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REPORT FOR THE PERIOD JANUARY 1975 TO DECEMBER 1976.(U)
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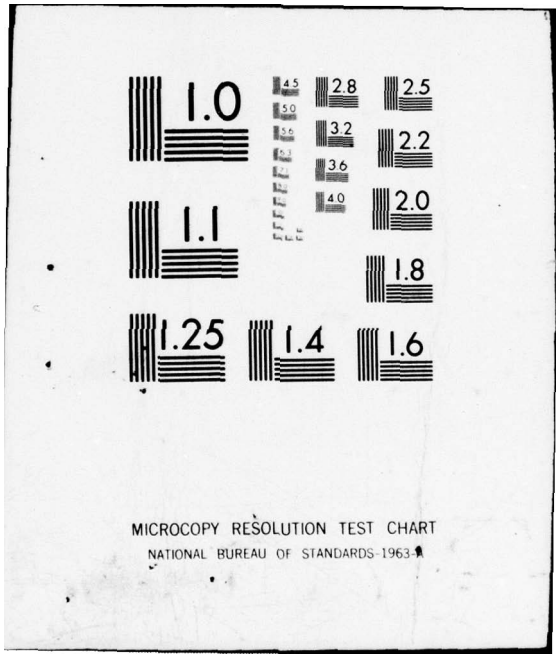
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Royal Naval Personnel Research Committee

(6) REPORT for the period
Jan 1975 to Dec 1976.

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ROYAL NAVAL PERSONNEL RESEARCH COMMITTEE
(RNPRC)

MEMBERSHIP - December, 1976

Chairman	Professor K W Donald DSC QP MA MD DSc FRCP FRSE The Royal Infirmary, Edinburgh
Medical Director General (Naval)	Surgeon Vice-Admiral Sir James Watt KBE QHS MS FRCS
-The Medical Officer-in-Charge Institute of Naval Medicine	Surgeon Rear-Admiral J S P Rawlins *OBE QHP MRCP MFCM FRAeS*
- Director of Health and Research (Naval)	Surgeon Captain R J W Lambert MA MB BCh MRCS LRCP MFCM DPH DIH RN
Chief Scientist (Royal Navy)	Mr B W Lythall CB MA
- Deputy Chief Scientist (Navy)	Dr J Tunstead MA PhD
- Senior Psychologist (Naval)	Mr E Elliott BSc FBPsS
Director of Naval Warfare	Captain D R Reffell RN
Flag Officer Submarines	Rear-Admiral J D E Fieldhouse
Dr A D Baddeley	Medical Research Council
Professor W Burns CBE MB ChB DSc FRCP	Professor of Physiology University of London Charing Cross Hospital Medical School
Professor O G Edholm MB BSc	University College London
Professor G R Hervey MA MB	Professor of Physiology University of Leeds
Professor R J Linden MB PhD DSc	Professor of Applied Physiology University of Leeds
Secretary	Dr H W Bunjé MD FRCP MRC Headquarters Office Staff
Assistant Secretary	Mr J A Brown MM MRC Headquarters Office Staff

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CONTENTS

INTRODUCTION

Changes in RNPRC Membership

1. | | | |
|---|---|---|
| Surgeon Rear-Admiral J S P Rawlins | vice | Surgeon Rear-Admiral A O'Connor(INM) |
| Captain D R Reffell | vice | Captain J D E Fieldhouse (DNW) |
| Rear-Admiral J D E Fieldhouse | vice | Vice-Admiral J G Raikes (FOSM) |
| Dr A D Baddeley | vice | Professor G C Drew |

2. In the period under review Dr D E Broadbent resigned from the RNPRC on relinquishing the post of Director of the MRC Applied Psychology Unit. Professor G C Drew also resigned from the Chairmanship of the Operational Efficiency Subcommittee and from the Main Committee. Dr A D Baddeley, the new Director of the MRC Applied Psychology Unit, has consented to assume the Chairmanship of the Operational Efficiency Subcommittee.

