

**Naval Medical Research Center
Daniel K. Inouye Building
503 Robert Grant Avenue
Silver Spring, Maryland 20910-7500**



NMRC 02-01 MARCH 2002

**MULTI-DAY AIR SATURATION AT 20 AND 22 FSW
WITH DIRECT ASCENT:
DATA REPORT ON PROJECT 92-09**

**R. W. Bill Hamilton
E. D. Thalmann
D. J. Temple**

20060417026

**Department of the Navy
Bureau of Medicine and Surgery
Washington, DC 20372-5120**

**Approved for public release;
distribution is unlimited**

NOTICES

The opinions and assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the naval service at large.

When U. S. Government drawings, specifications, and other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated, furnished or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Please do not request copies of this report from the Naval Medical Research Center. Additional copies may be purchased from:

Office of the Under Secretary of Defense (Acquisition & Technology)
Defense Technical Information Center
8725 John J. Kingman Road, Suite 0944
Ft. Belvoir, VA 22060-6218

Federal Government agencies and their contractors registered with the Defense Technical Information Center should direct requests for copies of this report to:

TECHNICAL REVIEW AND APPROVAL

NMRC 02-01

The experiments reported herein were conducted according to the principles set forth in the current edition of the "Guide for the Care and Use of Laboratory Animals," Institute of Laboratory Animal Resources, National Research Council, National Academy Press, 1996."

This technical report has been reviewed by the NMRC scientific and public affairs staff and is approved for publication. It is releasable to the National Technical Information Service where it will be available to the general public, including foreign nations.

RICHARD B. OBERST
CAPT, MSC, USN
Commanding Officer
Naval Medical Research Center

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-01-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden to Department of Defense, Washington Headquarters Services Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) March 2002			2. REPORT TYPE Technical		3. DATES COVERED (From - To) 1992-1993	
4. TITLE AND SUBTITLE Multi-Day Air Saturation at 20 and 22 FSW with Direct Ascent: Data Report on Project 92-09				5a. CONTRACT NUMBER		
				5b. GRANT NUMBER		
				5c. PROGRAM ELEMENT NUMBER 63713N		
6. AUTHORS R.W. Bill Hamilton, Edward D. Thalmann, Diana J. Temple				5d. PROJECT NUMBER M0099		
				5e. TASK NUMBER .01A		
				5f. WORK UNIT NUMBER 1002		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Medical Research Center (Code 00) 503 Robert Grant Avenue Silver Spring, Maryland 20910-7500				8. PERFORMING ORGANIZATION REPORT NUMBER 2002-01		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Bureau of Medicine and surgery (MED-02) 2300 E Street, NW Washington, DC 20372-5300				10. SPONSOR/MONITOR'S ACRONYM(S) BUMED		
				11. SPONSOR/MONITOR'S REPORT NUMBER(S) DN241126		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited.						
13. SUPPLEMENTARY NOTES						
14. ABSTRACT The purpose of this report is to provide access to experimental laboratory data involving human decompression exposures that have not been published and thus are not presently available for analysis by Navy and other researchers. As such this is only a report of the data, not a write-up of the experiment. This project was designed to evaluate experimentally the maximum depth from which a diver could ascend directly to the surface from saturation with air without getting decompression sickness.						
15. SUBJECT TERMS Diving, decompression sickness, decompression tables, No-D limits						
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	
a. REPORT	b. ABSTRACT	c. THIS PAGE			Diana Temple	
Unclass	Unclass	Unclass	Unclassified	36	19b. TELEPHONE NUMBER (Include area code) 301.319.7642	

2001 December 31

MULTI-DAY AIR SATURATION AT 20 AND 22 FSW WITH DIRECT ASCENT: DATA REPORT ON PROJECT 92-09

R.W. Bill Hamilton, Edward D. Thalmann, and Diana J. Temple

Report contains description of the project, list of diving subjects, profiles, and decompression outcome.
1993 January – 1993 May

