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By MCAUST 5 May 06
Ref: 2007/1002198



TELEPHONE. 9297933

IN REPLY QUOTE 1/17/6

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ROYAL AUSTRALIAN NAVY
STAFF IN CONFIDENCE

HMAS PLATYPUS
NORTH SYDNEY NSW 2060

15 APR 1981

The Flag Officer Commanding
HM AUSTRALIAN FLEET

REPORT OF THE BOARD OF INQUIRY
INTO THE CIRCUMSTANCES SURROUNDING THE
DEATH OF ABUW C.J. PASSLOW R123920

- References:
- A. Manual of Naval Law, Chapter 25
 - B. Fleet Commander's Orders PA111 dated 02 March 1981
 - C. HMAS ONSLOW message MBC 011330Z MAR 81
 - D. Board of Inquiry Interim Report dated 05 March 1981

Sir,

1. We have the honour to report that we have completed a full and careful investigation into the circumstances surrounding the death of ABUW C.J. PASSLOW, R123920 onboard HMAS ONSLOW at 020005L MAR 81, as reported in HMAS ONSLOW MBC 011330Z MAR 81.

2. The investigations were conducted at HMAS PLATYPUS during the period 02-06 March 1981. They included an inspection of HMAS ONSLOW, detailed inspection and operation of her main machinery, interviews of selected members of her ship's company and initial and thorough medical investigations. Further detailed medical investigations continue, Annex C refers.

3. On 03 March 1981, Surgeon Lieutenant T.C. DAWBARN RAN attended the autopsy on the body of ABUW PASSLOW at the Sydney City Morgue.

Witnesses

4. All witnesses were interviewed separately and evidence was given freely. Minutes of evidence taken are enclosed.

5. Whilst all witnesses gave evidence freely, it was noted that early witnesses were still suffering greatly from the physical and emotional stresses endured, together with the special effects of breathing diesel exhaust fumes. Further comment on these effects is given in the Medical section below.

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Introduction

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6. The period covered by this report is from 012030L to approximately 020230L March 1981. All times used are zone time Lima (-11) with the exception of the report by the Medical Officer, HMNZS WAIKATO, which is in zone time Kilo (-10).

Brief Review of Events

7. At 2030 ONSLOW was taking part in Exercise SEA EAGLE 81-10. The submarine was snorting on both main generators; the Control Room in normal night configuration with black lighting and sets of blackout curtains rigged at either end of the Control Room. At approximately 2040 the OOW instigated "stop snorting" procedure to avoid detection by a "hostile" aircraft.

8. A detailed reconstruction of subsequent events is contained at Annex A. At the time of stopping snorting twenty-six personnel were in the Control Room area, including seven in the Auxiliary Machinery Space and Radar Office, five in the vicinity of the Heads and Bathrooms, and two in the Wireless Office. Four personnel were in the Engine Room. PASSLOW was one of the sailors under instruction in the Radar Office.

9. Within 30 seconds of operation of the stop snorting alarm, individual compartments had undertaken normal stop snorting drills. By this time a dense cloud of white, acrid, noxious smoke had filled the Engine Room and was being circulated throughout the Control Room and accommodation space by ship's ventilation. Confused pipes relating to the situation of possible fires were made and immediately the Commanding Officer ordered the OOW to surface the submarine. This operation was conducted quickly and effectively.

10. Within 3 minutes the Engine Room had been evacuated and of the thirty personnel mentioned above, sixteen had already been seriously affected by smoke to such an extent that nine were about to collapse or were in a state of collapse. Of these nine, three were still in the Radar Office and two were still in the Wireless Office. By this time PASSLOW had proceeded to the Junior Sailors' Bathroom where he had probably lost consciousness and slumped in the shower recess obscured from view in a position such that his chin was hard down on his chest.

11. By this time it was apparent to all that the problem source was in the Engine Room and it was then that (MTP4) CPO G [REDACTED] entered the Engine Room, wearing a breathing mask supplied from the Control Room Air Breathing System (CRABS), to ensure that all watchkeepers had been evacuated and that the machinery was in a safe state.