3. The Committee noted with regret the termination of Professor Drew's association with the work of the Committee. Professor Drew had participated in the work of the Committee since 1959, in which year he took over the Chairmanship of the Operational Efficiency Subcommittee.

Current Work

4. The work of the Committee is summarised below in individual reports by the Chairmen of the various Subcommittees and working groups. These sub-groups provide a forum for discussion of the various projects, of the conduct of experimental work and of the final results. Recommendations in the light of the work are prepared by sub-groups and, if endorsed by the RNPRC, communicated to the appropriate Service department.

5. The arrangements for carrying out studies are agreed by the Subcommittee in discussion with the staff of those mainly concerned, principally the Medical Director General (Naval) and Chief Scientist (Royal Navy). In broad terms the work is carried out in the following ways:

(a) By Navy Department scientists and medical officers carrying out research within the Service with advice, when needed, from the RNPRC on the scientific aspects of the work.

(b) In Navy Department establishments with assistance from the Medical Research Council (MRC) in terms of equipment and scientific or technical personnel.

(c) By MRC staff working on projects in MRC Laboratories.

Reports

6. Reports covering the work are produced as MRC/RNPRC documents and distributed widely within the Ministry of Defence and also on an international basis in consultation with the Defence Research Information Centre. It has proved possible in almost every case to produce reports which are of 'unlimited' distribution and therefor freely available to whoever may need them. Scientists associated with the RNPRC, both inside and outside the Royal Navy, are encouraged to publish their findings in the open scientific press, subject to the customary MOD clearance.

7. As in-Service research increases so a number of establishments such as INM and RNPL produce their own reports. Such reports are independent of, and do not contain reference to, MRC or RNPRC.

THE ROLE OF THE RNPRC

Terms of Reference

8. The terms of reference of the RNPRC are:

(1) To advise the MRC on such investigations as the Council may be asked to undertake on biological, medical, physiological and psychological problems affecting the health and fighting efficiency of Naval personnel and to suggest investigations with a view to increasing or improving the health, fighting fitness and environment of Naval personnel, and to aid and supervise such investigations as expedient.

(2) To advise the Navy Department through or on behalf of the MRC on the Navy Department Personnel Research Programme, including biological, medical, physiological and psychological aspects affecting the health and efficiency of Naval personnel.

RNPRC/MOD Liaison

9. The revised arrangements, recorded in the last report, for liaison between the RNPRC and MOD have continued to work well. Representatives of the RNPRC now attend meetings of the Chief Scientists Advisory Committee on Human Engineering Research and Chairmen of the Subcommittees have an opportunity of meeting with Navy Department staffs annually for discussion of the overall in-Service programme of personnel research.

SUMMARY OF WORK

ENVIRONMENT Subcommittee (ES) - Chairman: Professor O G Edholm

Protective Clothing

10. Following the trials of protective clothing carried out in Arctic waters in 1974, the Environment Subcommittee set up an ad hoc group to consider the problems revealed during the course of the trials. Immediately, the group arranged for the carrying out of two surveys, both of which yielded information of real practical value.

11. The first of these involved the carrying out of measurements to determine the wind speed and heat loss arising in the turbulent air conditions existing in the vicinity of and beneath operating helicopters. Wind speeds and convective cooling coefficients were measured beneath a Sea King helicopter in the presence of a surface wind of 6-9 m/s (11-17 knots) on land at an air temperature of 18^{o}C. Maximum air velocities generated underneath and to the side of the aircraft were found to be 9 m/s (17.5 knots) when the aircraft was on the ground and 18 m/s (35 knots) when it was hovering at a height of 15 feet. During landing and takeoff, velocities as high as 33 m/s (64 knots) were recorded.

