that they were not consulted about the amendments made to the 26 Mar 18 dive and did not give authority for the changes. SMDI 1 was asked to provide phone log evidence of the call to DDS but he was unable to do so.

N2

Witness 1,
25

N36

1.4.62. There are other examples of deviations from the CP without any authorisation noted in the Project Plan (by the DS, DO or OiC DTG). Examples from this AD2 particular course include a significant increase in depth during the harbour dive on 21 Mar 18 (21m rather than the given max of 15m) and the omitted dive (DAR 16) on 23 Mar 18. SMDI 2 was the senior instructor for both these events though JMDI 1 was acting as the DS for the Harbour Dive and clearly no DS was listed as responsible for the omitted dive. There was also additional evidence of failure to comply with the DAP/SOP 21 on other courses when documentation was reviewed in the archive store. The Panel believe it is a relatively frequent occurrence and it is not restricted to any one course or training team. In this case the Panel found that changes had been made to the CP without a full understanding of the overall increase in risk to the students. Accordingly, the Panel find that the unauthorised amendment of the course is a **Contributory Factor**.

N2, N1d,
N2e, N1a,
N2f

N6, N6a

Recommendation R19. MWS to instigate a process to ensure the Dive Amendment Process is adhered to and is auditable.

1.4.63. The Panel have identified a number of shortcomings with the current DAP. Individually most are not considered contributory factors however, taken as a whole, the Panel believe it evidences a systemic failing of the DAP process. Had the DAP process been implemented as intended then the Panel believe the scheduled, simpler dive would have taken place which would have given all the students greater experience at depth. Had Dive 19 been conducted on the 26 Mar 18 then LCpl Partridge is likely to have completed the Monday dive without incident. The Panel believe that an occurrence of this nature was likely at some point based on other factors explored elsewhere, but the Panel have identified the following DAP shortcomings:

- a. The process is not being followed by instructors at DDS, with dives frequently deviating from the authorised programme without consulting the relevant DO.
- b. No audit is conducted to confirm the diving that actually occurs, recorded on the form 288d, is what was authorised in the CP.
- c. The DAP, as written, is ambiguous; What is the difference between a timing change and a minor time change? There are differing levels of authorisation yet the SMDIs is not mentioned at all and it removes DCOP directed responsibility from the DO.

- d. There is no over-arching record of dive amendments, which might be reviewed or audited; each amend is buried in the relevant CP which is archived on completion of each course.
- e. The SMDI is not provided with a non-repudiable confirmation that their request to amend the CP has been authorised; they are left exposed.
- f. The policy provides no guidance on what action a SMDI or DO should take if they are unable to contact their immediate superior, whether obvious mistakes in the CP require an amend, or how absences by the OiC DTG managed.
- g. Not all changed information is being entered into the CP.
- h. Alterations to the CP are compressing the programme and increasing the difficulty gradient without suitable or effective risk control measures.

1.4.64. The Panel find that the decision to amend the dive without permission is an example of the point noted at para 1.4.6 above where routine exposure to the dive site and task (and so the risks involved) may well have drawn the team into a heuristic trap. Heuristics⁸ are a fundamental part of how humans make decisions and judgements satisfactorily but at the risk or expense of a perfect solution. They are a mental shortcut that allows us to reach a short-term goal by defying sensible logic or common sense.

Whilst using an explanation based on avalanche risk management Schneiwind⁹ believes there are four key forms of heuristic that people fall victim to in the mountains which are equally applicable to diving:

- a. Over-commitment to a goal: Don't just press on because you feel you have to achieve the task set (such as securing the Distance Line to the helicopter).
- b. Familiarity with the terrain: Having completed this dive before several times on a Monday it'll be ok this time.
- c. Scarcity: It was Good Friday at the end of the week and there was a possibility of shortening the week by completing the dive a day early.
- d. Social proof: Other AD2 students have laid the Jack Stay/Distance Line before without an issue.

1.4.65. SQEP DO & DS. As identified in the Pelly Review in 2003 there remains no training for DOs. In addition, there is no minimum experience required for the DDS Army DOs. From a DCOP or HSE perspective the DOs are the accountable person who is wholly responsible for the safe management of the dives. That such a critical safety appointment can be filled without any experience or training beyond passing the Dive Supervisor course is thought to be inherently risky and exposes the incumbent. As such the Panel believe that whilst those fulfilling DO appointments at DDS at the time of the occurrence are qualified and meet the MoD defined standard but not all have the experience the Panel believe is appropriate. They cannot therefore be described as Suitably Qualified and

N53
Witnesses
1, 21, 30
N25b,
N17b,
N26d,
N57c, N32

Witness 1

⁸ Based on <https://www.ellis-brigham.com/what-are-heuristic-traps> dated Feb 18.

⁹ Henry Schneiwind is an internationally renowned snow and avalanche expert who studied avalanche forecasting as part of a Geology degree. He gives talks at international snow science conferences and has published many papers and articles, often in the British press. Henry identified that 9 out of 10 victims of avalanches trigger the avalanche themselves and many of these could have been avoided. He delivers a risk management formula to those involved in snow sports and mountaineering.

Experience Personnel (SQEP). Having an additional ‘overseeing DO’ in the OiC DTG appointment at DDS mitigates the risk to a degree though the Panel believe more should be done to reduce this risk. The lack of DO training is found to be an **Other Factor**.

Recommendation R20. Cap GM to address the lack of training and experience required for the role to ensure the risk carried by Army DOs is ALARP.

1.4.66. Further evidencing that supervision on 26 Mar 18 was not managed by a SQEP DS the HSE identified the omitted Air Endurance Calculation lesson (ADS LSpec 34) from SMDI 1’s ADS course. Unable to identify how many courses omitted this LSpec all Army SABA diving was suspended on 17 Oct 18 until the Army dive teams could evidence that their DS had completed the necessary remedial training. This action is now complete and the LSpec has been re-inserted into the ADS course. However, that such a critical aspect of dive supervision was omitted from the course over an unknown period of time alongside the numerous failures to meet policy direction found on AD2 course 1703 highlights that the quality assurance mechanisms in place are not sufficient. As such the Panel find the QA system to be an **Other Factor**.

N75

N6

Recommendation R21. MWS to develop and implement a more robust and effective QA system for DDS courses.

1.4.67. Whilst reviewing the requirements of a DO it became apparent that not only were Army DO’s not trained but that their accountability exceeds their realistic authority. With the DCOP being a development of the civilian ACOP, the DO maps to the “contractor” and as such is the individual solely responsible for the safe conduct of the dive and the project plan. The Panel believe that to be in such a position, regardless of the OiC DTG appointment, without formal training and or minimum level of experience is inappropriate and as such is an **Other Factor**. In the civilian dive community, the Dive Contractor is seen as a controlling mind with significant control over how a dive is run, what policy is applied and what equipment is used.

N25b,
N17b,
Witness 1,
21, 25

Recommendation R22. DDST to ensure that DCOP 20 is rewritten to accurately reflect the military diving capability, the unique military equipment and appropriate safety measures.

1.4.68. **Dive Briefs.** In order that the students can participate in AARs (see para 1.4.43), whether diving or task focused, they need to understand what the KLPs are before they commence the activity. Whilst student feedback confirms good, clear Dive Briefs are conducted before every dive the focus is on the military task rather than the diving aspects. The Dive Briefs are seen as orders for the task rather than part of the learning process.

Witnesses,
11, 13, 14
15, 16, 19

1.4.69. Whilst there is a DDS Dive Brief template, used not only at DDS but also across the Field Army, which is well suited to dive teams it has not been designed as a teaching aid. Its use causes the focus of the dives to be on the military task rather than the diving KLP. Current practice amongst the DS varies with some using a tablet (iPad) to brief from and others using paper/nyrex. In both cases there is no record of the dive brief retained. The Panel found it exceptionally difficult to capture the detail of what was covered in the brief given on 26 Mar 18 and even the length of the brief was impossible to confirm (reported as being between 15mins and 45mins).

N18

Witness 1-7

Witness 2,
7, 9, 12, 14,
20

1.4.70. Despite the use of the template and the lack of recorded detail the Panel believe that the brief given on 26 Mar 18 did include some elements of the risk assessment (discussed further at para 1.4.73) but was focused on the reconnaissance of the helicopter. The change of planned dive is discussed below but the DS stated that he did so to give the students something of interest to dive to. Whilst the recollection of students and staff present differed the only constant was the detail of the task.

Witness 9,
10, 12,

1.4.71. As the DDS dives are repeated several times a year at the same venue the Panel believe that the development of a standard brief for each dive would be beneficial. It would ensure all briefs were appropriately focused on developing diving KSE, were standardised ensuring all students received the same experience and information and would enable an auditable record to be kept. There would need to be a section written on the day to account for daily conditions but this would be based on the mandated dynamic risk assessment. This approach is entirely in keeping with the existing approach to risk assessment used by DDS where the generic risks are captured centrally and then updated by the site and date specific dynamic RA. Without changing the template establishing dive briefs for each dive with an overt focus on the diving KLP would create the conditions for improved learning. The students would be conscious of the KLP during the dive and, combined with the recommended AARs, would aid consolidation of those learning points. The lack of an auditable dive brief in this case prevents a confident, clear understanding of what was briefed being ascertained and as is highlighted as an **Other Factor**.

Witness 2,
3,

Recommendation R23. MWS are to develop standardised dive briefs for each DDS dive which ensure diving KLPs are emphasised and ‘interest’ tasks are appropriate.

Recommendation R24. MWS to ensure training dive briefs are retained and archived iaw with the Dive Project Plan.

1.4.72. Handover Takeover (HOTO). Accepting that DDS already aspire to maintain constancy in staff for a given course, in this case it was evident that staff:student dynamics detracted from the learning taking place. SMDI 1 was responsible for the course for the first two weeks of the course and then returned to be the DS on the morning of the 26th having been away on other activities for two weeks. Returning to manage the final week of the course SMDI 1 had spoken to SMDI 2 who had been covering for weeks three and four. This included several informal telephone discussion but which did not constitute what the DDS CoC described as an appropriate hand over. In the Panel’s view he could not have had an adequate understanding of the ability of each of the students. SMDI 1 confirmed that he had chosen the pair tasked with laying the DL based on rank and having a can-do attitude. He also described LCpl Partridge as one of the better students though this is at odds with the testimony of the other staff and students. The Panel believe that the HOTO was inadequate and as a consequence SMDI 1 did not have a correct picture of each student’s strengths and weaknesses. An inadequate HOTO is considered a **Contributory Factor** as had SMDI 1 had a better understanding of LCpl Partridge’s ability he is unlikely to have been selected for this task. He would have completed a simpler, shorter dive removing many of the other contributory factors.

Witness 1,
2, 3, 23, 25

Witness 2

Witnesses
12, 20

Recommendation R25. MWS to establish and mandate an appropriate auditable instructor hand over process.

1.4.73. Risk Assessment, Risk Management and Method Statements. The Diving at Work Regulations 1997 (DaWA) requires the Dive Project Plan to be based on a Risk Assessment (RA). This requirement is then reflected in the subordinate military diving policy documents Defence Code of Practise (DCOP) 20 and Book of Reference (BR) 2806 Vol 2. The Defence Dive School Standard Operating Procedures (DDS SOPs) then develop this policy with training specific aspects. The Navy Safety Centre undertook a review of the DDS Safety and Environmental Management System in 2017 and concluded that the system was compliant with the required standards. It stated that most RAs were of a good standard and was broadly positive of the DDS process. For diver training the Risk Assessment system has three components:

N25b,
N26d, N11c
Witness 21,

N72a

N19

- a. DDS Diving Training Generic Risk Assessments (DTGRAs) 1 to 36.
- b. The LSpecs which are the DDS's stated Method Statements.
- c. The On-Site Diving Risk Assessment (OSDRA) which defines which DTGRAs are in force and a review of any other applicable hazards and control measures.