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12. Rescue parties from forward were organized and assisted in removing casualties from the affected area. In fact three early members of rescue parties collapsed in the vicinity of the Wireless Office passageway and several more rapidly became minor casualties. Simultaneously many of the personnel on watch in the Control Room were overcome, there being insufficient effective GRABS masks. This necessitated the evacuation of the Control Room except for personnel wearing effective breathing apparatus, this being normal procedure.

13. In the After Ends of the submarine, MTP3 CPO B [redacted] and POMTP3 R [redacted], dressed in DOBA equipment, entered the Engine Room. These persons then took action to start the port main engine and clear smoke.

14. Whilst PASSLOW was initially found in a state of collapse by CPO G [redacted], it was not until the port main engine had been started and smoke clearance commenced, that effective assistance was able to reach him. By this time he had been exposed to high concentration of exhaust fumes for more than 20 minutes.

Cause of Smoke and Noxious Gas

15. POMTP3SM S [redacted] was in charge of the Engine Room. On receipt of the stop snorting alarm he carried out the normal drills to shut down and secure both main engines. Within seconds of shutting the Group Exhaust Valves the Engine Room filled with smoke. Evidence from all Engine Room personnel on watch indicates that initially both engines ran down as normal, but that the starboard engine then appeared to continue running at reduced speed. Both PO S [redacted] and LSMTP P [redacted] reported the sound of "rushing air", which they assumed to be an HP Airburst on No. 6 cross connection.

16. S [redacted] testified that, once he had realised that the starboard engine was still running, he attempted to operate the engine panel stop push, even though he was almost overcome by the smoke. It is not known whether this action was effective.

17. In their evidence both CPO G [redacted] and CPO B [redacted] indicated that both engine control panels had been shut down correctly although the thick smoke and their breathing apparatus would have made it difficult to see this at a glance. POMTP R [redacted] indicated that when he prepared the engine control panel to start the port main engine he thought that the starboard panel was still switched on. This is a point of conflict in evidence.

18. Annex B details the technical investigations carried out on board HMAS ONSLOW. It may be seen that:

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- a. to produce the amount of exhaust gases necessary to fill the Engine Room in such a short period of time one engine running with fuel available would be required, and
- b. there were no technical reasons why the starboard engine should have run on if correct stopping procedures had been carried out.

19. It is therefore concluded that the fumes were produced by the starboard main engine which was not in the correct stopping condition prior to the shutting down of its exhaust system. This situation would be caused by:

- a. incorrect initial operation of the engine control panel power supply switch, or
- b. the inadvertent switching on again of the engine power supply switch.

This latter action could have occurred whilst in the process of operating other controls on the panel, either by hand or by catching with clothing, prior to the collapse of the collapsable bell crank lever (see Annex B).

Spread of Smoke

20. On stopping snorting the flow of air through 77 bulkhead door is affected by battery ventilation airflow, expansion of hot air in the Engine Room, and the general equalisation of pressures within the submarine. These factors contribute to an initial flow of air from the Engine Room to the Control Room. Thus there is a major air flow into the Auxiliary Machinery Space which carries any smoke from the Engine Room in that direction. As the ship's ventilation system draws air from the AMS, any smoke is rapidly distributed throughout the forward compartments. This situation occurred in ONSLOW, all evidence indicating that personnel in the accommodation space were the first to raise the alarm.

21. Once the alarm had been raised, action to stop all ventilation and shut down bulkheads was rapid and effective, with the exception of 77 bulkhead. This bulkhead was not shut down at any stage due to:

- a. the rapid effect of the smoke on personnel in the vicinity,
- b. the inability of personnel to establish control in the vicinity due to the number of casualties and amount of smoke, and
- c. the initial passing of GPO G's air hose through the door.

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22.

The most badly affected areas were therefore:

- a. the Engine Room,
- b. the after end of the Control Room between the blackout curtains and 77 bulkhead, including both sailors' bathrooms,
- c. the Auxiliary Machinery Space and Radar Office, and
- d. the Wireless Office.

Review of Medical Effects

23. A detailed study of Carbon Monoxide, its effect on the body and the application of Carbon Monoxide and other noxious gas exposure, in relation to the ship's company of ONSLOW, is contained at Annex C.