12. Convective cooling coefficients were found to be 43 $W/M^{2}C$ on the ground and over 80 $W/M^{2}C$ during hovering. These extreme losses were attributed to the highly turbulent nature of the airflow and indicated that convective heat loss from personnel working in such air streams would be likely to be at least 2-3 times the loss that would be expected from mean air speed alone.

13. In the light of these findings and of experience gained in the trials carried out in Arctic waters in 1974, a further study was mounted to examine the effectiveness of a number of clothing assemblies. In this study, use was made of infra-red thermography to visualise the temperature distributions over the garment assemblies and the results were recorded on colour film. In addition, skin temperature measurements were made on the subjects using thermocouple probes.

14. As a result of these studies it has been possible to recommend improved protective clothing assemblies for immediate adoption and some further trials of items of these recommended assemblies are being carried out in cold chamber conditions. The studies have also pointed to the areas in which development of improved protection is clearly needed, notably for the head and face.

HEARING Subcommittee (HeS) - Chairman: Professor W Burns

Deafness in Divers

15. The survey of all divers passing through HMS VERNON on basic, CD2 and CD1 courses has continued; all men being tested to find out if a measurable hearing loss has been associated with diving. The total numbers surveyed so far are:

(a) Basic Course: 160
Average age 17: diving experience about 5 months introductory training.

(b) CD2 Course: 55
Average age 22: diving experience about 3 years.

(c) CD1 Course: 5
Average age 26: diving experience 7.5 years.

(d) Submarine Escape Training Tank Instructors: 87
Average age 33 years 6 months: diving experience 2 years 8 months.

(e) Others: 11
Ages ranged from 20.5 years to 26.5 years and diving experience from 1.5 years to 7.5 years.

It had been decided that all men with hearing levels (relative to the Audiometric zero of BS2497, Part 2, 1969) in excess of 20dB in either ear expressed as the average of hearing levels at 0.5, 1 and 2 kHz and/or 3 and 4 kHz should be referred to RNH HASLAR. Of the 318 men surveyed to date 27 have been so referred.

16. The phenomenon previously encountered, that hearing in the right ear is usually better than in the left ear, has continued to be met. It is normal practice to test the left ear first so that this difference may be the result of a learning effect.

17. The survey is being continued.

Aircrew Hearing

18. The Subcommittee discussed work being undertaken by the Royal Aircraft Establishment to investigate the noise dosage received in aircraft and, in particular, at the ears of aircrew. This survey is being extended to aircraft operated by the Royal Navy.

19. Measurements taken so far of noise levels reaching the ears of aircrew have proved to be high - in excess of 90dB(A) and the otological effects of this are not yet known, in the context of the exposure patterns of service conditions. Efforts are to be made to link an audiometric survey with the noise dose survey and to carry out an audiometric survey of all aircrew at the next aircrew medical examination. This will enable comparison to be made with the audiometry carried out on aircrew admission to try to establish what hearing changes, if any, have occurred.

Audiometric Standards for New Entries

20. Two surveys (at Manchester for ratings and at London for officers) were initiated to assess the hearing levels of new entries in order to provide an estimate of the consequences of adopting various hearing standards for entry. Owing to difficulties at the statistical stage, presentation of the formal report on these surveys has been delayed. However, the general findings of the surveys have been made available and utilised in the formulation of standards for new entries.

Noise levels in Ships

21. A series of audiometric surveys of engineering staff in ships is currently under way and, although not yet complete, some results are already emerging which show changes in hearing levels in excess of those to be expected from advancing age alone. The Subcommittee awaits the final report on this work for early consideration.

22. The Subcommittee considered reports on a survey carried out during the sonar

trials in HMS MATAPAN and on a later audiometry survey of the ship's company. Although very high noise levels were encountered in this work the Subcommittee agreed that, from the information available, no cause for disquiet had been disclosed.

OPERATIONAL EFFICIENCY Subcommittee (OES) - Chairman: Professor G C Drew (until April 1976) Dr A D Baddeley (from Nov '76)

23. The OES provides coverage for human factors problems which may arise within the general framework of operational efficiency.