Prepared for

Naval Medical Research Center
Silver Spring, MD

by

Hamilton Research, Ltd.
Tarrytown, NY

under purchase order N0463A-00-M-0051 from the Navy Experimental Diving Unit, Panama City, FL

TABLE OF CONTENTS

A. Description of Project 92-09	1
1. Nature of this report	1
2. Background	1
3. Methods	1
B. Diver List	3
C. Profiles	4
1. Profiles from logbook	4
2. Profiles taken from Excel spreadsheet file	8
D. Dive Notes and Medical Records	11
1. Notes from Dive Log	11
2. Notes from Medical Records	11
3. DCS Notes	11
E. Materials	12
1. Material delivered as part of this report	12
2. Original materials obtained from NMRC	12
APPENDIX	13
Appendix A	
Types dive log extracts, 9 pages, "Notes from Dive Log"	13
Appendix B	
Typed dive log extracts of medical notes, 6 pages, "Notes from Medical Records"	23
Appendix C	
Types dive log extracts, 3 pages, "DCS notes"	30

ACKNOWLEDGEMENTS

This research was supported by the Navy Medical Research and Development Command, Work Unit 63713N M0099.01A-1002. The opinions expressed in this report are those of the authors and do not reflect the official policy or position of the Department of the Navy, the Department of Defense, or the U.S. Government. No experiments involving human subjects were conducted for the compilation of the data represented here. Data were taken from human exposure experiments previously reviewed and approved by the Committee for the Protection of Human Subjects.

This work was done by U.S. Government employees as part of their official duties; therefor, it cannot be copyrighted and may be copied without restriction.

A. Description of project 92-09

1. Nature of this report

The purpose of this report is to provide access to experimental laboratory data involving human decompression exposures that have not been published and thus are not presently available for analysis by Navy and other researchers. As such this is only a report of the data, not a writeup of the experiment.

This project was designed to evaluate experimentally the maximum depth from which a diver could ascend directly to the surface from saturation with air without getting decompression sickness.

The following sections were derived from the original Human Research Protocol 92-09 from the Naval Medical Research Institute, prepared on 1992 December 02. Project Officer was LT. D. Gummin, and Principal Investigator was CAPT E.D. Thalmann.

2. Background:

The current U.S. Navy standard air decompression tables have 30 fsw as their shallowest depth, implying that dives shallower than this will not require decompression stops no matter what the bottom time. Current evidence suggests, however, that this air saturation no-stop or no-decompression depth limit may be shallower than 30 fsw. Decompression sickness (DCS) has been reported after saturation at depths as shallow as 25.5 fsw. Dives to depths of 20.0 to 21.3 fsw have had no DCS in 75+ man exposures. A total of 32 man exposures to 24 fsw with direct ascent to the surface resulted in 2 cases of DCS. Thus the evidence suggests that the air saturation no-decompression depth is in the range of 20 to 22 fsw.

Establishing the air saturation no-decompression depth is important from a practical and theoretical standpoint. On the practical side it will determine the shallowest air decompression table that must be tested. On the theoretical side, this depth will define the shape of the no-decompression curve for shallow depths. Defining the shape of this curve is important in developing mathematical models for computing decompression tables. This study seeks to define the deepest depth that one can saturate at while breathing air and still ascend directly to the surface.

3. Methods

Informed volunteer diver-subjects were compressed on air where they remained for at least 72 hours to ensure complete saturation. The chamber O_2 fraction was to be controlled at between 20.8 and 20.9 percent, and the CO_2 was not to exceed 4 mmHg. According to the logs these criteria were satisfactorily met.

Decompression was accomplished in a dry chamber at an ascent rate of 60 fsw/min directly to the surface.

The study involved 8 air saturation exposures (simulated dives) with 6 divers on each dive. A total of 48 man-exposures were made involving 44 subjects who were qualified as Navy Divers, with 18 man-dives exposed to 22 fsw and 30 exposed to 20 fsw. The initial test depth was 22 fsw. The original criteria were that if more than a single case of DCS were to occur within the first 10 or 12 man exposures, the test depth would be reduced 2 fsw for the next exposure. This was done, with 3 exposures made at 22 fsw and the remaining 5 at 20 fsw.