24. It is apparent that no member of ONSLOW's ship's company escaped without suffering some symptom attributable to inhalation of noxious gas (particularly Carbon Monoxide).

25. Information gained from the investigation and a questionnaire circulated to the ship's company has revealed the following morbidity figures:

- a. one member died,
- b. nine members lost consciousness then suffered some form of convulsion,
- c. nine members lost consciousness for varying periods but were not observed to suffer convulsions,
- d. seventeen members suffered from symptoms attributable to the noxious gas exposure for more than three days after,
- e. twenty-five members suffered symptoms for one to three days afterwards, and
- f. six members only suffered symptoms prior to coming alongside HMS PLATYPUS (12 hours after the event).

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26. Whilst application has been made, a copy of the Autopsy report on PASSLOW has not yet been received. A copy of the forensic report on post-mortem samples has been received together with a gas analysis of air samples taken during the subsequent machinery trials. Copies are attached.

Conclusions

27. It is concluded that:

- a. ABUW C.J. PASSLOW died at or about 020005L MAR 81;
- b. contributory factors to his death were:-
 - (1) inhalation of noxious gases,
 - (2) carbon monoxide poisoning, and
 - (3) possible obstruction to his respiration;
- c. all medical actions taken by ONSLOW personnel to revive PASSLOW were correct and conducted in an exemplary manner bearing in mind the facilities available and the conditions pertaining at the time;
- d. the noxious gases were produced within the submarine by maloperation of the starboard main engine control panel during stop snorting drills at approximately 012040L MAR 81;
- e. inadequate initial establishment of smoke boundaries allowed rapid spread of the noxious gases throughout the submarine;
- f. there were no technical defects in ship's systems or equipment which would have contributed to the production of noxious gases; and
- g. the forensic report on post-mortem samples indicated a blood alcohol content of 0.01 gm per 100 ml. This is considered to be consistent with consumption of a standard beer issue some time prior to death and such consumption is not considered to have had any effect on PASSLOW's actions.

28. PASSLOW was found in the Junior Sailors' Bathroom and evidence confirms his movements from the Radar Office to the Auxiliary Machinery Space ladder. It can only be assumed that his movement from the top of the Auxiliary Machinery Space ladder to the Bathroom was caused by:

- a. the congestion in the passageway;

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- b. a mistaken idea that the air would be cleared in the bathroom or probable inducement of nausea/vomiting from inhalation of the acrid atmosphere.
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It is assumed that whilst in the Bathroom he lost consciousness and fell backward into the shower recess.

29. Whilst initial actions by OPOMTP4SM G and OPOMTP3SM B, the first persons to attend PASSLOW, were limited and ineffective, this is understandable as both were already affected by the noxious gas and on the point of collapse. Despite his condition G did manage to reposition PASSLOW to allow a clear airway, as he was still breathing hoarsely at that time, to raise the alarm via POMTP R in the Engine Room, and to attempt ineffective mouth to mouth resuscitation.

30. In respect to the production of smoke from the starboard main engine, it is apparent that POMTP3SM S was confused in his priorities by the mistaken assessment that the exhaust gas flow from the starboard main engine exhaust drain was an HP airburst. By the time he realized that the engine was still running and attempted further stopping action, he was severely affected by inhalation of the gases.

31. The lack of any action to shut 77 bulkhead door by Engine Room staff, or other personnel in the vicinity, may be explained by:

- a. the desire of senior sailors to ensure that all junior staff had been evacuated,
- b. the rapid effects of choking/nausea after inhalation of the gases, and
- c. the particular effects of carbon monoxide poisoning in distorting judgement.

Recommendations

32. In view of the rapid production and spread of the gases, the early onset of nausea/vomiting after inhalation of these gases, and the particular effects of carbon monoxide poisoning, disciplinary action against Engine Room watchkeeping personnel or others responsible for establishing smoke boundaries is NOT recommended.