Human Factors

24. The final three outstanding chapters (Chapters 5, 8 & 9) of the RNPRC Handbook 'Human Factors for Designers of Naval Equipment' have now been printed and issued to all recipients of the Handbook. The Senior Psychologist (Naval) retains reponsibility for all in-Service distribution, but the Secretary, RNPRC, also retains copies for sale at cost price to industry and interested commercial organisations. There has been a steady, if intermittent, demand for copies of the Handbook and by the end of 1976 the number of copies remaining with the Secretary, RNPRC, for disposal was reduced to seven.

25. The use of some or different sensory modalities for information and instructions (OES 19/74). An investigation was undertaken in which subjects acted upon incoming information in accordance with instructions which were altered from time to time. Five conditions were examined: instructions heard, information seen; instructions seen, information heard; both seen; both heard; both randomly mixed. Performance was markedly superior in the first of these and the Subcommittee endorsed a recommendation that, where possible, data should be presented visually and instructions be conveyed in auditory form.

26. Colours for Sizes (OES 20/74) An investigation was initiated to try and determine whether there was a natural human preference for the association of colours with relative sizes. The results of a simple experiment suggested that red should represent the largest size and probably white the smallest size. Intermediate sizes could be represented by colours arranged in rainbow order. After considering the outcome of this experiment the Subcommittee expressed some reservations and decided to defer any conclusion pending enquiries as to experience in this connection elsewhere.

Interaction of Stresses

27. The effects of noise and of loss of sleep upon the observation of three sources of signals with unequal probabilities (OES 11/74) The experiment reported upon here was designed to test the effect of noise and of loss of sleep on a man's performance in searching a display. It was found that noise had a beneficial effect in making the man concentrate more on the most probable source of signals but that it had a detrimental effect in increasing the number of misses in the second half of the experimental period when it tended to mask other cues. Loss of a night's sleep clearly served to degrade performance.

28. Progressive deterioration in short term memory while breathing pure oxygen at normal atmospheric pressure (OES 12/74) In the experiment reported upon here twelve men performed a step tracking task involving a short term memory while breathing pure oxygen from a demand-type mask, while breathing air from the mask and in a control

condition without the mask. A reliable progressive deterioration over 8 minutes was found while breathing oxygen, but not in the other two conditions. The progressive deterioration was particularly marked in the most difficult short term memory condition. This result suggests that men should not breathe 100% oxygen at normal atmospheric pressure for periods longer than a few minutes if they must remain fully efficient.

29. The effect of prior noise or prior performance on serial reaction (OES 13/74)
Performance during continous and variable intermittent noise and wearing ear protection (OES 14/74)
Comparison of performance with headphone and free field noise (OES 15/74)
Effect of noise on the Stroop Test (OES 16/74)

The experiments reported upon in these four papers were all concerned to elucidate how noise affects efficiency. Noise can prevent a person from hearing what he wishes to hear and may degrade performance by masking of auditory cues which a person would normally use while working. On the other hand, noise also produces various psychological changes which can be described as an increase in arousal which tends to improve performance, especially in prolonged dull tasks. The theory has been postulated that noise has a detrimental effect on work which is distinct from arousal and masking. The results of these experiments suggest that it is not necessary to believe in this third effect and that arousal and masking are sufficient on their own to account for observed variations in performance.

30. Conclusions derived from this series of experiments were as follows:

(a) Where a person has been exposed to high intensity noise for an appreciable period of time, he may need a period in quiet in order to regain the level of efficiency which he had before he was exposed to the noise.

(b) On first entering noise the deterioration in performance is probably due to the intensity of the noise, which makes the subject too aroused. Later on the lack of variability of the noise becomes partly responsible for the deterioration.