1.4.74. The Panel found that eight of the DTGRAs have a risk rating of high and 27 are assessed as medium. JSP 375 requires that:

N19

“Step 8. Where any residual risk is greater than Low (once further controls have been implemented) and there are no further controls available, inform the Chain of Command and ask for further direction

Step 9. The Chain of Command should review the task and amend the direction given to reduce the risk where possible or, where it remains essential, apply for authority to continue the activity.”

1.4.75. The SI has been unable to find any evidence that authority for the medium and high-risk activities to continue was requested or issued. None of the 36 DTGRAs discuss the risk of an out of air situation or of drowning. In addition to the DTGRAs, the Active Risk Management (ARM) database is used to record and track military diving risks, of which there were 14 military diving risks in Jul 18, of which five are equipment risks that could impact on DDS training. None of the risks on ARM correlate with any of the issues identified by this Service Inquiry (SI) or any of the other audits seen by the Panel, for example the Flag Officer Sea Training Second Party Audit (FOST 2PA) or the Defence Maritime Regulator (DMR) review of Diving Governance.

N7

1.4.76. The wider shortcomings of the practical LSpecs, and therefore the Method Statement, are discussed at paras 1.4.14-18 above and are not repeated here but from a RA perspective they are not of a quality that should be relied upon. The Panel also found that the OSDRA completed on the 26 Mar 18 is for the original flange task (Dive 19) rather than the helicopter task that was actually conducted. As such none of the three components of the RA system were fit for purpose. Separately none of the three parts of the RA system met the requirement outlined in DCOP 20 (Para 38) to assess the risk to members of the public arising from diving activity. As such the Panel find the RA does not ensure a system of training where the risks are ALARP and is an **Other Factor**.

N1c
N3d
Witness 2

N17a

Recommendation R26: CO DDS to ensure his residual medium and high risks are held at the correct level.

Recommendation R27: MWS to establish a DTGRA for an out of air situation for diver training serials.

Recommendation R28: MWS to review their Risk Management System to ensure all three elements of the RA process are implemented in accordance with DCOP 20.

Equipment

1.4.77. SABA Mod 1 Testing. LCpl Partridge's SABA set and dive ancillaries were taken by the Health and Safety Executive (HSE) after the incident and sent away for expert assessment. This resulted in four reports; one for the SABA system, one for the Scubapro Digital 330M Depth Timers and two for the Diver Through Water Communications (DTWC) system. The QinetiQ report relating to the main SABA equipment (not including the Scubapro or DTWC), dated 25 May 18, concluded that the LCpl Partridge's SABA air apparatus:

N62e

“Showed signs of considerable use. Some areas and specific items were of concern (i.e. unsatisfactory) and, although not contributory to the incident, should be addressed prior to the apparatus being returned for operational use.”

N61a

“The performance and function of the apparatus was satisfactory when tested.”

1.4.78. Accordingly, the Panel believe that the main SABA equipment, excluding comms, operated as designed and in accordance with the safety case. However, beyond the system testing requested by HSE the Panel assessed several elements of the equipment as independent components as their use may have had a direct bearing on events of 26 Mar 18.

1.4.79. Using the QinetiQ results (shown in Figure 1.4.13) and information found through the inquiry processes it is possible to extrapolate various details about the dive:

N62e

- a. There was ≥ 180 bar in both cylinders at the start of the dive.
- b. LCpl Partridge dived to approximately 27.5m.
- c. Both cylinders were emptied at c.15 minutes 30 seconds into the dive.
- d. That the consumption of air must have been c.45 litres per minute (ie in excess of the planning figure of 40l/m).
- e. That his SBA opened within the first 10 minutes.
- f. This gives a CPS activation time of c.9m 35s.
- g. The CPS deactivation time and cylinder handover time was at c.12m 30s.

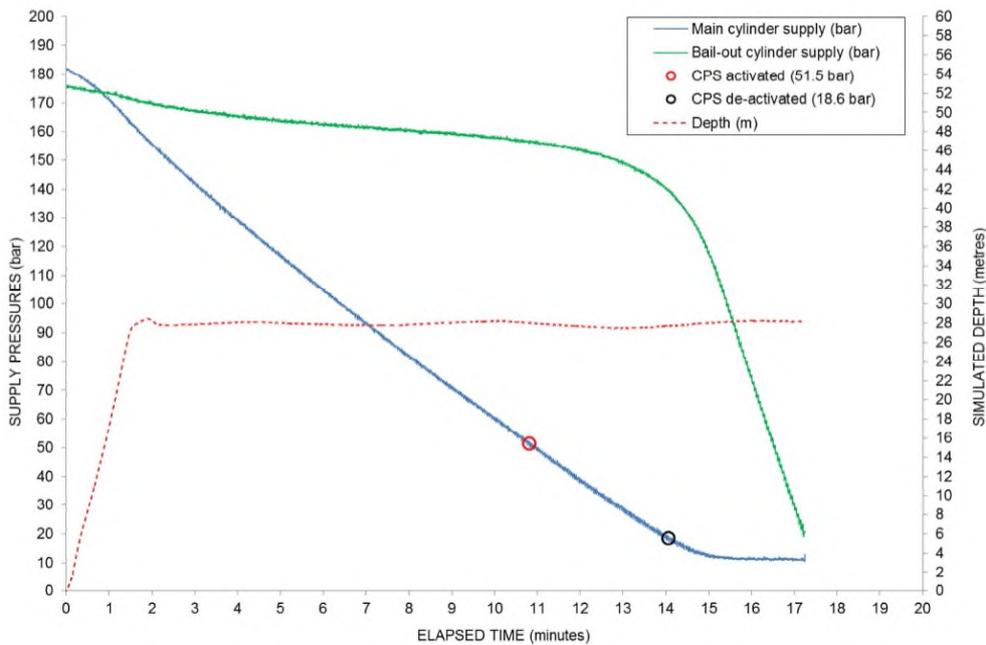


Figure 1.4.13. QinetiQ Test Results

N62e

1.4.80. Cylinder Pressure Sensor (CPS). HSE directed testing of LCpl Partridge's diving equipment by QinetiQ has proven that his CPS was working. As LCpl Partridge was found with both cylinders empty the Panel found it is extremely likely that LCpl Partridge swam beyond his CPS activating and exhausted his air supply. As can be seen in Fig 1.4.7 above (p.1.4.9) the CPS is located only centimetres away from the diver's eye. All witnesses asked confirm it is impossible not to see the light as it activates and the Panel saw for themselves a CPS activated at depth at Paisley Tank. The Panel believe the CPS activated as designed and is **not considered an accident factor** from an equipment function perspective.

N62e

1.4.81. Emergency Cylinder (EC). The QinetiQ testing confirmed that LCpl Partridge's EC was fully charged and had no mechanical faults preventing it from being operated. The Panel therefore conclude that LCpl Partridge did not attempt to activate the EC. Had he activated the EC LCpl Partridge would have surfaced rapidly and without having to expend any further energy. Even if he lost consciousness he would still have surfaced. There is a significant risk that he would have suffered pressure related injuries, such as Pulmonary Barotrauma or Arterial Gas Embolism, through such an uncontrolled ascent. Equally it is not known what affect such an ascent would have on his heart anomaly.

N62e

1.4.82. Whilst all students asked could tell the Panel where the EC is and when it should be used, the Panel believe there is a training gap which is likely to have contributed to the occurrence. Currently the use and location of the EC is taught with students being required to touch the EC as part of their pre-dive checks and they are taught about the significant risks of an uncontrolled ascent. The AD2 course does not require the students to see the EC activated nor do they practice using it.

Witness 14,
15, 20

1.4.83. The Panel believe that had LCpl remembered to use his EC once he realised both his Main and Bail Out cylinders were empty that he would probably have survived. The Panel cannot know why LCpl Partridge did not use his EC but, given the importance of this emergency drill, the medical implications of both using it and not using it and the fact it is a last resort option must suggest it is

N50b

delivered as a, carefully designed, Cat. 2 element¹⁰ of the course. As such the Panel believe the failure to deliver effective training in the use of the EC is an **Contributory Factor**.

Recommendation R29. MWS redesign the EC and associated drills elements of the course ensuring they are delivered as a Category 2 training element.

1.4.84. Switch Block Assembly (SBA). The SBA is a diver activated hand wheel valve which changes the air supply from the main cylinder only (fully closed) to both the main and bailout cylinders (open). The valve requires three and a quarter turns to be fully opened from closed but when tested by the SI team the valve passes a breathable amount of air when rotated just 1/8 of a turn. The current SBA, known as the Apeks SBA, is the third iteration of SBA to be introduced into service.

1.4.85. It came into service in 2016 after the EA were tasked to identify a suitable replacement for the previous mask mounted SBA. Two waist mounted options were selected from six bidders and taken forward to a Phase 2 trial in Sep 15. The trial report notes that *“operator error could result in both systems being inadvertently breathed down at the same time, a core failing of the SABA Mod 1 system we are trying to overcome!”*. A follow-on Ph 2B trial also raised concerns that it is impossible to tell visually if the valve is open or closed and that the designed requires three full turns to switch from completely open to completely closed was excessive.

Witness 21,
22, 23

1.4.86. The trial report was subsequently reviewed at the SCADE Extraordinary Project Safety Committee Meeting 5 on 4 Aug 16, where the EA voted against the introduction of the Apex SBA due to the single point of failure in the hose from the SBA to the FFM and the lack of indication on the valve, but was overruled by Navy Command, Army HQ and Royal Marines Poole. The meeting also confirmed that they would not make the suggested changes (reduce the number of turns and include a visible open/closed indicator). The Apeks SBA was subsequently authorised for use by Diving Related Information (DRI) 12/16 in Sep 16.

N67

N44

1.4.87. This was soon followed by DRI 02/17 was issued in Jan 17 and Diving Safety Memorandum 4/17, issued in Jun 17 which both recognised instances where the SBA had inadvertently opened. They noted that this resulted in *“Divers breathing down some of their Bailout cylinder contents, thus reducing the amount of air in event of an emergency.”* They attribute this to user error and failure to follow procedures yet it evidences the diving community knew the SBA ‘liked to come open’. This and other recorded instances evidence the flaws in the SBA identified in the trial phase continue.

N31

1.4.88. The Panel believe on the balance of probability LCpl Partridge inadvertently knocked the SBA open whilst trying to untangle the Distance Line rather than intentionally opening it. It is highly likely that in the process of unravelling the tangled Distance Line he drew his arm across the SBA and accidentally knocked it open. Due to the depth of the dive and the likely rate of air consumption the procedural safety measures (gauge checks no greater than 10min apart) will not necessarily capture the fault before CPS activates. It is likely that LCpl Partridge continued beyond CPS activation believing he still had a

Witness 21

¹⁰ By the end of the [Cat.2] training activity the trainee will have performed the whole task at least once to full Role Standards, under realistic physical, functional and environmental conditions and in a realistic scenario. The trainee should be able to perform the task on arrival in the workplace”. JSP 822 Pt 2 p.40.

full Bailout Cylinder. When his Main Cylinder emptied and his mask began to suck onto his face he will have tried to open his SBA expecting 150-180 seconds of air remaining in his Bailout only to find he had already consumed the air. It must also be noted that it is also possible that LCpl Partridge intentionally opened his SBA however this would have been the third significant warning that he had to end the dive immediately and would have given him sufficient time, approximately 3min, to surface.