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33. In addition to the recommendations made in the Interim Report (Reference D) at paragraphs 11 and 12 the following further recommendations are submitted for consideration:

- a. that an investigation be carried out into the provisioning of more suitable portable breathing apparatus for use in submarines. The DCBA set currently in use is cumbersome, difficult for a single man to put on, and restricts movement in confined spaces;
- b. that an investigation into fitting more extensive Emergency Breathing Systems be conducted. Extension of systems such as the CRABs to the Engine Room/Motor Room areas and Auxiliary Machinery Space should be considered. The possibility of a fixed main, utilising air from one nominated HP air bottle group, which could be maintained pure, and servicing fixed points in machinery spaces and offices, should not be overlooked;
- c. that the provision of CO absorption masks in damage control lockers and machinery spaces be considered. A variety of masks which provide protection for up to 45 minutes are known to be in use in the Mining Industry;
- d. difficulty in communication by personnel wearing various forms of breathing apparatus was experienced. Whilst some issue face masks are fitted with speech discs these have been sealed in later issue masks to allow a limited diving capability. In any case, speech through these discs is very distorted. Investigation into the feasibility of equipment fitted with throat microphones or built in microphones utilising modern small "beeper"/paging type equipment is recommended;
- e. for personnel using CRABs type systems for extended periods, where air is supplied direct from the HP Air ring main, the use of small granulated carbon filters in the supply to each mask to filter out residual odours is recommended;
- f. that an investigation be conducted into the feasibility of fitting an electrical interlock system, utilizing existing exhaust system valve position indication circuits and an engine speed sensing circuit, to ensure engine

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shutdown in the event of the exhaust system being inadvertently shutdown. Such a system should be fail safe and be fitted with a manual override or time delay to enable normal engine starting procedures to be employed.

34. It is appreciated that the above recommendations are no substitute for correct initial drills and it is further recommended that the ongoing training and practice of smoke containment drills in operational conditions be continued.

35. The use of smoke containment curtains at bulkhead doors (as fitted in HMAS OTAMA) is not entirely satisfactory as whilst they are useful in a minor smoke situation they are ineffective against large air flows and can cause obstruction when shutting doors. Further investigation into physical containment of smoke is necessary.

36. With respect to future generation submarines it is considered that ducting of snort air to the diesel generator compartment through remotely controlled valves and the fitting of air locks between the main machinery spaces and operational/domestic areas to ensure positive control should not be overlooked.

37. The primary cause of this totality was due to probable operator error at the time. This is, however, in no way prejudicial to the general operational efficiency of HMAS UNSLOW and does not reflect the actions and performance of many of the ship's company in dealing with the catastrophic effects of this incident and their efforts to prevent further loss of life. In particular, the actions of LSUC C [REDACTED], ABMTP D [REDACTED], POMTP R [REDACTED], LSCK H [REDACTED] and LCDR M [REDACTED], merit recognition. It is recommended that the award of Commendations for Bravery to these personnel be considered.

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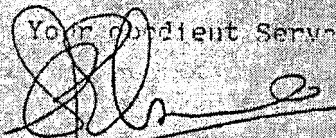
We have the honour to be

Sir,

Your obedient Servants



(R.H. WOOLRYCH)
Commander RAN



(C.J. WISTONE)
Commander RAN



(T.C. DAY, ARN)
Surgeon Lieutenant RAN



(C.J. MACDONALD)
Surgeon Lieutenant RAN

- Annexes:
- A. Detailed Review of Events
 - B. Report of Technical Investigation
 - C. Medical Report

- Enclosures:
- 1. Report of Medical Officer, HMNZS WAIKATO
 - 2. Minutes of Evidence

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SEQUENCE OF EVENTS

1. At the time of stopping snorting in HMAS ONSLOW at 2030L on 1 March 1981, personnel were distributed in the area of the Wireless Office (WT) passageway and Auxiliary Machinery Space (AMS) and Engine Room (ER) as follows:

Radar Office	LSRP [REDACTED] ABUW PASSLOW ABMTP [REDACTED] ABETS [REDACTED]
AMS	LS [REDACTED] ABETS [REDACTED]
Refrigeration Space	ABCK [REDACTED] ABUW [REDACTED]
Senior Sailors' Bathroom	ABUC [REDACTED]
Wireless Office	RO [REDACTED] RO [REDACTED]
Heads	SMNMTP [REDACTED]
Engine Room	POMTP [REDACTED] LSMTP [REDACTED] ABMTP [REDACTED] ABMTP [REDACTED]

In addition to the above, the normal watchkeepers plus the Engineer Officer were present in the Control Room, a further 8 individuals.