(c) Noise through headphones produces mainly slow and irregular responses. This is probably due to an increase in perceptual isolation. Free-field noise produces mainly errors. This may be because it sounds louder than headphone noise of the same intensity, and so is more annoying.

(d) In a colour sorting task noise increased the interference between colour and conflicting colour names and this interference increased with time spent in the noise. This could be due to the over-arousal produced by the noise, or to the perceptual isolation which the noise also produced.

SUBMARINE Subcommittee (SMS) - Chairman: Professor R J Linden

Work of Submarine Medicine Section at INM

Carbon Dioxide

31. As indicated in the last report, the long term study of the effects on men of continuous exposure to 0.5% carbon dioxide was commenced in May, 1974. The experiment was carried out in the closed environment of the Environmental Medicine Unit at the INM, the subjects living in isolation for 67 days (Days 1-67 of the experiment). For 5 days prior to this and for 6 days afterwards they lived in the chamber but were allowed free access to the grounds around the EMU.

32. An open-ended control period was started on Day 1 of the study proper and the length of this period was based on the daily computer-assisted assessment of 10 main parameters indicating when the subjects metabolic activity had reached steady-state levels in the closed chamber. As a result, the ambient CO_2 was raised to 3.8mm Hg (0.5%) at 5 a.m on day 22, without the subjects' knowledge and held at this level until 6 a.m on day 57 when it was returned to the normal ambient of 0.23 mm Hg (0.3%). During the course of the experiment measurements were taken to endeavour:

(a) to determine whether 0.5% CO_2 induces respiratory acidosis, or an increase in the body load of CO_2, as reflected by PCO_2 and pH;

(b) to determine whether this impaired level of CO_2 induces renal or respiratory compensatory changes in acid-base control;

(c) to determine the degree to which changes observed previously in mineral metabolism are due to exposure to CO_2;

(d) to investigate the effects of extended chamber isolation on mineral metabolism;

(e) to investigate the respiratory effects of continuous exposure to 0.5% CO_2.

33. The report on this experiment (INM Report No 22/76) has now been received and is undergoing preliminary study by the Chairman SMS.

Carbon Monoxide

34. In the early part of 1975 arrangements were put in hand for a study of the effects of long term exposure to CO and a pilot study, utilising a CO concentration of 75 ppm was carried out in the environmental chamber. The pilot study included subject behaviour - activities and reaction, haematological investigations, biochemical investigation, mental performance studies, studies of cardo-respiratory physiology and sleep studies. The results of this pilot study were made available to a scientific advisory group of the Submarine Subcommittee which met to advise on the protocol for the main investigations.

Watchkeeping Studies

35. The final report on Watchkeeping Studies on a nuclear submarine (SMS 4/75) was circulated to the Subcommittee in 1975 for comment and it was decided that the report should be published with a special foreword by Surgeon Commander Davies. Arrangements for publication of the report are currently in train.

36. It had been shown clearly in laboratory investigations into the effects on mental efficiency of the 'rotating' and 'fixed' watchkeeping systems used in Royal Navy ships, that in the former a substantial degree of variability in performance occurs in response to the persisting diurnal rhythms, whereas in the latter, a degree of adaptation of these rhythms occurs which stabilises the performance level considerably. The extent of changes in diurnal rhythms induced by various rotating and fixed watchkeeping systems during the very long underwater patrols now undertaken by nuclear submarine crews had not previously been investigated in the Royal Navy, and the studies reported here had the aim of determining whether, in this new situation, effects similar to those found in the shorter shore-based studies would be seen. An important factor in the submarine environment was the concomitant absence or reduction in strength of external physical Zeitgeber such as sunlight and day/night temperature variation.