Each diver should have had a detailed neurologic examination within 1 year and neuropsychologic baseline within 3 years, updated in the event of changes. The female diver was not pregnant.

External ear prophylaxis using a Otic Domboro solution was conducted a minimum of twice daily according to Navy practice. All prophylaxis was timed and logged. Application procedure is as follows:

tilt head to side and fill ear canal gently with solution; retain solution in ear canal for 5 minutes, then tilt head to other side and drain canal; repeat for other ear.

Meals were to be prepared according to NMRI Technical Report 91-21 and the medical officer indicated in the log that the meals were adequate.

DCS arising after dives was treated in accordance with Chapter 8 of the U. S. Navy Diving Manual. For subjects developing DCS, a neuropsychological assessment was performed to more completely evaluate the possibility that Type II DCS symptoms are present.

B. Diver list

A total of 44 diver-subjects participated in this project, 43 males and one female. For purposes of this report the divers names have been replaced with numbers. A list of names and assigned diver numbers is on file with the original materials, at the library of the Naval Medical Research Center, Forest Glen, MD. Cognizance of the list and materials rests with Ms. Diana Temple at NMRC. This list remains property of NMRC and can be made available to researchers who need it provided they will maintain diver anonymity in any publications.

One note identifying female diver was extracted and is included with the separate Diver ID list.

A list of diver numbers according to the dive exposure groups is as follows. Diver ID numbers were assigned according to the diver list used by the investigators at the time; the divers in Dive 6 were listed before those in Dive 5, which accounts for the difference in order.

Note that divers 5, 6, 10, and 11 from Dives 1 and 2 also participated in Dive 8.

Group or Dive 1, 22 fsw, 1993 Jan 25-28
1, 2, 3, 4, 5, 6

Group or Dive 2, 22 fsw, 93 Feb 08-11
7, 8, 9, 10, 11, 12

Group or Dive 3, 22 fsw, 93 Feb 22-25
13, 14, 15, 16, 17, 18

Group or Dive 4, 20 fsw, 93 Mar 09-12
19, 20, 21, 22, 23, 24

Group or Dive 5, 20 fsw, 93 Mar 15-18
31, 32, 33, 34, 35, 36

Group or Dive 6, 20 fsw, 93 Mar 29-Apr 01
25, 26, 27, 28, 29, 30

Group or Dive 7, 20 fsw, 93 Apr 26-29
37, 38, 39, 40, 41, 42

Group or Dive 8, 20 fsw, 93 May 10-13
43, 44, 5, 6, 10, 11

C. Results

Two different exposure types were performed, with saturation at 22 and 20 fsw.

1. Profiles from logbook

Logs of the 8 dives taken from the logbook showing the inflection points in word processor tables follow.

1993 January 25-28
22 fsw Saturation Dive
Dive #1

Date	Time	Depth, fsw	Gas Mix	Remarks
Jan 25	0811	0		L/S; Divers 1, 2, 3, 4, 5, 6
	0812	22		R/B
Jan 28	0948	22		L/B
	0952	0		R/S

1993 February 08-11
22 fsw Saturation Dive
Dive #2

Date	Time	Depth, fsw	Gas Mix	Remarks
Feb 08	0802	0	air	L/S; Divers 7, 8, 9, 10, 11, 12
	0803	22	air	R/B
Feb 09	1919	22	air	DMO entry, Diver 12 has scratchy throat and post-nasal drip, given aspirin. Dr. Robinson
Feb 10	0917	22	air	Diver 12 same. Diver 11 gets Sudafed. Dr. Ball
	1250	22	air	Divers 8 and 9 get antacid. Dr. Ball
	1914	22	air	Diver 7 headache, gets aspirin; Diver 12 still congested, every 6 hr. Dr. Ball
Feb 11	0805	22	air	L/B. 3 days, 3 min bottom time.
	0809	0	air	R/S. Dive complete.