1.4.89. As was noted in para 1.4.1. LCpl Partridge was found with his mask off. It is extremely unlikely that a mask could come off accidentally and there is no evidence to suggest that LCpl Partridge was snagged at any point. The Panel therefore believe LCpl Partridge must have consciously taken it off. It is a recognised response to running out of air the diver's body tells them they '*have to breath something*' and despite being under water they rip off their mask. The fact the pathologist's report notes there was no stigmata of drowning suggests death was almost instantaneous after the mask was removed and possibly caused by the resulting cold-water shock.

N60, N80

1.4.90. The Panel considered whether LCpl Partridge may have taken it off as a result of pain from his heart rather than having run out of air but the lack of excessive air escaping from a removed mask suggests he had exhausted or almost exhausted his air supply before removing his mask. Two witnesses did note what they believed to be excessive bubbles¹¹. Such bubbles could have been caused by LCpl Partridge venting his suit/BCA (unlikely as this would have reduced buoyancy at a time when he would be surfacing), shallow breathing caused by stress, exhaustion or pain (quite likely), a mask off venting residual air not accessible to the diver due to depth/pressure or a mask taken off whilst air remains in the cylinders. However, the facts remain there was no stigmata of drowning, both cylinders were empty and, whilst there was some degree of continuous venting observed, its duration suggests the cylinders emptied at almost exactly the same moment as LCpl Partridge's heart failed. The Panel cannot establish which came first, removal of mask, the heart failure or exhaustion of accessible air. The Panel find that it is more likely than not that LCpl Partridge ran out of accessible/usable air before removing his mask.

Witnesses
9, 14

N60, N80

1.4.91. Had the SBA taken a positive and intentional act to open the Bailout cylinder LCpl Partridge would have been forced to realise he had consumed all his main cylinder when he still had a reserve available which was sufficient to surface safely. Accordingly, the Panel believe the ease with which the Apeks SBA opens without diver input is a **Contributory Factor**.

Recommendation R30: The Equipment Authority is to investigate whether the SBA is fit for purpose and determine whether the activity of switching from main to bail-out cylinders is assessed as ALARP.

1.4.92. The MoD have already begun the process of procuring a new SABA system which will include the replacement of the SBA. Previous attempts to procure a replacement SBA have not involved any Human Factor team input, whether in the requirement setting stage or the trials stage and as such did not confirm to JSP 912 requirements. At the time of writing the Panel are not aware of any current involvement by INM (or other) HF specialists in the ongoing

Witness 21,
22, 23, 26,
27

¹¹ All witnesses were asked specifically about bubbles to establish if there was air remaining in the cylinders when the mask was removed. Two witnesses commented on observed bubbles, Witness 9 noted a continuous stream of air which then stopped and Witness 14 remembers seeing a lot of bubbles halfway to the helicopter. Had the mask been removed before CPS activated excessive bubbles would have been seen for over a minute. Whilst the Panel acknowledge there was a period of excessive bubbles noted the evidence does not support a venting of over 55bar from the main cylinder, ie there was only residual air remaining in either the main or reserve cylinder when the mask was removed.

procurement. Through the parallel study conducted by INM into this fatality there is now a high level of understanding of SABA activity within INM and the Panel believe much could be gained, whether reviewing ergonomics or designing trails, through their involvement.

N48b

Recommendation R31: DE&S to ensure specialist human factors expertise to be involved in writing the requirement, procurement and acceptance process for all dive equipment law JSP 912.

1.4.93. First Stage Regulators (FSR). Should the SBA open during a dive the interaction of the main and bail-out FSRs will produce one of three outcomes which are explained below. This is because policy directs that both FSRs are set to 9.5bar (+/- 0.5bar). The +/- 0.5bar generates a pressure imbalance when the SBA is open and it is not possible for the diver to know in advance which outcome their equipment will deliver. It is also clear that many divers do not understand the interaction between first stage regulators and the SBA. The three outcomes are:

Witness 21,
22, 26, 27

N62e

a. If the main cylinder FSR Intermediate Pressure(IP) is set to a higher pressure than the bail-out FSR IP then the main cylinder will empty first, then the bailout as seen in Figure 1.4.14. This is the safest outcome which most closely replicates the SBA being closed and retains a reserve supply. LCpl Partridge’s FSRs were set in this manner; main cylinder first stage regulator was set to 9.4 bar and the bail-out was set to 9.3 bar.

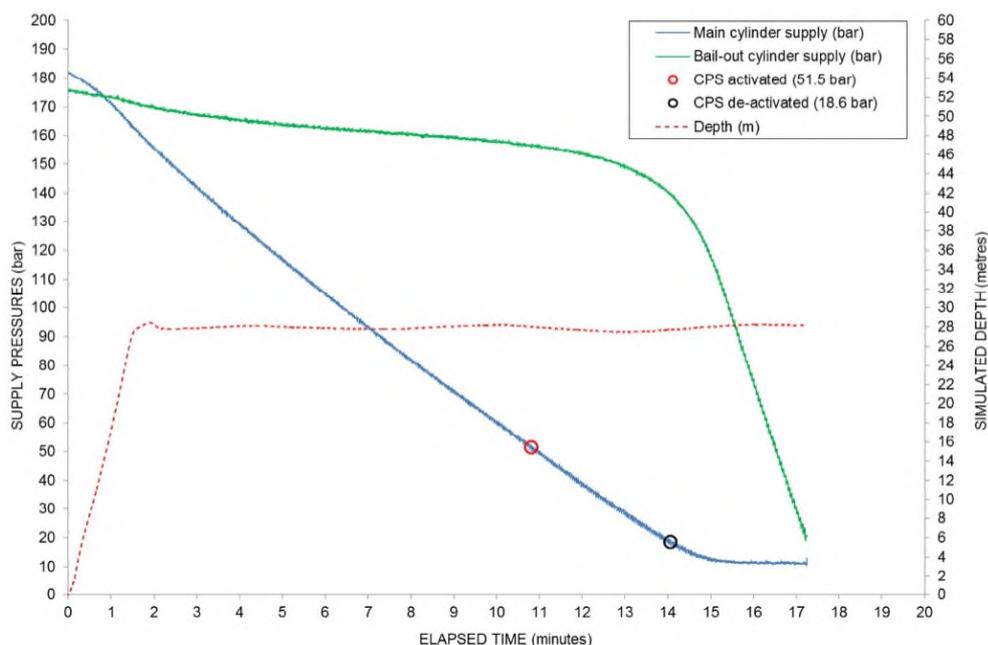


Figure 1.4.14. Breathe down rate configuration 1

b. If the bail-out FSR is set to a higher pressure than the main FSR then the bail-out cylinder will empty first, as seen in Figure 1.4.15. This is the most dangerous outcome as after only 4mins (at c.27m) the diver will effectively have no bailout air remaining. Whilst the combined quantity of air available to the diver remains the same the diver no longer has a reserve supply in case of an emergency. This was the case a year before LCpl Partridge’s death when a member of DDS staff completed exactly the same dive at NDAC. In that case the diver surfaced safely only to find he had exhausted his Bailout cylinder though accidentally knocking his SBA and having the most dangerous configuration of the FSR pressure settings.

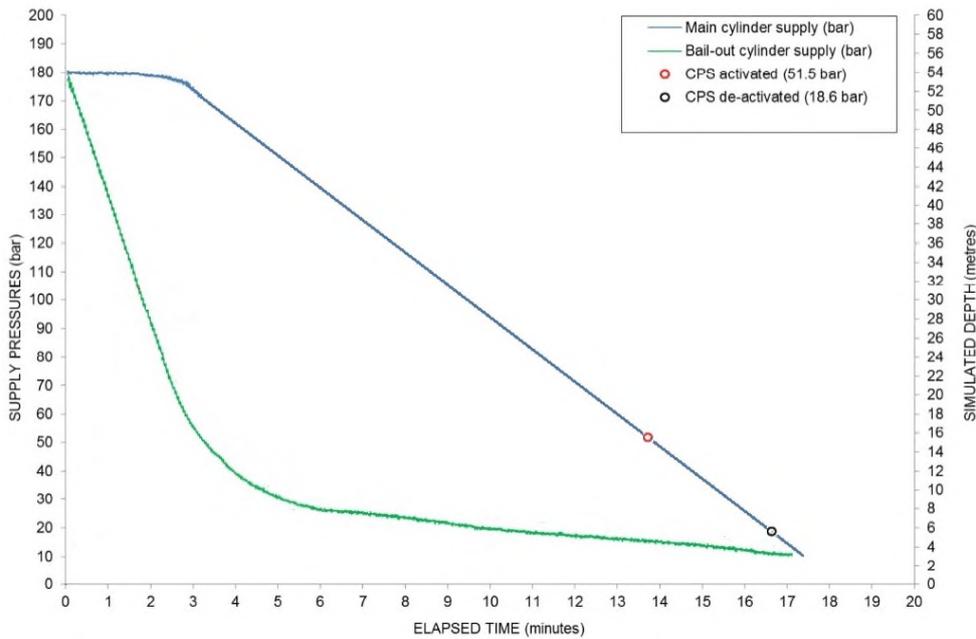


Figure 1.4.15. Breathe down configuration 2

c. If the FSRs IP settings are less than 0.1 bar different, the pressure in both cylinders will drop simultaneously giving two superimposed lines as seen in Figure 1.4.16. This is an extremely unlikely outcome as the chances of both FSRs being set within those tolerances is slim. In such an event the CPS will activate later but when it does there will be no isolated reserve the diver can switch to. The safety measures intended through having an independent reserve are therefore lost.

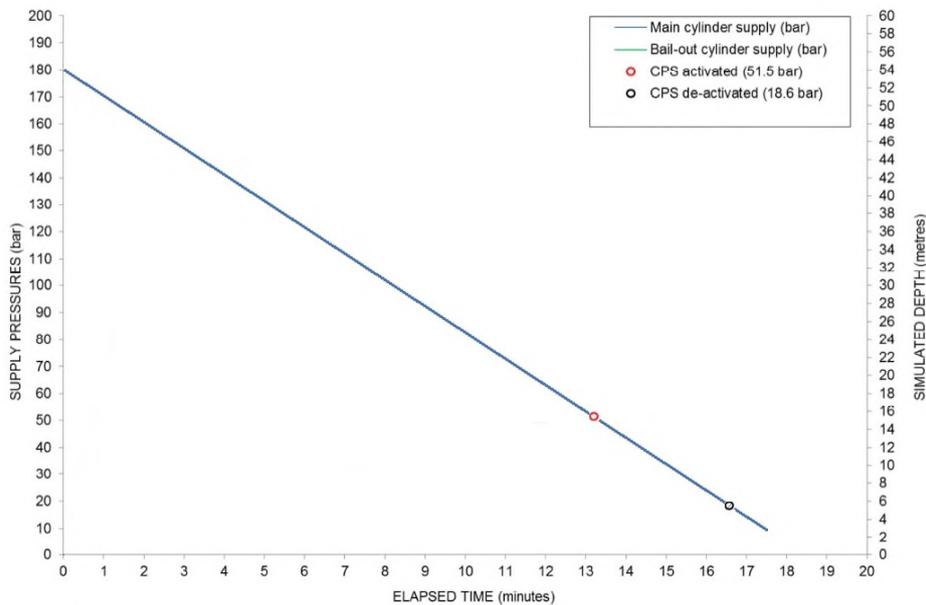


Figure 1.4.16. Breathe down configuration 3

1.4.94. The fact that LCpl Partridge's FSRs were set in the safest configuration means he had as much time after CPS activation to surface as could be with an open SBA. It would have been similar to that experienced if he had opened his SBA once he had exhausted his Main Cylinder. A simple equipment amendment would ensure that configurations two and three could not occur. If the Main and Bailout FSRs were set at different pressure settings so that the +/- range did not

N62e

overlap it would be possible to ensure that the Bailout cylinder only drained once the Main had been used. This would require an additional check to be required during maintenance to ensure the correct FSR was fitted to the cylinder but it would ensure the diver had a viable reserve after the Main had been used. The Panel do not believe the FSR settings had a direct bearing on LCpl Partridge's death however they are considered to be an **Other Factor**.