37. It was appreciated from the outset that many unknown or uncontrollable variables would be present in these studies and, accordingly, only the procedures of temperature data collection and self-reporting of sleep patterns were attempted. Due primarily to small numbers of subjects in each watchkeeping group and the presence of major uncontrollable variables, no firm conclusions could be drawn from the results. However it was possible to show that temperature rhythm amplitudes became compressed in most subjects on a rotating system, and that the degree of desynchronisation of these rhythms with shipboard time as the patrol progressed varied widely between subjects from no change in rhythm at all to complete desynchronisation. It was also demonstrated that sleep patterns changed considerably, with a reduction in the amount of night sleep taken in most cases, and in some individuals the accumulation of a considerable sleep deficit. The significance of some of these changes for operational performance may be considerable, as may the different degrees of adaptation to fixed watchkeeping systems which were also noted.

38. It must be concluded from the studies that while the changes observed are sufficient to suggest that in some circumstances, operational performance may be compromised, much more extensive physiological measurements are required under conditions where close control over experimental variables can be applied, before definite conclusions can be drawn, and the Navy given results of sufficient validity to allow them to act in the real situation. It is clear that to achieve this aim further primary studies must be conducted in the laboratory, with the results being validated secondarily at sea.

SURVIVAL AT SEA Subcommittee (SS) - Chairman: Professor G R Hervey

Survival at Sea - Bibliography by Mr F E Smith

39. The bibliography together with its accompanying historical note on the Navy's and Subcommittee's investigations into survival at sea has now been completed and published as Report No SS 1/76. The report has attracted a great deal of interest and has been the subject of unusually heavy demand. Some 400 copies have already been distributed and further requests are continually being received so that arrangements for a further reprinting have had to be made.

Research into hypothermia

40. The emphasis has recently been placed on the physiological events which cause, or are associated with, the "after-drop": the continuation of the fall of body core temperature

seen after removal from cold water. This is important because it appears that death is particularly likely to occur at this - ie in practice the post-rescue-stage. This work, and the studies of blood chemistry changes originally planned for human subjects, are now being carried out using pigs by Surgeon Commander Golden, at Leeds University, but as part of INM's research programme. As complete a picture as possible is being assembled of the physical and physiological events which occur during the after-drop; and of the factors which determine its duration and extent. The physical factors - insulation and heat flow - are also being investigated on a computer model. The results are encouraging, and suggest that the occurrence of the after-drop may be adequately explained by simple physical considerations of heat flow, and does not require the vasomotor events which have hitherto been invoked to explain it. A publication on this aspect of the work is in preparation.

41. Further research on human subjects is also planned, particularly to study the causes of the wide variation in cooling rates already observed in immersed subjects, which may not be entirely attributable to variations in body fat; the importance of vascular factors in insulation; and the mechanism of the adaptations to cold immersion seen, for example, in long-distance swimmers and in Naval divers.

Life-raft Trials

42. Manned free drift trials were carried out in the English Channel in May 1975, but the weather was too calm to produce any conclusive results on the sea keeping qualtities of the rafts. Major deficiencies were observed on the thermal insulating properties of the new rafts, while once again 'sea sickness' was a noticeable feature, in spite of the pre-medication with Hyoscine Hydrobromide and the moderate sea state (4 to 5).

43. The thermal problem was considered to be of immediate urgency and following modifications to the raft cold weather habitability trials were planned. These were held in UK waters and provided a less severe test than had been hoped. Nevertheless sufficient information was obtained to go ahead with a raft modification programme for all rafts in service. This trial is now the subject of a report (INM 14/77).

44. During the cold weather habitability trial at Rosythe Naval Base in relatively mild conditions (mean temps: air 4.7, water 5.5; wind speed 4.5 knots), 10 of the 15 occupants of the rafts subsequently developed a mild non freezing cold injury of the feet. Further research in this area is required at some future date.

UNDERWATER PHYSIOLOGY Subcommittee (UPS) - Chairman: Professor K W Donald

45. The role of the UPS has continued to be that of an advisory body covering the RN programmes in the Deep Diving and Submarine Escape fields. The experimental and laboratory work involved is carried out at the RN Physiological Laboratory, the Admiralty Experimental Diving Unit, HMS VERNON and HMS DOLPHIN.