1993 February 22-25
22 fsw Saturation Dive
Dive #3

Date	Time	Depth, fsw	Gas Mix	Remarks
Feb 22	0758	0		L/S; Divers 13, 14, 15, 16, 17, 18
	0800	22		R/B
Feb 25	0225	22		Started OP17
	0250	23.3		OP17 completed, rezeroed reference gauge, depth @ start 22.0 @ end 23.3; informed Project Officer, readjusted chamber to 22.0
	0250	23.3		
	0251	22		MRCC @ depth IAW OP17
	0758	22		L/B 3 days, 0:00 h:min
	0802	0		R/S

1993 March 9-12
20 fsw Saturation Dive
Dive #4

Date	Time	Depth, fsw	Gas Mix	Remarks
Mar 09	0830	0		L/S; 19, 20, 21, 22, 23, 24
	0831	20.3		R/B
	0831	20.3		
	0831	20		
Mar 12	0830	20		L/B. 3 days, 0 hr, 0 min
	0833	0		R/S

1993 March 15-18

20 fsw Saturation Dive

Dive #5

Date	Time	Depth, fsw	Gas Mix	Remarks
Mar 15	0832	0		L/S; Divers 31, 32, 33, 34, 35, 36
	0833	19.6		R/B
	0836	20		
Mar 18	0833	20		L/B
	0835	0		

1993 March 29-April 1

20 fsw Saturation Dive

Dive #6

Date	Time	Depth, fsw	Gas Mix	Remarks
Mar 29	0827	0		L/S; Divers 25, 26, 27, 28, 29, 30
	0828	20		R/B
Apr 01	0827	20		L/B. Plus time 3.00:00
	0828	0		R/S

1993 April 26-29

20 fsw Saturation Dive

Dive #7

Date	Time	Depth, fsw	Gas Mix	Remarks
Apr 26	0824	0		L/S; Divers 37, 38, 39, 40, 41, 42
	0827	20		R/B
Apr 29	0824	20		L/B
	0825	4.5		Hold. Diver 40 left ear.
	0826	4.5		Commenced ascent
	0829	0		R/S

1993 May 10-13
20 fsw Saturation Dive
Dive #8

Date	Time	Depth, fsw	Gas Mix	Remarks
May 10	0830	0		L/S; Divers 43, 44, 5, 6, 10, 11
	0831	20		R/B
May 13	0830	20		L/B
	0832	0		R/S. Ascent time :02::13

2. Profiles taken from Excel spreadsheet file

The following table is saved from a Microsoft Excel file **logdat.xls** in tab delimited text format. This file was with materials provided by NMRC. We do not know who prepared this file. It has some minor errors, noted. This file is enclosed on the CD furnished with this report.

92-09 logbook

Dive #	Day	Date	Clock t	Depth	Comment
1	1	25-Jan-93	8:00:00	0	
1	1	25-Jan-93	8:11:00	0	LS
1	1	25-Jan-93	8:12:10	22	RB
1	1	25-Jan-93	23:13:00	22	
1	2	26-Jan-93	0:06:00	22	
1	2	26-Jan-93	23:56:00	22	
1	3	27-Jan-93	0:09:00	22	
1	3	27-Jan-93	23:57:00	22	
1	4	28-Jan-93	0:15:00	22	
1	4	28-Jan-93	9:48:00	22	LB
1	4	28-Jan-93	9:52:05	0	RS

"Divers in Dive #1: 1, 2, 3, 4, 5, 6"

Dive #	Day	Date	Clock t	Depth	Comment
2	1	08-Feb-93	8:02:00	0	
2	1	08-Feb-93	8:02:50	22	
2	1	08-Feb-93	23:11:00	22	
2	2	09-Feb-93	0:02:00	22	
2	2	09-Feb-93	23:45:00	22	
2	3	10-Feb-93	0:01:00	22	
2	3	10-Feb-93	23:55:00	22	
2	4	11-Feb-93	0:05:00	22	
2	4	11-Feb-93	8:05:00	22	
2	4	11-Feb-93	8:09:05	0	

"Divers in Dive #2: 7, 8, 9, 10, 11, 12"