Witness 26,
27, 21

Recommendation R32. ACNS(SHIPS) to amend the policy to ensure that Main Cylinder 1st stage regulators are set at a higher pressure than the Bail Out 1st stage regulator.

1.4.95. A further recommendation to prevent divers exhausting their Bailout Cylinder without realising would be to fit a CPS to the Bailout Cylinder. When charged to a typical 180bar a Bailout cylinder lasts for around 3mins below 25m. If a diver checks their gauges once they have reached the sea bed they will still have over eight minutes before they are required to check their gauges again. If there is an equipment failure or the SBA is accidentally knocked open soon after the diver could be continuing without a reserve for three or four minutes. A CPS on the Bailout would alert the diver as soon as the pressure dropped to a set point allowing them to abort the dive ASAP. This would be particularly useful for use in novice diver training when the students are more likely to be focused on other matters and have less experience. The absence of a warning signal on the Bailout system is found to be a **Contributory Factor**.

Recommendation R33. Noting recommendations 31 and 32, the Equipment Authority are to evaluate the requirement for an indication of the bail-out cylinder pressure when it drops below a specified limit.

1.4.96. Communication/DTWC. QinetiQ carried out testing on LCpl Partridge's DTWC diver unit twice. Initial immersion testing noted that the unit was seen to activate (defined as the red LED illuminated). However, the supervisor unit was not provided at that test so a voice test could not be conducted. The diver unit was opened to check the channel and battery voltage and QinetiQ noted that the positive wire of the internal battery plug was detached, as can be seen in Figure 1.4.17. The wires and plug terminals were also badly corroded but there was no sign of water within the battery compartment.

N62a

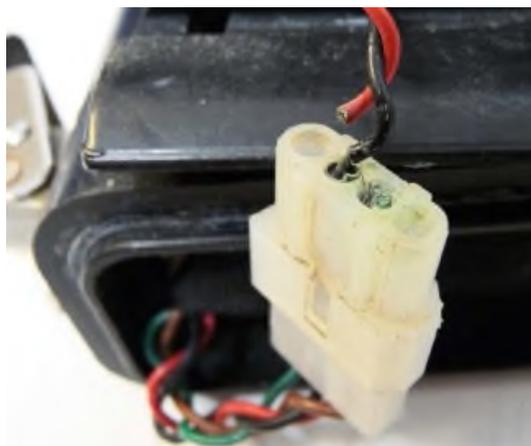


Figure 1.4.17 – DTWC battery plug

1.4.97. The second test was conducted with the surface unit (enabling voice communication to be tested) and a new report was published. The test was carried out at the Ocean Basin, Haslar with the diver unit immersed at the surface and the surface unit transducer 60m away at 2.7m depth. The report noted:

N61

“Initially, Diver to Supervisor functioned satisfactorily, but Supervisor to Diver could not be heard. Subsequent re-plugging using the hand-held microphone (S/N 1333) resulted in satisfactory communication; both sides ‘loud and clear’.” (para 3.2.7)

1.4.98. Witness testimony also notes, during the dive there was occasional communication received from LCpl Partridge though it was not possible to establish if LCpl Partridge heard anything from the surface. Diver 2’s DTWC is known to have failed neither receiving nor sending successfully. In line with the QinetiQ test and the evidence from the day it is thought likely that LCpl Partridge could not hear the surface once the dive began. Due to the manner with which the course used DTWC and the fact communication from LCpl Partridge to the surface had worked the Panel do not believe LCpl Partridge tried to use the communication system once he realised he was in difficulty.

Witness 16,
20

N62a

1.4.99. The Panel found a complete acceptance that the DTWC system is not reliable amongst the DDS staff and students. The only dive where staff and students remembered reliable voice communication took place in the SETT, a 30m deep metal swimming pool. Despite policy (DCOP 20) and DDS direction (LSpecs) clearly stating that for novice divers there must be reliable two-way voice communications, dives routinely continue without reliable voice communication being in place. It is noted that novice divers do have a form of two-way communication in either the lifeline or the ‘blob’ line both of which are used to send messages between diver and the surface. Once qualified these are the principal means of communication during dives and rather than being a backup to DTWC form the primary means of communication.

Witnesses
1-20

N3e, N22d,
N17c

1.4.100. Considering the reported frequency of DTWC sets being unreliable the number of faults reported has fallen and DE&S and the SU are unaware of the extent of this issue. Table 1.4.1 shows the number of S2022s relating to DTWC for the most recent 24mth period (Jul 16 – Jul 18) period and the Jul 06 – Jul 08 period when the equipment came into use.

Witness 26,
27, 21
N65

Period	Equipment	Number of DTWC related S2022s	Total against all S2022s
Jul 06 – Jul 08	Supervisors Comms Unit	56	98 of 308 (32%)
	Battery / charger	16	
	Diver comms unit case	89	
	Divers ear / microphone	51	
	Supervisors headset	36	
	Supervisors handset	22	
	Transducer	29	
Jul 16 – Jul 18	Supervisors Comms Unit	6	11 of 118 (10%)
	Battery / charger	1	
	Diver comms unit case	2	
	Divers ear / microphone	2	

Table 1.4.1. S2022 numbers for DTWC

1.4.101. It is worth noting that the number of:

- a. S2022s for all equipment has fallen from 308 to 118.
- b. DTWC S2022s has fallen from 98 to 11.

- c. DTWC S2022s have also fallen as a percentage of all S2022s from 32 percent to 9 percent.
- d. Some S2022s for the 16 – 18 period are being submitted with multiple defective equipment within a single S2022. At interview it was established that this practice was requested by DE&S.

1.4.102. Considering the routine failure of the DTWC as evidenced through this inquiry (only one dive out of over 30 during the course was routinely cited as having reliable communications, the SETT dive) the reduction in S2022s raised evidences that the reporting processes are flawed. The Panel believe there are several probable causes for the reduction in fault reporting including:

- a. Reporting fatigue, where high numbers of reports in the past have resulted in no discernible improvement in the equipment;
- b. DE&S direction to amalgamate multiple failures onto one S2022;
- c. The Panel did not find any evidence suggesting DTWC was in routine and regular use by Field Army diving teams and it appears that DTWC is essentially only used by DDS so no field force diver units observe the failures;
- d. DTWC is culturally accepted as being unreliable and so is not used to it's full potential (especially as a teaching tool);
- e. The fault testing process is flawed and does not suitably test against the equipment requirements (a bench test may show equipment to be 'working' yet once on a dive environmental and other in-use factors cause the equipment to fail).

1.4.103. As a result the Panel find that as a consequence of the combined effect of the above issues the risk has been 'normalised' and the involved staff have become desensitised to the inherent risks. The DDS CoC is aware of the fragility of the DTWC system though it was clear the scale of the issue was not known. Equally the rationale for occasionally continuing without voice communication was that if you had stop diving every time through-water comms stopped then DDS would not be able to deliver its outputs from a school perspective. The Panel consider the normalisation of DTWC failure to be a **Contributory Factor**.

Witness 1,
2, 23, 25

Recommendation R34. MWS enforce the existing policy that novice divers must end a dive when reliable 2 way voice communications fails.

Recommendation R35. MWS enforce the necessity to report faults in the DTWC.

1.4.104. The BR clearly articulates how such faults should be tested. The Panel established that the DTWC equipment when reported as faulty is tested in air and not through water as directed in the BR. The diver and supervisor transceivers are placed on a work bench some two to three metres apart and energised. Successful passing of voice is viewed as a positive result and no S2022 is raised. This process is clearly at odds with BR2807(9)(E) which clearly states *"DO NOT ATTEMPT TO TEST THE OPERATION OF THE SUPERVISOR UNIT WITH THE TRANSDUCER IN AIR, AS THIS MAY DAMAGE THE CERAMIC TRANSDUCER."* (page 3 of Maint Op No 2). This is identified as an **Other Factor**.

N13c

Recommendation R36. MWS to enforce DTWC reliability and maintenance procedures are conducted iaw BR2807.

1.4.105. Lines and Ropes. The task given to LCpl Partridge and Diver 2 was to lay a Distance Line(DL) (see 1.4.107 below) from the Shot to the helicopter so

Witness 2,
20

that other students could follow it and conduct a reconnaissance of the helicopter. The line selected was without doubt one of the main contributory factors in this occurrence as it was totally inappropriate for the task. At over three times the required length and with a taped reef knot joining two lengths together the resulting tangle undoubtedly took all LCpl Partridge’s focus during the dive. Whilst any line may become tangled when handled in water, considering this was the first dive at depth away from the shot line for the novice divers, without experience of laying line in this manner and with a line three times longer than necessary the Panel believe the DL is considered a **Contributory Factor**.

Exhibit 1

Recommendation R37: MWS to amend the course instructions to specify which lines are used dependent on the task.

1.4.106. As noted above the task given to the first pair of divers was significantly different from the task given to the other students. Archived S288s from previous courses show that most students laying this line take c.50% extra time on task than the following students who simply follow the line and return to shot. It is illogical from a learning perspective to ask pairs of novice divers to conduct such differing tasks. Whilst the laying of a line may be considered a routine task for a qualified and experienced diver this was the course’s first experience of swimming away from the shot at this depth. The KLPs for the planned dive were focused on simulated decompression and did not require the students to lay line or conduct a reconnaissance.

Witness 2,
20

N1d

Witness 2

N3d

1.4.107. Recommendations R5 and R6 (p.1.4.14) have already identified that the course design should be reviewed to ensure the LSpecs clearly articulate activity is KLP focused which should address this issue. The Panel believe that the use of a DL for this scenario was inappropriate, especially laid by students. DDS staff laying a jackstay (iaw BR2806(1) para 0277) prior to the dive would have been a significantly safer and more appropriate approach.

N10i

1.4.108. The Panel also believe policy on DLs is ambiguous as it was unable to establish if the line used was a swim line, jack stay or distance line. Given the ambiguity surrounding lines the line used did not technically break any policy guidelines despite being completely unsuitable. The Panel believe type of line (length, diameter, material) should be clearly set against suitable use. The lack of such clear guidance is found to be an **Other Factor**.

Recommendation R38: ACNS(SHIPS) to issue clear guidance for which lines to use for each specific diving task.

Post Event Management

1.4.109. Emergency Actions. According to policy/protocol once the DS identified there may have been a problem he could have responded in a slower, more methodical manner utilising three thunder flashes deployed at a rate of one every 60sec to signal the diver to surface ASAP before sending in the Standby Diver. However, the DS reacted immediately and the Standby Diver was ordered into the water as soon as the DS understood all communication with LCpl Partridge had been lost. The initial fear was that LCpl Partridge had been got caught on a snag. The Standby Diver entered the water and found LCpl Partridge almost immediately. He tried to use LCpl Partridges own cylinders to fill his BCA but found them both empty. He then inflated his own BCA in order to recover LCpl Partridge as quickly and safely as possible.