2. From the moment of stopping snorting it is considered that the Engine Room and the adjacent area just forward of 77 Bulkhead and the AMS became filled with a lethal level of exhaust fumes and noxious gases within one minute, and within this time the effect of the gases on individuals was being felt.

3. The attached Appendix to this Annex, provides a detailed graphical representation of the more important individual actions taken during the period, from activation of the Stop Snorting telegraph until heart massage was commenced on ABUW PASSLOW. Relevant ship events are listed in the first column of the Appendix, but for ease of

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reference are detailed below:

<u>Time</u>	<u>Event</u>
Minute 00.00	Stop snorting.
00.30	Smoke in Engine Room and AMS.
00.45	Pipe of fire in Accommodation Space.
01.00	(1) Submarine surfaced. (2) Problem confirmed as source in Engine Room.
02.00	(1) First casualties. (2) Commenced evacuation of casualties.
02.15	ABUW PASSLOW collapsed into JS shower recess.
08.00	XO ordered an engine for smoke clearance.
15.10	CPOMTP4 G discovered PASSLOW attempted a form of resuscitation.
21.00	Engine started for smoke clearance.
24.00	(1) Majority of smoke cleared. (2) PASSLOW receiving medical assistance from ship's medical party.

All times quoted above are the best estimate that can be made from the evidence received.

4. Qualified medical assistance from HMNZS WAIKATO arrived some 3½ hours after the submarine had surfaced in this emergency situation and ABUW PASSLOW was pronounced dead shortly afterwards. More detailed account of the actions taken by the Medical Officer are contained in Enclosure 1.

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As stated in paragraph 3 above, all times at best, are very approximate. At the time of conducting interviews, the personnel of HMAS ONSLOW were in a state of severe depression and shock, and were still suffering the effects of the inhalation of the noxious gases. It was quite obvious during the period of the interviews that personnel had lost all sense of time during the incident and that all persons had been severely affected by the experience. The only time that can be positively confirmed is the DTG of the first signal from HMAS ONSLOW (ADA 011030Z MAR 81) with a time of receipt in HMAS PLATYPUS of 011040Z.

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HMAS PLATYPUS
NORTH SYDNEY 2060

7 May 1981

The Flag Officer Commanding
HM AUSTRALIAN FLEET

REPORT OF THE BOARD OF INQUIRY INTO THE CIRCUMSTANCES
SURROUNDING THE DEATH OF ABU C.J. PASLOW
R123920

- References:
- A. AF 6/2/243 dated 23 April 1981
 - B. COMAUSFLT message ABA 280520Z APR 81
 - C. Board of Inquiry Report 1/17/6 dated 15 April 1981
 - D. Board of Inquiry Report 1/17/6 dated 5 March 1981

Sir,

We have the honour to submit our Supplementary Report on the subject Inquiry as directed at Reference A.

2. After further interviewing of ONLOW personnel and re-examination of Ship's Standing Orders and records, the following comments on the matters raised at Reference A, Paragraph 2, are forwarded:

- a. Engine State. POMTP33M 3 [REDACTED] switched off the power supply to the starboard engine whilst setting up the panel to start the port engine for smoke clearance. It cannot be determined whether the action of POMTP33M 3 [REDACTED] in pressing the panel stop push effectively stopped the starboard engine. By the amount of unburnt carbon deposits discharged from the starboard engine exhaust front drain it is deduced that the engine stopped due to oxygen starvation.
- b. Disciplinary Action. It is not recommended that any disciplinary action be taken against POMTP33M 3 [REDACTED]. It is not considered that he was negligent in the performance of his

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duties as Engineer Officer of the Watch. As reported at Reference C, S [REDACTED] has stated that he switched off the engines and subsequently, when he realized that the starboard engine was still running, he attempted to operate the panel "stop" push, despite being almost overcome by the effects of the noxious gases. It is not considered by this Board that his actions constitute negligence.