Dive #	Day	Date	Clock t	Depth	Comment
3	1	22-Feb-93	7:58:00	0	
3	1	22-Feb-93	7:59:30	22	
3	1	22-Feb-93	23:13:00	22	
3	2	23-Feb-93	0:09:00	22	
3	2	23-Feb-93	23:23:00	22	
3	3	23-Feb-93	0:01:00	22	Actually 93 February 24
3	3	23-Feb-93	23:19:00	22	Actually 93 February 24
3	4	24-Feb-93	0:17:00	22	Actually 93 February 25
3	4	24-Feb-93	7:58:00	22	Actually 93 February 25
3	4	24-Feb-93	8:01:56	0	Actually 93 February 25

"Divers in Dive #3: 13, 14, 15, 16, 17, 18"

Dive #	Day	Date	Clock t	Depth	Comment
4	1	93-Mar-09	8:30:00	0	
4	1	93-Mar-09	8:31:30	20	
4	1	93-Mar-09	23:05:00	20	
4	2	93-Mar-10	0:02:00	20	
4	2	93-Mar-10	23:56:00	20	
4	2	11-Jan-00	0:30:00	20	Actually 93 March 11
4	2	11-Jan-00	23:27:00	20	Actually 93 March 11
4	2	12-Jan-12	3:36:00	20	Actually 93 March 12
4	2	12-Jan-12	8:30:00	20	Actually 93 March 12
4	2	12-Jan-12	8:33:08	0	Actually 93 March 12

"Divers in Dive #4: 19, 20, 21, 22, 23, 24"

Dive #	Day	Date	Clock t	Depth	Comment
5	1	93-Mar-15	8:32:00	0	
5	1	93-Mar-15	8:33:00	20	
5	1	93-Mar-15	23:55:00	20	
5	2	93-Mar-16	0:05:00	20	
5	2	93-Mar-16	23:57:00	20	
5	3	93-Mar-17	0:11:00	20	
5	3	93-Mar-17	23:50:00	20	
5	4	93-Mar-18	0:02:00	20	
5	4	93-Mar-18	8:33:00	20	
5	4	93-Mar-18	8:34:49	0	

"Divers in Dive #5: 31, 32, 33, 34, 35, 36"

Dive #	Day	Date	Clock t	Depth	Comment
6	1	93-Mar-29	8:27:00	0	
6	1	93-Mar-29	8:28:07	20	
6	1	93-Mar-29	23:49:00	20	
6	2	30-Mar-29	0:07:00	20	Actually 93 Mar 29
6	2	30-Mar-29	23:51:00	20	Actually 93 Mar 29
6	4	93-Mar-31	0:01:00	20	
6	4	93-Mar-31	0:23:55	20	
6	5	93-Apr-01	0:10:00	20	
6	5	93-Apr-01	8:27:00	20	
6	5	93-Apr-01	8:28:57	0	

"Divers in Dive #6: 25, 26, 27, 28, 29, 30"

Dive #	Day	Date	Clock t	Depth	Comment
7	1	93-Apr-26	8:24:00	0	
7	1	93-Apr-26	8:27:00	20	
7	1	93-Apr-26	23:34:00	20	
7	2	93-Apr-27	0:02:00	20	
7	2	93-Apr-27	23:50:00	20	
7	3	93-Apr-28	0:03:00	20	
7	3	93-Apr-28	23:58:00	20	
7	4	93-Apr-29	0:01:00	20	
7	4	93-Apr-29	8:24:25	20	
7	4	93-Apr-29	8:25:00	5	
7	4	93-Apr-29	8:26:00	5	
7	4	93-Apr-29	8:28:40	0	

"Divers in Dive #7: 37, 38, 39, 40, 41, 42"

Dive #	Day	Date	Clock t	Depth	Comment
8	1	93-May-10	8:30:00	0	
8	1	93-May-10	8:31:00	20	
8	1	93-May-10	23:50:00	20	
8	2	93-May-11	0:05:00	20	
8	2	93-May-11	23:32:00	20	
8	3	93-May-12	0:02:00	20	
8	3	93-May-12	23:07:00	20	
8	4	93-May-13	0:01:00	20	
8	4	93-May-13	8:30:00	20	
8	4	93-May-13	8:32:13	0	