Witness 2

Witness 2,
14, 15, 16,
19

1.4.110. In an identical manner to that rehearsed only 20mins previously LCpl Partridge was then moved onto the jetty and first aid initiated. SMDI 1 immediately contacted the emergency services through 999 and continued to pass on advice to those delivering first aid. Staff and students continued CPR until relieved by the air ambulance staff.

Witnesses,
6, 7, 10, 11-
20

1.4.111. The Panel are firmly of the view that once the emergency procedures were initiated, ie, the Standby Diver entering the water, the staff and students could have done nothing more to help save LCpl Partridge. In particular, the speed with which the Standby Diver found and recovered LCpl Partridge should be commended. In less than a minute he dived to 24m, assessed the situation, used his initiative and brought LCpl Partridge to the surface. In so doing he knowingly put his own life at risk (through exceeding guideline rates of descent and ascent) in an attempt to save the life of LCpl Partridge. The Panel find that the emergency actions were not an accident factor.

1.4.112. Emergency Communications. The mobile signal is reported as being weak but workable at the dive site and once, during the call to the emergency services, SMDI 1 lost signal. However, the emergency services called back immediately and the call continued until the paramedics arrived. There is a landline away from the dive site in the NDAC office which could have been used if the signal continued to fail. However had this been required messages to the dive site would have required a runner and been much less effective. The lack of a reliable mobile signal at the dive site is found to be an **Other Factor**.

Witness 2

Recommendation R39. MWS to establish a reliable method of emergency comms at remote dive sites

1.4.113. Management of Involved Persons. Once the police and paramedics arrived on scene the DDS staff and students were moved off the jetty, initially to the classroom where they received the dive brief earlier that morning. The staff and students were then retained on site either in the classroom or café area of NDAC. For much of that time LCpl Partridge covered body was in view which significantly added to the stress felt by the staff and students. They were kept at NDAC for the following 24hrs, finally leaving on Tuesday afternoon. DDS had no action plan in place for such an event which resulted in the students and staff unsure of what to do or what should be happening. This is a point also picked up on an Organisational Safety Assessment by SoDD recently (Jun 18) identified there is no “common incident management and reporting protocol” and recommended:

Witness 2,
6, 7, 10, 16,
20,
24

N59c

- a. The implementation of a common incident management and reporting protocol. Para 4.5
- b. That NLIMS becomes the default management system for the capture and analysis of diving incidents. Para 4.6
- c. There is an accepted protocol for incident ownership. Para 4.7

1.4.114. The lack of a common incident management and reporting protocol is found to be an **Other Factor**.

Recommendation R40. MWS to action the OSA dated Jun 18 and establish an emergency contingency plan for dive occurrences.

1.4.115. As a Permanent President of Service Inquiries the President is aware there has been a significant amount of work conducted recently by both DSA and the Army Inspectorate regarding the management of witnesses or those involved in investigations. Both have identified that Defence could do more to protect and assist those involved. Having recommended that DDS develop a CONPLAN for traumatic incidents the Panel also believe that there should be guidance from either DSA or CDP regarding how best to manage our people in such circumstances.

Recommendation R41. CDP are to establish guidelines for the management of the MOD personnel involved in a fatal incidents.

1.4.116. Investigations. All evidence gained throughout this process indicates that there is no tactical level understanding of priority between the various investigating organisations, the Police, HSE or DAIB. There is a high level agreement between HSE and DSA and a similar one is being developed between the Police and DSA however these are not recognised at the investigation level. Whilst DAIB may have primacy in MOD terms, from a police or HSE perspective they are a representative of the employer who may be culpable for the accident. In this case the police officer on the scene did not know how to treat the SABA equipment and directed that it be broken down (against the HSE and DCOP protocols). DAIB staff, with the DMR SMEs, were on the scene before HSE arrived and could have advised the police as to how such equipment should be treated as evidence. However, without an agreed protocol or MOU between the principal actors (police, HSE, DSA/DAIB) they have no authority to direct what happens.

N76

N56

1.4.117. The Panel believe that had a MOU been available at the tactical level the errors in evidence handling and the lack of direction throughout the afternoon of the 26th March could have been avoided. It would also form the basis of MOD level contingency plans for significant diving incidents from which unit dive teams could base their own plans. The Dive Project Plan requirements ensure that actions on regarding first aid and use of emergency services are covered but the Panel believe there is a requirement for a higher level plan for fatalities or significant near misses. The lack of a strategic level MOU which is recognised at the tactical level is identified as an **Other Factor**.

N56

Recommendation R42. DSA are to establish a suitable Post Incident Management Protocol, (wrt interaction with HSE, Civilian Police and military investigators) ensuring factors such as primacy, evidence collection and acceptable/appropriate military investigative actions are understood and exercised.

1.4.118. Review of other significant cases. The RN received a Crown Censure in April 2004 for the death of Lt David Christie RN in March 2002. This resulted in the Naval Service Diving Safety Review (NSDSR). Subsequently a further three in service diving related deaths occurred in 2005, 2006 and 2008.

N16

1.4.119. The NSDSR made 40 recommendations of which DMR and SU assess that 14 of these are complete and 23 are no longer relevant (principally due to the abolition of Ship’s Divers or organisational changes within the RN). The remaining three actions are in progress and cover a Dive Officer Course, increasing the priority for Remotely Operated Vehicle capability and transferring basic dive training currently at RM Poole to DDS. The Panel also believe that dismissing those recommendations because they directly related to Ship’s Divers is flawed. Whilst it is correct Ship’s Divers are no longer employed, Army divers are employed in a manner almost exactly the same as a Ship’s Diver used to be. (They have a primary role and diving forms a secondary function.) Failure to learn from the NSDSR and extrapolate relevant lessons across the Defence diving community is found to be an **Other Factor**.

Witness 21,
22

Recommendation R43. Cap GM to review the closed NSDSR recommendations which reference Ship’s Divers and check applicability to Army divers.

1.4.120. The table below identifies the NSDSR conclusions and compares them to the findings of this SI as the Panel believe that three of the conclusions still have resonance today. The first, as captured by the NSDSR, is still correct for many spoken to in the dive community but not for those responsible for the resulting investigations. For completeness the 4th relevant NSDSR conclusion is also listed but is not thought to be an issue in 2018:

N57b

NSDSR	2018 SI Finding
The dive community focused on human error as the cause of those incidents, without examining the wider picture.	The Panel came across many within the diving community that assume LCpl Partridge’s death was caused by simple human error. The fact that this SI was given such a wide remit and has reviewed a broad range of factors evidences that NSC has learned that lesson.
Warning signs had been missed and there has been consistent over confidence about diving operations.	Warning signs have been ignored or only partially mitigated such as the almost identical near miss at NDAC in 2017, the acceptance of a switchblock which “likes to open” or refusal to address the first stage regulator setting issues.
Diving management had failed to establish a system that trains divers to report all incidents, no matter how trivial.	Not all errors are reported, with the cultural acceptance that DTWC is not reliable. S2022s are submitted with multiple entries and DTWC testing does not adequately assess if the equipment is FFP.
Training had focused on courage and fitness at the expense of [dive] skills.	The Panel found no evidence of this and are virtually certain that what was evidenced by the NSDSR 14yrs ago is no longer true. What this SI has identified though is that the focus is on the engineering task and not sufficiently focused on diver knowledge, skills and experience.

N57b

Table 1.4.2

1.4.121. Equally there is significant overlap between the findings and conclusions of the HSE 2004 report and the current Service Inquiry:

HSE Finding	2018 SI Finding
The management of medical issues was not satisfactory.	Whilst LCpl Partridge's diving medical assessment was in line with policy a medical tracking process may have identified in the four known events a possible trend and further, enhanced medical assessments been conducted.
The underwater breathing apparatus did not reduce the risks to the diver to ALARP.	The Switch Block and First Stage Regulators have known design faults which are not adequately mitigated resulting in the SABA equipment which does not reduce the risks to the diver to ALARP.
The laid down process for communicating with novice divers was not followed and no checks were conducted to make sure the students were comfortable and coping with the dive.	DTWC is consistently unreliable. Policy directs that novice divers must have reliable two-way voice communications and yet dives are regularly conducted without.
Unauthorised changes to the practical training programme and the subsequent impact on student safety was not properly assessed.	The Dive Amendment Process allows ambiguity and is not followed. Dives are amended without the required authority.
The RA process was not suitable or sufficient.	The Panel found that all three elements of the RA process were flawed.
Instructional staff were not familiar with the relevant instructions and procedures and laid down policy was deviated from.	The Dive Amendment Process is routinely deviated from and Army DOs and DS are not SQEP.
Hazardous activities were not managed by SQEP personnel.	The is no trg or minimum experience for DOs and no AET training for the DS.

Table 1.4.3

1.4.122. As far as this SI has been able to determine the NSDSR and other legacy cases have become dormant with no active ownership. The endorsement of the recommendations, the assigned owners of the respective actions and the level implementation have not been recorded. As the two tables above show there are recognisable similarities with the factors identified in this SI and those of previous reports. Had the conclusions and recommendations of the NSDSR and other legacy cases been fully and thoroughly implemented, the incident on the 26 Mar 18 is less likely to have occurred. The Panel believe failure to implement the recommendations effectively is a **Contributory Factor**.

1.4.123. It must be noted that NSC had already identified that legacy cases have not been tracked and closed down thoroughly. At the time of the occurrence NSC had already begun reviewing legacy cases although they had not looked back far enough to capture these particular reports.

N77

Witness 21

Recommendation R44. SoDD to establish the status of the recommendations for all military diving fatality investigations since 2002

1.4.124. In December 2017 DMR published a “*Review of Diving Governance for the Defence Safety Committee*” having been tasked to “*review the Governance of Defence Diving in particular against the DSA requirements from the DSA Charter and the Secretary of State’s Policy Statement*”. One of the outcomes of this report was an Organisational Safety Assessment (OSA) which was conducted as the SI was proceeding. The OSA Report evidences three recommendations which relate to incident reporting and the lessons process which include:

N64
Witness 21,
30

- a. The implementation of a common incident management and reporting protocol. Para 4.5
- b. That NLIMS becomes the default management system for the capture and analysis of diving incidents. Para 4.6
- c. There is an accepted protocol for incident ownership. Para 4.7

1.4.125. This is very much in keeping with the findings of this SI and the Panel endorse the above recommendations.

1.4.126. Lessons Data Management. The Navy Lessons Information Management System (NLIMS) was found by the Panel to be a useful means of reporting accidents for Navy owned dive teams. It is not used by Army Regimental or MAB dive teams however and as such only captures an element of all potential lessons. Whilst the lack of use by Army teams is a relatively simple process change it has been recommended by SoDD before but has not been acted upon. This is a significant failing as the equipment used by the three groups is the same yet the three independent lessons processes cannot be linked. Equally as currently populated and managed NLIMS does not provide a means of systematic analysis. This issue has also been identified by INM staff who have tried to utilise the data stored there for various studies and NSC are also aware of the shortcomings (based on previous work INM did for NSC).

Witness 21
N82

1.4.127. The Panel understand that efforts to address these issues are underway though currently, regardless of search parameters set, results were at best inconsistent and the level of accessible detail significantly hindered the SI process. The agreed creation of a specialist SO2 post focused on Diving Safety Management and the establishment of the Delivery Duty Holder will bring additional personnel who will be able to undertake some of this longitudinal work, but a longer-term review of how NLIMS can be amended to fit the needs of the military diving community is probably required. The Panel view the inability of NLIMS to be used for trend analysis to be an **observation**.