- c. POMTP3SM S [REDACTED] - Qualifications. PO S [REDACTED] was properly qualified to be the Engineer Officer of the Watch. He was awarded the Engine Room Watchkeeping Certificate Diesel Submarines (E CDSM) (Qualification No. 908520) on 10 November 1980, as advised by HMAS ONCLOW Form PE5, Serial No. 2708, dated 14 November 1980. The award was made by LEUT K [REDACTED], the submarine's Marine Engineer Officer, after both written and oral examination in accordance with the syllabus laid down in ABR 27. During the period April - November 1980, S [REDACTED] was employed as the Outside Machinery MTF, watchkeeping on the panel. In preparation for the E CDSM examination he kept watches in the engine room dived under supervision. This period included at least 4 stop snorting evolutions under the supervision of C.O.T.43, G [REDACTED]. In conjunction with the award of the E CDSM, 2 further supervised stop snorting drills were conducted. Since the award SCRAIGH has conducted the stop snorting operation a minimum of 40 times and has continued to do so since the incident. His qualifications are fully and correctly documented in his Service documents.

- d. Engine Room Evacuation. Within the circumstances, the evacuation of the engine room was considered to have been properly executed. There is no laid down drill requiring all personnel to evacuate in one direction if practicable. Current practice involves the evacuation of personnel through the nearest safe exit, depending on the nature of the incident, with subsequent reporting of movements to the CO. No change to this policy is considered necessary nor is it considered that any change would be practical or enhance safety.

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- e. Training. The ship's company had been trained in the types of drills relevant to this particular incident. Standards of ship's company training had been monitored by sea riding staff on 14 January 1981, being assessed on that day as good. An Operational Readiness Evaluation was conducted in mid February and for this evolution the submarine was assessed as satisfactory in all respects.
- f. CP Lighting. The switching off of CP lighting was not in accordance with current doctrine. Since the introduction of ventilation "crash stop" push switches in the control room, the motor room watchkeeper is required to stand by the CP contactor in the event of "Fire" or "Emergency Stations" but only to operate it on the "OOV" command, or if a CP failure is apparent. Provided AC (fluorescent) lighting is maintained, as in this case, the practice of breaking CP can be beneficial as all unnecessary small machinery is safeguarded and CP (filament) lighting provides little extra advantage.
- g. Boundary Control. As stated in Reference C the actions taken to effect boundary control were not in accordance with current doctrine in that 77 bulkhead door was not shut. The control of the spread of smoke into adjacent compartments was therefore ineffective. In the circumstance, personnel in the immediate vicinity of 77 bulkhead were affected by the inhalation of Carbon Monoxide and worried about the clearance of personnel from the Engine Room.
- h. Beer Issue. The beer issue was authorized by the Commanding Officer. The issue was made at approximately 1830 by the beer caterer, C/MTP43M C. Amounts issued to mess decks at that time equated to 2 small cans per man requesting an issue. The issue was generally in accordance with your standing orders except that opened cans were not issued to sailors of PO rank and below. The engine room watchkeepers did not take part in the issue prior to going on watch at 1900.
- i. Matters Arising. See paragraph 3 below.

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- j. Stop Snorting Drills. Stop snorting drills are laid down in SSO's in accordance with RANSSO Article 0417, Standard Operating Procedure, and Article 1409, specific instructions to engine room personnel. There is no evidence to indicate that these instructions were not correctly followed by all on watch other than the uncertainty surrounding the operation of the starboard main engine shut down controls as previously reported. The previous recommendation for amendment to RANSSO Article 1409 to detail engine stopping procedures is considered the only action necessary.

3. As a result of the supplementary investigations no further aspects directly relating to the death of AB PASLOW came to light. It was noted, however, that whilst the current doctrine in submarines with respect to smoke containment and clearance is based on sound principles and is well practised, RAN Oberon Class Submarine Standard Orders (RANSSO's) contain insufficient general advice. Whilst it is realised that it is impracticable to detail orders covering all eventualities it is recommended that RANSSO Article 0436, Firefighting-General, be amplified to provide more general information on these subjects.

We have the honour to be,

Sir,

Your obedient servants,

SIGNED
(R.H. GOLRYCH)
Commander MBE RAN

SIGNED
(C.J. ELSMORE)
Commander RAN

Enclosure: 1. Minutes of Evidence

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