"Divers in Dive #8: 43, 44, 5, 6, 10, 11"

D. Dive notes and medical records

Three sets of notes from the dive log are included in the appendices to this report. They are described here. These were prepared and typed by personnel involved with the dives and were furnished with the materials from NMRC. They are included here without edit of the text material except occasionally to protect diver identity. All diver names have been replaced with diver numbers. We converted the original typed format from "landscape" to "portrait" orientation to make the logs easier to read.

Computer files of the log pages are included in the CD with this report.

1. Notes from Dive Log

Nine pages of notes typewritten in landscape format were extracted from the conventional handwritten logbook. These cover all 8 dives. Diver names have been replaced with diver ID numbers as mentioned above. A column for diagnoses ("Dx") originally filled out in pencil was added in. All these were "C" except as mentioned in D.3 below.

2. Notes from Medical Records

Six pages of medical notes were taken from the facing pages of the conventional bound logbook. As above, the diver names were replaced with numbers.

3. DCS notes

Three pages of notes were extracted from the Medical Record Notes log and included in this separate section by whoever prepared the original typed notes. Diagnoses are indicated in the second column. These show "marginal" DCS in Divers 3 and 6 from the 22 fsw exposures, and in Divers 24, 23, and 39 from the 20 fsw exposures. Definite DCS is recorded for Divers 17 and 18 from exposures at 22 fsw.

In addition to these notes a set of detailed medical notes for the individual divers in this section is available with the NMRC materials.

E. Materials

This section describes the materials having to do with this report.

1. Material delivered as part of this report

- a. Camera ready printout of this report.
- b. Compact Disk including relevant files of this report.

Files of this report,

9209text.wpd (WordPerfect), and
9209text.rtf,
9209text.pdf (Adobe PDF file)

Files of the log extracts included in the appendix,

9209divelognotes.wpd (WordPerfect), and
9209divelognotes.rtf,
9209divelognotes.pdf (Adobe PDF file)

each including 3 sets of notes as mentioned in section D, above.

Original Excel spreadsheet file extracted from dive logs, logdata.xls

File of the Diver ID list mentioned next, 9209IDList.rtf

- c. ID page mentioned in Section B above showing names and ID numbers of diver-subjects. The diver identification is furnished separately and not included in the text of the report.

2. Original materials obtained from NMRC

Two dive logbooks, one conventional dive log (dive record) and one chamber dive log.
Folder of dive records and notes, includes maintenance log and gas analysis
Typed log extracts and medical record notes; copies of dive log pages
Original Human Research Protocol for 92-09, NMRI
Blue folder of notes, mostly CPHS materials
Medical records folders for individual divers with DCS-like symptoms

APPENDIX

Appendix A

Typed dive log extracts, 9 pages, "Notes from Dive Log"

Protocol 92-09

Notes from Dive Log

25 January - 13 May 1993

20-22 fsw 72 hours

Original protocol indicated six dives with 4-6 divers each; 8 dives with 6 divers each were recorded in dive log, each diver participating in only one dive of the series. [Editor's note: 4 divers participated in 2 dives.]

Dive #	Date	Time DMO	Divers	Remarks
#1	25Jan93	0700 Gummin	1,2,3, 4,5,6	Breakfast served - food was of adequate quality & quantity
		1230 Gummin		Lunch served - food was of adequate quality & quantity
		1915 Gummin	5	c/o new left shoulder stiffness, likely attributable to position while watching monitor; Sx resolving
			3	c/o slight increasing right shoulder pain/stiffness which he attributes to position while resting; unchanged x past 2°.
			1	c/o persistent LBP unchanged since this a.m. no other complaints
	26Jan93	0800 Broome	1	no problems
			4	slight central low back pain - began before dive - no change; no other problems.
			3	No complaints - shoulder stiffness resolved
			5	left shoulder stiffness - positioned - now resolving
			6	No complaints
			2	slight lower back stiffness on waking but now resolving as he moves around.
		1940 Broome		No ear problems. No skin problems. Generally find the chamber hot especially at meal time (action supervisor). No complaints about the food!
			1	No problems
			4	No change in backache; otherwise, no problem
			3	No problems now
			5	Left shoulder - no change
			6	No complaints
			2	Back pain has cleared up. No complaints
				All find the temperature comfortable now. All well.