Witness 22

Recommendation R45. SoDD to routinely review and track all diving NLIMS submissions in order to identify possible trends.

Recommendation R46. ACNS(SHIPS) to ensure NLIMS is adopted defence wide for diving related occurrences.

1.4.128. The Panel also heard that the DE&S staff do not have access to the system with a work around being a monthly printout sent to them from NCHQ. The Panel believe that in order for DE&S to manage the equipment line of development routine and immediate access to NLIMS with sufficient detail to inform decisions is necessary.

Witness 22,
26, 27

Recommendation R47. Equip Authority to establish direct access to NLIMS. |

Defence Diving Safety Governance

1.4.129. In December 2017 DMR published a “Review of Diving Governance for the Defence Safety Committee” having been tasked to “*review the Governance of Defence Diving in particular against the DSA requirements from the DSA Charter and the Secretary of State’s Policy Statement*”. The report asked the Defence Safety Committee to endorse a number of recommendations, those that are relevant to the Panel’s TORs include:

N64

Witness 21

- a. The Defence Diving Policy 2012 is updated and is endorsed by each Senior Duty Holder as their direction on how the diving activity is to be conducted.
- b. That Navy Command provides Capability Management of all Military Diving equipment, acknowledged in Defence Diving Policy and in-Service Level Agreements.
- c. Army Duty Holding to be established and a small cohort of officers to be career managed to undertake the specialist roles required.
- d. That ACNS (Ships) is acknowledged as the Accountable Person with a responsibility to define and manage the generic operating envelope for military diving equipment.
- e. That a common incident reporting protocol is implemented for all diving.

1.4.130 As noted above the report also outlined the intent for DMR to conduct an Organisational Safety Assessment (OSA). By the time of the SI hearings the OSA report was on draft circulation and the Panel were provided a copy. Whilst the Panel did not explore diving elements beyond the SABA domain, the SI recognises all applicable issues captured in the OSA report. The aspirations explained in the report and at interview by the Superintendent of Defence Diving (SoDD) are wholly supported by the evidence found throughout this SI process and some of the findings section is taken directly from that report.

N64

Witness 21

1.4.131. The 2002 Navel Service Diving Safety Review (Pelley Review) resulted, after a Crown Censure(CC), in the restructuring of Defence Diving safety management. The Defence Diving Regulations were established and the SoDD post amended to focus on safety. As a result of the Nimrod Review (a wider study of MOD safety policy generally known as the Haddon-Cave Report after the author) DMR was established as part of a wider overhaul of safety management which saw a new tier of safety regulation deliberately removed from the Front Line Commands(FLC). The new DMR included the SoDD organisation and the Army’s Diving Inspectorate which collectively became the Diving Standards Team (DST) and more recently the Defence Diving Standards Team (DDST). At the same time the Duty Holding Construct was introduced creating the Operating Duty Holder (ODH).

N15, N53,
N16

Witness 21

1.4.132. Whilst the now independent DDST sat outside the FLCs as part of the Defence Safety Authority there was no uplift in liability and the limited number of SMEs were taken from the FLCs leaving the ODHs without the SQEP manpower. While each FLC is required by the DDR to actively manage the overarching safety management of diving activity within their area of responsibility the available resources across the FLCs differs notably. In particular, the Army do not have a

Witness 21,
22, 30

N64

diving dedicated ODH or, arguably more important, the organisational structure to conduct the safety management requirements.

1.4.133. As noted in the December 2017 Review (Page 2, para 7):

N64

“The review found that whilst Army diving safety was well managed at unit level and co-ordinated at Brigade level by proactive individuals, the absence of a specialist cadre and a noticeable lack of SQEP within the officer corps, has contributed to there being no defined ODH structure accountable for the Army Diving operating envelope. Encouragingly this shortcoming was recognised and accepted by the Army. As part of the review process, a series of DMR sponsored workshops have now determined where the responsibility would be best placed. This work recommends that once the Army Duty Holding responsibilities are confirmed, that the structure should be appropriately resourced or it will fail.”

1.4.134. And goes on to note:

“whilst the diving equipment is broadly multi-purpose, the review notes that military context in which diving is conducted is bespoke to each service and therefore each TLB must be capable of managing their own, role-specific envelope. The review recommends therefore these responsibilities and dependencies are now formally captured and articulated through SLAs” P2, para 8.

1.4.135. The Panel found that whilst the Army had informal diving champions at the time of the occurrence the lack of a diving specific ODH, aligned to the RN ODH construct continues. The Army is fully aware of this issue and throughout the SI process discussions were ongoing across the TLBs to resolve this issue. The Army have decided to retain ODH through the chain of command function rather than identify a capability (diving) ODH. However, the Army recognise diving as one of the eight risks to like activities that it has assigned ODH’s to. The ongoing Army Diving Capability Review aims to specify who the diving ODH is. Further, since autumn 2018 an Army OF3 desk officer in Cap GM has been given formal responsibility as the Army Senior Operator. This is a significant step forward from the situation in spring 2018 (which was described and commented upon in the 2017 Review of Diving Governance) though there remains a lack of a controlling mind for Army diving.

N78

N82

1.4.136. The lack of a structural diving safety management capability within the Army was noted as an issue by the RN SU in reference to both ownership and passage of information relating to diving safety.

Witness 22

1.4.137. Equally in the new User Requirement Document, drafted by the RN SU as part of the new SABA equipment procurement process, had no Army input as there wasn’t an equivalent POC. This issue has since been partially resolved as Cap GM do now have a dedicated desk officer. The remaining issue is, as noted in the OSA report, that the Army do not have a specialist cadre able to deliver SQEP to routinely man this appointment. The Panel find the lack of an Army Senior Operator construct, or “controlling mind” at the time of the incident to be an **Other Factor**.

Witness 22,
27

N82

Recommendation R48. Cap GM to ensure the Army Senior Operator construct provides sufficient capacity and authority to deliver necessary oversight and outputs.

1.4.138. It is important to note that the focus of Army and Naval diving is inherently different. The Navy is principally concerned with mine countermeasures with additional niche capabilities in the EOD, maintenance and repair activity, and submarine rescue. The Army is focused on support to mobility, counter-mobility, underwater engineering, demolition, repair, vehicle recovery and salvage.

1.4.139. During this SI it has become apparent that although the community is broadly aware of these differences, this is not always captured by effective policy or in safety management. This is illustrated in the differences in returning to shot on CPS activation instead of allowing a diver the ability to make a controlled, unsupervised ascent to the surface. This can also be evidenced through reviewing the various dive policy documents. They are written for and by the full time naval dive community and tend not to state or discuss key areas which are assumed knowledge. In the absence of a viable Army Senior Operator or singular diving focused ODH such differences are not captured. Should ACNS Ships become the Accountable Person and manage the operating envelope for all military diving equipment, as recommended by the OSA, there must be a robust understanding of this differing requirement and Army and MAB diving practises within NCHQ. The variances in routine ‘actions on’ across the TLBs is found to be an **Other Factor**.

N48c

N17a,
N10b, N12a

N59

Recommendation R49. ACNS(SHIPS) to minimise the differences between Naval and Army diving SOPs.

1.4.140. The OSA report also highlights the currently extensive range of responsibility and activity undertaken by SoDD and the DDST. This was one of the first observations made by the Panel as they conducted the initial phase of the SI. Formally part of the independent DSA structure, SoDD and the DDST manpower is used at all levels of activity less delivery. Responsible for writing policy (DCOPs, BRs, etc), assurance of diving activity at (in reality) all three levels (First, second and third party) and investigation into accidents (in support of DAIB). As the OSA report notes this is not in keeping with the DSA Charter and in many cases sees the organisation ‘*marking it’s own homework*’. The Panel find the breadth of the SoDD role and supporting DDST at the time of the occurrence to be an **Other Factor**.

N59

Witness 21,
22, 30

Recommendation R50: DMR to resolve the conflict of SoDD owning and assuring policy.

1.4.141. If the OSA recommendations are implemented in full then the ownership of the policy must also be reviewed and much more is likely to belong to Assistant Chief of the Naval Staff (Ships) as the Accountable Person for military diving¹². However, without additional resource this will simply move the problem from one over stretched area to another. The revised policy should provide an approachable, coherent, handbook to support the delivery of effective, safe and intelligent military diving and dive training. As an extrapolation of the over-extended SoDD role the lack of a coherent ownership of defence diving documentation is also seen as an **Other Factor**.

Witness 21

N59

¹² At the current time ACNS(Ships) is the ODH for Navy diving only. There isn’t a single Army Diving ODH who could act as the Accountable Person or “controlling mind” though the capability sits with Hd Cap GM.

1.4.142. Since the occurrence this issue has been addressed with SoDD owning what will be the Defence Diving Rules, the replacement for DCOP 20 and the RN Snr Operator owning the Book of Reference documents.

1.4.143. Diving Policy. While the DCOP has clearly been modified for military use, for example its discussion of Duty Holding, its opening paragraph stating it is based on the inshore ACOP has resulted in frustration across some of the diving community believing it to be a simple cut and paste. This might appear true on a cursory glance but DCOP 20 is much more than a simple reiteration of the Inshore ACOP with a few changed names. There are areas where the document does not fit with military diving and structure as opposed to its civilian counterpart.

N17b, N17a
Witness 21

1.4.144. The most obvious examples include the simple substitution of the Dive Contractor (DC) (civilian) with the Dive Officer (DO) (military). The DC has much greater freedom of manoeuvre compared to a DO who has much less control over the equipment used, how it is used or the structure of training. This is especially true of the DOs at DDS where there is an overarching DO appointment. While further refinement and improvement is required, this must be done as a coherent action with other diving policy. The stated intent of SoDD with regard to how a future DCOP (or similar document) should be structured is fully supported by the Panel.

N17f, N79,

Recommendation R51: SoDD to review the Diving Officer TORs to ensure the correct level of responsibility and authorisation are held.

1.4.145. The Panel found that the multiple layers of ‘policy’ (including the Regulations, DCOP, BRs, Standing Orders and ODH issued direction) is constantly being updated, contains errors and are not coherent. All appear to try to add something to particular issues, such as the roles of a Diving Officer, and in so doing confuse the users. This is an issue SoDD acknowledged at interview.

Witness 1,
3, 6, 21, 23,
25

1.4.146. The Panel found that in particular DCOP 20 and BR2806 had significant overlap and various sections which, for their level of authority, contained superfluous information. SoDD also noted in interview that in recognising this he aspires to reissue the DCOPs in a two section format, Part A the Rules (must be adhered to – to be owned by SoDD) and Part B how to meet those rules (the BR owned by RN Snr Operator). The Panel find the written policy documents supporting diving at the time of the occurrence to be contradictory and confusing and as such are seen as an **Other Factor**.

N17f, N79

Witness 21

Recommendation R52: SoDD to rewrite/replace DCOP 20 iot:

- a. **Accurately reflect the military diving capability.**
- b. **Simplify the DDR:DCOP:BR2806 relationship removing duplication and erroneous information.**

Section 1.4 Summary.

1.4.147. The Panel acknowledge the finding of the post mortem which identified that LCpl Partridge had an anomalous coronary artery gives the cause of death as Sudden Death in Adults. Considering the various accident factors identified throughout this report there were many contributory factors that made this accident more likely to happen. The course design placed him in a position where he did not have the intuitive understanding or experience of diving at this depth and was not prepared for the task as well as could have been expected. He was using equipment that in areas was unreliable or had design flaws, which compounded the situation. The task was physically exerting in nature and complicated by the tangling of the distance line. This, alongside his determination to complete tasks given, resulted in a mistake where LCpl Partridge failed to act as taught when his CPS activated.