Deep Diving

46. The UPS received a report (UPS 13/76) on the deep diving trials carried out at sea in collaboration with the US Navy the object of which was to test the RN Saturation Diving Decompression Tables and operational conditions. The following deep dives were achieved:

1 x 100m (24 hours bottom time) 3 hours in water work

1 x 250m (24 hours bottom time) 1 hour in water work

1 x 250m (7 days bottom time) with excursion to 300 metres on day 3 of the dive. Total time of 12 hours in water work.

Apart from Personnel Transfer Capsule (PTC) excursions the dives were maintained in an atmosphere of 0.4 bars O_2 balance He. PTC excursions used higher pO_2 of up to 0.6 bars. There were no cases of decompression sickness and only minor medical problems were encountered.

47. The UPS also received reports on trials being carried out by RNPL of the Armoured Diving Suit. This suit has now been dived to a pressure equivalent of 1500 feet with no loss of of movement in the joints.

Work by RNPL

48. During the period under review, the UPS has considered a number of reports prepared on the basis of work carried out at the RN Physiological Laboratory. These include:

(a) Some effects on the metabolism of dopamine and noradrenaline in men subjected to simulated dives of up to 1521 ft (46.4 bars) - Annex A to UPS 14/76.

(b) Preliminary findings on the use of oxygen as a breathing gas for buoyant ascent escape procedures - verbal report.

The use of pure oxygen instead of air as the breathing gas for submarine escape is being investigated. Rats have been used and the escape pressure cycle is, on the whole, similar to that in present air escapes.

Individual experiments have been carried out from 300m to 1000m. In this very limited series it appeared that 'escapes' were safe up to 300m (1000ft sw). Some animals survived 'escapes' from 400 and 500m but none from greater depths. Both oxygen poisoning and DCS were encountered.

Experiments are now proceeding with goats.

(c) Convective heat loss in the hyperbaric environment - RNPL 7/76 (UPS 8/76)

(d) Observations following the loss of consciousness under water - RNPL 5/76 (UPS 9/76).

In this and previous papers the thesis is presented that certain divers who are otherwise healthy are relatively insensitive to rises of alveolar and blood carbon dioxide levels, particularly on exercise under diving conditions.

This may be an inherent biological variation or, it is suggested, 'adaptation' to diving. 'Adaptation' should perhaps not be used to describe a hypothetical event that would in any case cause an added risk of CO_2 narcosis.

More work is needed on this very important subject.

(e) Preliminary Report on ADS Walking and Current Trials - RNPL 6/74 (UPS 11/76)

(f) Preliminary Report on DHB Armoured Suit - RNPL 6/76 (UPS 10/76)

PHYSICAL FITNESS Working Party (PF) - Chairman: Professor O G Edholm

49. The PF has been disbanded since the last report was issued. Recommendations for the setting up of a new tri-Service body have been submitted for consideration by the Medical Research Council, together with some draft terms of reference which have been agreed by representatives of all three Services.

SHIP MOTION Working Party (SMWP) - Chairman: Professor G R Hervey

50. At the request of the RN the RNPRC has agreed to set up a Working Party on Ship Motion and an informal meeting was held in 1976 to determine how this may best be achieved. Professor G R Hervey has consented to chair the Working Party, a number of people have been approached and consented to serve as Members and arrangements are in hand for the holding of the first meeting.

MEETINGS of the RNPRC and its subgroups have been held as follows. Copies of the minutes can be made available to RNPRC members on request.