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#1 22 fsw	27Jan93	0840 Ball	1	no problems
			4	stiff back, O/W OK
			3	stiff back & neck, chronic sore shoulder (right)
			5	stiff back, shoulder improved
			6	stiff back, O/W OK
			2	no problems
				Generally in good spirits without problems
		1743 DWO Carlson		**** entry as follows: DWO (LT Carlson) called Project Officer (LT Gummin) to alert him to .3-.4% He in chamber. LT Gummin suggested that nothing need be done to lower He.
		1940 Ball	1	No problems
			4	no problems
			3	stiff back
			5	no problems
			6	stiff back
			2	no problems
				Galley clean.
	28Jan93	0853 Robinson	1	no problems
			4	no problems
			3	stiff neck & back - chronically sore right shoulder
			5	no problems
			6	no problems
			2	no problems
#2 22 fsw	08Feb93	0740 Broome	7, 8, 9, 10, 11, 12	All divers fit to dive
		1940 Broome		No complaints, all well. Food is good as ever - temperature comfortable.

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#2 22 fsw	09Feb93	0845 Robinson	7,8,9, 10,11, 12	All OK Galley is shipshape as is food.
		1919 Robinson	8 12 9 7 10 11	OK describes scratchy throat & post nasal drip with ????? with purulent nasal discharge without fever; ASA V ii PO; Sudafed I PO now OK OK OK OK
	10Feb93	0917 Ball	8 12 9 7 10 11	no c/o; 1 diastolic BP reading >90, will follow up post dive scratchy throat, sniffles, ASA 2 PO every 4 hrs no c/o no c/o no c/o mild congestion, Sudafed 60 mg Divers in good spirits
		1250 Ball	8 9	requests antacids after lunch for indigestion, no hx of ulcer disease, occasionally takes antacids as needed requests antacids after lunch for indigestion, no hx of ulcer disease, occasionally takes antacids as needed Mylanta # 1-2 tablespoons after meals as needed
#2 22 fsw		1914 Ball	8 12 9 7 10 11	OK no sore throat, still some congestion (1 every 6 hrs) [ASA ?] OK headache, requests aspirin (2 every 4 hrs) OK OK Galley clean

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#3 22 fsw	22Feb93	0750 Broom	13,15, 16,17, 18	All divers fit to dive All report physically well. No problems during press. Food - too much if anything; temperature comfortable.
		2030 Broome	14	* #14 reports slight distant "weird" feeling - nothing specific - no other symptoms ?? - observe for any change or development of viral illness.
	23Feb93	0805 Robinson		All divers OK
		1904 Robinson		All divers OK, Galley is in order
	24Feb93	1955 Thalmann	15	Well
			13	mild indigestion
			17	well
			18	well
			] 16	well
			14	well
				Galley satisfactory
	25Feb93	1100 Schibly	13	~ 50 min post surfacing Diver 13 experienced 5 sec episode of lightheadedness with ringing in ears. Was seated at time. Associated with tachycardia; neuro complete WNL - no recurrence; all other divers OK; all had normal neuro exams, released 2 hrs post surfacing. Diver 13 released 3 hrs post surfacing
#3 22 fsw	25Feb93	1908 Moore	17	Recommended recompression for Diver 17 who presented at about 1830 with c/o pain in ankles and knees; Neuro exam was normal Dx: pain only bends Rx: 60 fsw resulted in immediate and complete relief of pain (additional note by DWO: TT6, 1 ext at 60 fsw and 1 @ 30 fsw)
		1930 DWO note	18	Other dive team members called - no other symptoms reported except Diver 18 who reported transient niggles in shoulder - talked with DMO; no treatment recommended
	26Feb93	DMO Broome	[18]	c/o right shoulder & wrist pain typical of musculoskeletal DCI; no neurological abnormality on detailed examination; recommend recompression Rx. [Diver ID not given in log but determined by personnel communication to be 18.]
			18	- gained relief from wrist pain by end of first O ₂ period at 60 ft and shoulder considerably improved. 4-6 on scale of 10 - still has 2/10 shoulder pain at end of ??? O ₂ period; 1 extension at 60 ft - push fluids