1.4.148. Alongside these factors, LCpl Partridge had a heart abnormality which has been shown to lead to circulation problems when exercising. Whilst Sudden Death in Adults is the causal factor, the panel believe that it is impossible to determine which factors, or combination of factors had impacted to a lesser or greater degree on his death. The Panel believe that given all the accident factors (summarised below in table 1.4.4) an occurrence of this nature was likely to occur at some point. Given the evidence available it is almost certain that even without his heart anomaly, LCpl Partridge would have had a serious occurrence on this dive. Equally, a similar combination of factors, as seen on this dive, has aligned before in 2017. That earlier near miss was due to the SBA and FSR issues noted above. Unless recommendations of this Service Inquiry, and those of earlier investigations, are acted upon the Panel believe a similar incident is likely to occur again at some point.

1.4.149. Furthermore, the Panel believe there is sufficient evidence to suggest that some or many of the factors identified above are likely to be present in the Naval diving component of DDS provision which was outside of this SI’s TORs. As consequence, and to ensure the identified recommendations are addressed appropriately, the Panel believe there is a requirement for a final and overarching recommendation

Recommendation R53. The Fleet Comd initiates an independent audit of the applicability of these recommendations across the whole of Defence Diver Training.

1.4.147. The table 1.4.5 below briefly captures the various accident factors (causal, contributory or other) identified by the Panel:

Table 1.4.5. Collated Accident Factors.

Ser	Causal, Contributory or Other	Page	Factor	Comment
1	Causal	10	Sudden Death in Adults	The stated cause of death in the pathologist’s report. The pathologist identified LCpl Partridge had an undiagnosed minor heart defect. It is not known exactly how this is linked to the cause of death but it is likely to have had some bearing. The correspondence between the pathologist and St George’s Hospital confirms the same issue has been linked to exercise linked deaths in the past.
2	Contributory	10	Tracking of physical training failures	LCpl Partridge had 5 separate episodes on different events that were not linked by the management chain. Had LCpl Partridge been signposted to the medical chain and a clear audit trail of past issues with endurance events been visible follow on action may have been taken.

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3	Other	11	Dive medical standards	LCpl Partridge was tested and had passed the necessary dive medicals. The heart anomaly is very difficult to identify and the Panel suggest INM review current assessment methods and standards in light of this occurrence.
4	Other	11	Physical Exertion	Whilst perceived as a fit and active soldier LCpl Partridge had an undiagnosed heart abnormality which is linked to Sudden Death in Adults. Due to the complications caused by the distance line and the self-imposed pressure to complete the task it is thought likely that LCpl Partridge would have had elevated breathing and heart rates. This would have reduced his air endurance time and increased the likelihood of his heart having some form of attack.
5	Other	14, 42	Failure to act on existing recommendations	There are various examples of where the organisation has not acted on recommendations made in either audit or investigation reports.
6	Contributory	15	Inadequate LSpecs	The practical LSpecs were not fit for purpose lacking sufficient detail to guide the instructors and having erroneous information included.
7	Contributory	15	Task focus vs development of fundamental dive skills	From a point in week two the AD2 course focuses on the military tasks required of Army divers rather than ensuring diver competence. In part due to the fact the LSpecs do not give the instructors the direction required. All 'Dive Briefs' are given in the correct format however they amount to military 'orders' rather than novice diver training briefs. The Dive Brief on 26 Mar 18 focused the student divers on the helicopter recce rather than the significant step up in diving ability/knowledge/experience the dive should have offered them.
8	Contributory	16	Poor course design lacking appropriate trg progression	Overarching poor course design results in an AD2 course which does not adequately prepare a diver to operate below 9m (only 2% of LCpl Partridge's dive time was below 9m). The LSpecs are inadequate and the course progression does not adequately assess the aptitude of the diver or prepare the students for depth. This has specific implications on the events of the 26 Mar 18, linked to switch block and gauge checks issues, actions on CPS activation and Emergency Cylinder use. A lack of true understanding of the implications of depth is highly likely to have influenced LCpl Partridge's decision to swim beyond CPS activation.
9	Contributory	16	Ineffective assessment strategy	The assessment strategy neither aided formative learning nor adequately assessed competence.
10	Other	17	Lack of After Action Reviews	A factor closely aligned to the ineffective assessment strategy.
11	Contributory	19	Dive duration planning using decompression rather than air consumption	It was clear that the risk analysis relating to dive duration on 26 Mar 18 was based on the No Stop Time / decompression factors rather than Air Endurance Times. Underpinned by the overarching dependence on CPS acting as

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				a safety mechanism and the fact the DS had not been taught how to calculate AETs resulted in the dive being managed based on the wrong calculation.
12	Other	20	Act on CPS	Actions on CPS activation are not standard with the default actions on CPS taught on Army diving courses at odds with the Safety Case.
13	Contributory	21	Swimming to CPS	Routinely swimming to CPS as the planned end point of a dive removes focus on gauge monitoring and lessens the importance of the warning.
14	Other	21	Exit cylinder readings	Neither policy of standard practice require divers to record the cylinder pressures on completion of a dive. To do so would aid students understanding of air usage rates v's depth and capture any unrecognised air linked equipment failures.
15	Other	22	Over burdened OiC DTG	The OiC DTG job specification is too large for a single post to ensure training risk is ALARP.
16	Contributory	22	Omission of Dive 19	Exacerbating the course design factors noted above the omission of Dive 19 removed a necessary safer dive to depth.
17	Contributory	23	Dive amendment process	The dive was changed without permission and the DO would not have agreed to the change resulting in a Mon AM dive which was based on the Shot Rope and much simpler dive.
18	Other	25	Lack of DO Training	Despite being identified in other reports there remains no training for Army DOs.
19	Other	25	Ineffective QA	An effective QA system would have identified many of the factors highlighted in this report and enabled the organisation to take remedial action.
20	Other	25	DCOP 20 responsibilities	DCOP 20 does not reflect the military diving capability, notably the mapping of role responsibilities.
21	Other	26	Dive Brief	There is a good dive brief template in common use but there is no requirement to retain the brief for audit/QA purposes.
22	Contributory	26	HOTO	Had there been a better HOTO it is more likely than not that another more competent diver would have been selected as the 1 st pair. This would have given LCpl Partridge a simpler dive and avoided the complications of the Distance Line.
23	Other	27	Risk Assessment	Despite good use of generic risk assessments the RA process does not capture or mitigate the known risks.
24	Contributory	31	EC Training	This was exactly the type of situation where the EC is designed to be used. Had LCpl P used his EC it is likely that he would have had a better chance of survival.
25	Contributory	32	Design faults of the Switch Block.	The switch block has been the source of many issues since SABA was introduced. Now on the 3 rd version the current one is well known to open without intentional diver input. This fault was known about through the trials process but dismissed with procedural safety processes implemented to mitigate. In this case had the switchblock remained closed LCpl Partridge would have exhausted his main

				cylinder and then been forced to switch to his bailout. He would then have had sufficient air to surface and the strongest possible reminder to do so.
26	Other	35	1 st Stage Regulators (FSR)	<p>It is quite possible that a diver will use their whole bail out cylinder without realising if the FSRs are set in one of the three possible configurations and the switchblock is open. The Panel believe this poses a significant risk to life. This is true even if they follow gauge check protocols. This was not the case for LCpl Partridge but is included here as an “other factor” in order to prevent recurrence.</p> <p>The implications of variances, within policy accepted tolerances, of the First Stage Regulator (FSR) were not understood by most of the divers interviewed. It is also not possible for a diver to know which configuration his FSRs are set to.</p>
27	Contributory	35	Lack of warning system on bailout cylinder	Whilst air in the Bailout Cylinder should never be used to continue a dive when the bailout cylinder either fails or is inadvertently drawn upon removes the diver’s emergency supply. Aside from the gauges there is no warning mechanism to aid the diver.
28	Contributory	37	Normalisation of DTWC failures	Despite clear direction in policy and training material novice divers are routinely completing dives without reliable 2-way voice communications.
29	Other	37	Failure to carry out DTWC maintenance iaw the BR	The DTWC maintenance schedule (routine and on failure) is not iaw policy.
30	Contributory	38	Distance Line used on the day.	The distance line used by LCpl Partridge had a significant effect on this occurrence. It was three times longer than necessary and had a knot one third in. It is also questionable that whilst an accepted and proven dive activity for the AD2 course whether students should be laying a distance line at all as they are not trained to do so at any point.
31	Other	38	Ambiguous policy direction wrt lines	Possibly exacerbating the above DL factor the guidance and policy over line usage is ambiguous.
32	Other	39	NDAC mobile signal	NDAC does not have a reliable emergency phone on or near the pontoons and has a poor mobile phone signal.
33	Other	40	Incident management and reporting	There is a lack of a common incident management and reporting protocol in occurrences which cross the Service boundaries.
34	Contributory	41	Failure to have an effective learning environment.	It is clear not all HSE 2004 or NSDSR recommendations have been implemented. Had some of the recommendations been acted upon when issued several key contributory factors in this case would not have been present. As the conditions which generated this incident were formed due to a combination of accident factors had several

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				been removed the situation is much less likely to have occurred.
35	Observation	43	NLIMS	Whilst the Panel are aware work is ongoing to improve the NLIMS package the Panel found it was very difficult to interrogate legacy cases and must be developed if diving is to be a learning organisation.
36	Other	46	Lack of Army Senior Operator	At the time of the accident there was no Senior Operator construct to act as a guiding mind for the Army diving community.
37	Other	47	Variations between Services	The SI identified areas where dives and their management differed between the Services. The issue is not with the differences but in that the differences are not known about nor in line with the Safety Case.
38	Other	47	SoDD remit	At the time of the occurrence SoDD was involved in all aspects of dive governance from writing policy to 1 st , 2 nd and 3 rd line assurance activity.
39	Other	48	Clarity of dive policy	Dive policy documents are contradictory and confusing.