MAIN Committee		
59th Meeting	October 1975	RNP 5/75
CHAIRMEN's Meeting		
4th Meeting	March 1975	RNP 2/75
5th Meeting	December 1975	RNP 9/75
Informal Meeting (Chairmen et al)	January 1976	RNP 1/76
ENVIRONMENT Subcommittee		
Subcommittee Meeting 6th Meeting	May 1975	ES 4/75
Ad hoc group on) 1st Meeting	June 1975	ES 5/75
Protective Clothing) 2nd Meeting	September 1975	ES 8/75
3rd Meeting	May 1976	ES 5/76
HEARING Subcommittee		
Subcommittee Meeting 29th Meeting	November 1976	HeS 4/76
OPERATIONAL EFFICIENCY Subcommittee		
Subcommittee Meeting 72nd Meeting	February 1975	OES 3/75
SUBMARINE Subcommittee		
Ad hoc group on CO studies 1st Meeting	April 1975	SMS 3/75
SURVIVAL AT SEA Subcommittee		
Ad hoc group on life-raft trials 1st Meeting	January 1975	SS 1/75
UNDERWATER PHYSIOLOGY Subcommittee		
Subcommittee Meeting 52nd Meeting	July 1976	UPS 14/76
SHIP MOTION Working Party		
Exploratory ad hoc meeting	October 1976	SMWP 1/76

REPORTS AND PAPERS

GENERAL

Committee Papers

RNP 3/75	Report for the period January 1973 - December 1974.
RNP 7/75	The role of the RNPRC in the revised MOD research structure.
RNP 8/75	Note by Secretary with RNPRC terms of reference.

ENVIRONMENT Subcommittee

Committee Papers

ES 2/75	Guidelines for RNPRC's considerations on Arctic clothing.
ES 3/75	Extreme cold weather clothing for personnel in ships.
ES 6/75	A review of cold/foul weather clothing.
ES 7/75	A note to the RNPRC Environment Subcommittee regarding wind speed and heat loss underneath helicopters.
ES 1/76	Air velocity and convective cooling coefficient measurements beneath a Sea King helicopter.
ES 3/76	Advance report on cold, foul weather clothing assemblies for exposed personnel in HM Ships.
ES 4/76	A study using infra-red thermography of clothing assemblies for use by personnel working beneath operating helicopters.

HEARING Subcommittee

Committee Papers

HeS 2/76	Hearing standards for the RN: hearing standards and the PULHEEMS system.
HeS 3/76	Agenda papers for 29th Meeting of HeS.

OPERATIONAL EFFICIENCY Subcommittee

Committee Papers

OES 11/74	The effects of noise and of loss of sleep upon the observation of 3 sources of signals with unequal probabilities.
OES 12/74	Progressive deterioration in short term memory while breathing pure oxygen at normal atmospheric pressure.
OES 13/74	The effect of prior noise or prior performance on serial reaction.
OES 14/74	Performance during continuous and variable intermittent noise and wearing ear protection.
OES 15/74	Comparisons of performance with headphone and free field noise.
OES 16/74	Effect of noise on the Stroop Test.
OES 19/74	The use of same or different sensory modalities for information and instructions.
OES 20/74	Colours for sizes.
OES 2/75	Human Factors Handbook: Chapter 8 - Hearing and Auditory displays.

SUBMARINE Subcommittee

Committee Papers

SMS 1/75	The effects on men of continuous exposure to carbon monoxide.
SMS 2/75	Basic findings in pilot study of men exposed to an atmosphere containing 75 ppm CO.
SMS 4/75	Watchkeeping studies on a nuclear submarine - final report.

SURVIVAL AT SEA Subcommittee

Committee Paper

SS 1/75	Manned life-raft trials - working paper on trials procedure.

Report

SS 1/76	Survival at Sea - Survey of the research carried out between 1940 and 1975 to develop the knowledge, techniques and equipment necessary for saving life after accidents at sea with particular reference to work done for and by the Armed Forces in Great Britain.

UNDERWATER PHYSIOLOGY Subcommittee

Committee Papers

UPS 2/76	Submarine Escape Training Tank Incidents Nos 128-132.
UPS 3/76	Analysis of Submarine Escape Training: Jan 75 - March 76.
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