SECTION 1.5

Diving SI - Collated Recommendations

Ref.	Recommendation.	Page	Recommendation Owner
1	MWS to develop an auditable process which ensures failures (either failure to complete endurance aspects or to start or complete dives) are scrutinised by the DO, Medic and OIC DTG weekly to identify any potential medical issues.	1.4.10	CO MWS
2	INM to confirm that the current diving medical assessment is Fit for Purpose.	1.4.11	CO INM
3	MWS to action the recommendations from the May 17 2nd Party Audit Report	1.4.14	CO MWS
4	MWS to implement a quality management system which ensures new course material from BFL is fit for purpose before being accepted into use.	1.4.15	CO MWS
5	MWS to re-write all AD2 course lessons to ensure the Dive Supervisor has sufficient information to base his lesson on.	1.4.15	CO MWS
6	MWS to re-write all AD2 Course KLPs to ensure they are written iaw JSP 822 and with a diving effect focus.	1.4.15	CO MWS
7	MWS to enhance air consumption awareness during training serials by increasing the frequency of gauge checks.	1.4.15	CO MWS
8	MWS to redesign the course to develop trainees as a competent diver (to 30m) before delivering the military task element.	1.4.16	CO MWS
9	MWS to re-design the course to increase instructor covered diving experience for the trainees between 10-30 m.	1.4.16	CO MWS
10	MWS to expand the assessment process to include summative assessments and improved formative assessments.	1.4.17	CO MWS
11	MWS to instigate After Action Reviews after all dive training serials.	1.4.17	CO MWS
12	CO DDS to ensure students report Air Endurance Times to the Dive Supervisor prior to the start of all training dives.	1.4.19	CO DDS
13	ACNS(SHIPS) is to ensure that a pan Defence procedure is adopted for actions on CPS activation.	1.4.20	ACNS(SHIPS)
14	LWC to review the RPS to ensure AD2 divers are required to conduct a controlled ascent away from a shot rope prior to diving below 9 metres.	1.4.20	AH Trg Plans
15	MWS is to cease the practise of deliberately diving to CPS activation.	1.4.21	CO MWS
16	MWS to amend the post dive procedures to include discussion of remaining cylinder pressure at the end of every training dive.	1.4.21	CO MWS

17	MWS conduct a role analysis of the OiC Diving Training Group role to ensure all safety critical activity can be conducted and that manpower capacity meets that requirement.	1.4.22	CO MWS
18	Recommendation R18. DDS to ensure all scheduled dives are completed in accordance with the course Dive Project Plan.	1.4.22	CO DDS
19	MWS to instigate a process to ensure the Dive Amendment Process is adhered to and is auditable.	1.4.23	CO MWS
20	Cap GM to address the lack of training and experience required for the role to ensure the risk carried by Army DOs is ALARP.	1.4.25	AH Mvr Sp
21	MWS to develop and implement a more robust and effective QA system for DDS courses.	1.4.25	CO MWS
22	DDST to ensure that DCOP 20 is rewritten to accurately reflect the military diving capability, the unique military equipment and appropriate safety measures.	1.4.25	SoDD
23	MWS are to develop standardised dive briefs for each DDS dive which ensure diving KLPs are emphasised and ‘interest’ tasks are appropriate.	1.4.26	CO MWS
24	MWS to ensure training dive briefs are retained and archived iaw with the Dive Project Plan.	1.4.26	CO MWS
25	MWS to establish and mandate an appropriate auditable instructor hand over process.	1.4.26	CO MWS
26	CO DDS to ensure his residual medium and high risks are owned at the correct level.	1.4.28	CO DDS
27	MWS to establish a DTGRA for an out of air situation for diver training serials.	1.4.28	CO MWS
28	MWS to review their Risk Management System to ensure all three elements of the RA process are implemented in accordance with DCOP 20.	1.4.28	CO MWS
29	MWS redesign the EC and associated drills elements of the course ensuring they are delivered as a Category 2 training element.	1.4.31	CO MWS
30	The Equipment Authority is to investigate whether the SBA is fit for purpose and determine whether the activity of switching from main to bail-out cylinders is assessed as ALARP.	1.4.32	UEW TL
31	DE&S to ensure specialist human factors expertise to be involved in writing the requirement, procurement and acceptance process for all dive equipment iaw JSP 912.	1.4.32	UEW UW Engr Mgr
32	ACNS(SHIPS) to amend the policy to ensure that Main Cylinder 1 st stage	1.4.35	ACNS(SHIPS)

	regulators are set at a higher pressure than the Bail Out 1 st stage regulator.		
33	Noting recommendations 31 and 32, the Equipment Authority are to evaluate the requirement for an indication of the bail-out cylinder pressure when it drops below a specified limit.	1.4.35	UEW TL
34	MWS enforce the existing policy that novice divers must end a dive when reliable 2 way voice communications fails.	1.4.37	CO MWS
35	MWS enforce the necessity to report faults in the DTWC.	1.4.37	CO MWS
36	MWS to enforce DTWC reliability and maintenance procedures are conducted iaw BR2807.	1.4.37	CO MWS
37	MWS to amend the course instructions to specify which lines are used dependent on the task.	1.4.37	CO MWS
38	ACNS(SHIPS) to issue clear guidance for which lines to use for each specific diving task.	1.4.38	ACNS(SHIPS)
39	MWS to establish a reliable method of emergency comms at remote dive sites	1.4.39	CO MWS
40	MWS to action the OSA dated Jun 18 and establish an emergency contingency plan for dive occurrences.	1.4.40	CO MWS
41	Defence People are to establish guidelines for the management of the MOD personnel involved in a fatal incidents.	1.4.40	Hd SP Welfare Policy, Def People
42	DSA are to establish a suitable Post Incident Management Protocol, (wrt interaction with HSE, Civilian Police and military investigators) ensuring factors such as primacy, evidence collection and acceptable/appropriate military investigative actions are understood and exercised	1.4.40	TL-DSPA, DSA
43	Cap GM to review the closed NSDSR recommendations which reference Ship's Divers and check applicability to Army divers.	1.4.41	AH Mvr Sp
44	SoDD to establish the status of the recommendations for all military diving fatality investigations since 2002	1.4.43	SoDD
45	DDST to routinely review and track all diving NLIMS submissions in order to identify possible trends .	1.4.43	SoDD
46	ACNS(SHIPS) to ensure NLIMS is adopted defence wide for diving related occurrences.	1.4.43	ACNS(SHIPS)
47	Equip Authority to establish direct access to NLIMS .	1.4.44	UEW TL

48	Cap GM to ensure the Army Senior User construct provides sufficient capacity and authority to deliver necessary oversight and outputs.	1.4.46	AH Mvr Sp
49	ACNS(SHIPS) to minimise the differences between Naval and Army diving SOPs.	1.4.47	ACNS(SHIPS)
50	DMR to resolve the conflict of SoDD owning and assuring policy.	1.4.47	DMR
51	SoDD to review the Diving Officer TORs to ensure the correct level of responsibility and authorisation are held.	1.4.48	SoDD
52	SoDD to rewrite/replace DCOP 20 iot: a. Accurately reflect the military diving capability. b. Simplify the DDR: DCOP: BR2806 relationship removing duplication and erroneous information.	1.4.48	SoDD
53	The Fleet Comd initiates an independent audit of the applicability of these recommendations across the whole of Defence Diver Training.	1.4.49	Fleet Comd

SECTION 1.6 – CONVENING AUTHORITY COMMENTS

1.6.1 On 26 Mar 18 Lance Corporal George Partridge died during a diving training serial as part of his Army Diver Class 2 (AD2) course at the National Diving and Activity Centre (NDAC), Chepstow. As the Convening Authority I have now read the subsequent Service Inquiry (SI) and interviewed the Panel. I am content that the Panel has delivered a comprehensive and well investigated SI drawing sufficiently on appropriate Subject Matter Experts, including Diving Medical expertise. The SI has determined the likely cause of LCpl Partridge's tragic death and identifies a number of contributory, aggravating and other factors leading to a series of Recommendations. I have carefully considered the Panel's Report and clarified elements in a formal face-to-face meeting with them. I accept their observations, factor analyses and Recommendations in full.

1.6.2 LCpl Partridge's cause of death was identified by post-mortem as 'Sudden Death in Adults'. The report also reflects the Post Mortem findings that LCpl Partridge had an anomalous coronary artery which has been shown to affect circulation of the blood when exercising. However, whilst the Panel could not establish which came first, the removal of the mask, the heart failure or exhaustion of accessible air, they concluded that it was more likely than not that LCpl Partridge firstly ran out of accessible/usable air through using up all the air in both the main and emergency cylinders. As soon as his air supply ceased, heart failure and death were virtually coincident immediately after the conscious removal of his mask underwater, given the fact that the pathologist's report notes no stigmata of drowning. I accept that the Panel's conclusion that the strenuous nature of the dive was a 'contributory' factor but this was not a causal factor. The triggers that precipitated LCpl Partridge's heart attack, immediately after he removed his mask, were more likely to be factors such as cold shock and the mental shock of running out of useable air. The physical nature of diving generally, including the AD2 course, should therefore not warrant undue significance to this incident and I am of the opinion that the level of physical activity articulated in the Report is appropriate for the training outcomes sought. That said, I do fully support Recommendation 1; there needs to be a mechanism where medical assessment can be called upon if a 'trend' in physical symptoms is seen over time when a person is placed under physical exertion. To all staff in this case, it was assumed that LCpl Partridge was an extremely fit man and without a more focussed medical investigation into his heart defect (anomalous coronary artery) the training staff on AD2 had no reason to doubt that LCpl Partridge was fit for training.

1.6.3 The SI articulates the suite of factors and recommendations clearly and I do not wish to pick over each one – I accept them all as written. I should, however, like to comment on the poor quality of Course Design and associated documentation with the AD2 Course. This is unacceptable particularly given that this has been identified previously in other Audits. Whilst this did not constitute a casual factor in the death of LCpl Partridge on 26 Mar 18, it is an issue that had to be addressed without delay, and I understand that this work is being done. Staff and Instructors must be delivering against a properly designed Course with the right I-Spec and DSAT standards of prescription for issues such as briefing formats and in-water 'instructor-student' periods (particularly apposite for courses for inexperienced or ab initio diver students). It is clear that the documentation was woefully inadequate – commands, authorities, instructors and Duty Holders must be encouraged to ensure they challenge, and critique contractor provided products and that enough SME and DSAT qualified personnel are involved in the delivery and QA of diving training design and documentation.

1.6.4. I would also like to comment on the various equipment failings the report highlights, and in particular, the risk appetite to continue diving despite lack of resolution at the time. Whether it is the ease with which the Switch Block Assembly opens (and so allows the reserve/emergency cylinder to drain without the diver's knowledge), the illogical First Stage Regulator settings or the unreliability of the Divers' Through Water Communication system commanders must ensure diver safety is paramount. The now ongoing project to replace the SABA Mod 1 system should address these issues but divers and their commanders must cease diving when equipment failings prevent the dive from being conducted within the safe system of training.

1.6.5. This thorough investigation identifies many other factors and observations. Taken as a whole, it is a timely reminder for Commanders and Training Staff that there is inherent risk in diving activity, particularly in initial diving training with ab initio diving students, which requires vigilance and careful risk management in their organizations. In reviewing the list of factors and recommendations I therefore accept Recommendation 53 and, consequently, I have written to the Army and Joint Forces Command to convene a Pan Defence Military Diving Review; they are both in agreement. The aim of this independent Review will be to look across Defence and tighten up the governance, assurance and risk management processes in place across all 3 TLBs that conduct military diving activity; this panel will be headed by an independent civilian with diving and safety expertise.

1.6.6. Having read the totality of the SI, and although not explicit in the Report, it is my opinion that there is also inherent risk in personnel, at any rank or rate, coming from the front-line on operations direct to training roles. I acknowledge that this is a subjective factor but it is possible, if not probable, that acceptance of risk, perhaps adjusting or relaxing SOPs, may manifest in a training environment. For individuals returning from trained, practiced and worked up teams at the front-line, a 'mental re-set' may be appropriate to ensure that training staff understand fully the need for them to re-calibrate when dealing with very inexperienced and unconfident students.

1.6.7. I am satisfied that the SI has been conducted in accordance with the regulations and that those whose character or reputation may have been affected by this enquiry have had the opportunity to comment on the relevant sections of the report. I have therefore tasked the Panel President to inform the Potentially Affected Persons that they are no longer subject to Regulation 18.

1.6.8. Lastly, I noted the impressive speed of response and logical decisions taken by the Directing Staff to this tragic incident once it became apparent on the day itself that all communications with LCpl Partridge had been lost. The speed with which LCpl Partridge was recovered by the Standby Diver and the fact that he risked his own life through exceeding descent and ascent rates, both to find LCpl Partridge in the water column and then to recover him to the surface, is to be commended.