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#3 22 fsw	93Feb26 (cont'd)	1045 1118 1340 1400		- little change now at end of O ₂ extension at 60 ft; discomfort is no longer intensive but vague stiffness. - little to be gained by further extensions at 60 ft and there is likelihood of developing O ₂ tox.; decompress to 30 ft - at 30 ft no deterioration during the pull and indeed feels better. ????? well now - good - continue. now has reported complete relief of symptoms no problems during pull to surface complete resolution of symptoms and exam NAD post dive; to remain in vicinity of chamber for 2 hours; in view of weather conditions, allowed home in company of wife (who is a physician)
#4 20 fsw	09Mar93	0700 Moore	19,20, 21,22, 23,24	divers interviewed and found fit to dive
		2015 Moore		All Divers well and in good spirits
	10Mar93	1930 Ball	24 21 19 20 23 22	slight post nasal drip; continue on Septra DS BID for chronic prostatitis slight nasal congestion no problems no problems slight nasal congestion no problems food well prepared, galley clean
	11Mar93	1000 Gummin	19 21 20 22 23 24	no complaints slight right frontal "pounding" HAX past 12°, now improving; no sinus tend., fundi WNL; Tylenol 650 mg PO now & re-evaluate no complaints no complaints slight sinus congestion & rhinorrhea without pain; no other complaints sinus congestion & bifrontal "pressure" HA, PND, & "???" productive cough over past 12 hrs. Px (in chamber) -- no sinus tend no PND; bilateral basilar wheezing; temp 37.2° oral (Propag), 98.9° F (fac. penetration) oral; acute bronchitis - likely viral; increase PO fluids, Tylenol, 650 mg PO q 4° PRN; rest; sputum culture; consider change Abx if Sx increase over next 24 hrs.

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#4 20 fsw	93Mar11	1730 Gummin	19	no complaints
			23	no complaints
			20	no complaints
			22	no complaints
			21	HA decreased somewhat after Tylenol, but has now recurred; no other complaints
			24	states increased nasal congestion and HA persists; cough slightly decreased and has not been productive; no other complaints; Dimetapp, one PO new, repeat PRN; continue Tylenol and increase PO fluids
	12Mar93	0700 Gummin	24	Administered Dimetapp one PO to Diver 24 for congestion
		0800 Broome	21	no problems
			22	no problems
			20	no problems
			19	no problems
			23	slight sinus problem but can clear ears and no chest symptoms/signs; long standing stiffness right 3rd/4th MP joint right hand following injury; itch right upper arm - feels like insect bite (came on last night); otherwise well
			24	Medication - Dimetapp a sulfur drug! Nasal congestion resolving but still has headache right temporal area; can clear both ears; no chest signs or symptoms; otherwise NAD. All keen to surface - good general spirit/morale
#5 20 fsw	15Mar93	1935 Robinson	31,32, 33,34, 35,36	all OK
				Galley inspected, food inspected at breakfast, lunch, dinner today all OK
	16Mar93	0855 Moore		All divers cheerful without complaints
		1855 Moore		Dive team remains in good spirits. No problems
#5 20 fsw	17Mar93	0830 Moore	31	notes mild low back pain which he attributes to shoveling snow before the dive; not in legs, no neuro symptoms
			35	notes diarrhea -- loose stool last night and again this morning; mild abdominal cramps, no blood in stool; no nausea. Feels well otherwise; Kaopectate prescribed; Team leader instructed to make sure all divers do good handwashing before eating.
				No other problems

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#5 20 fsw	93Mar17	1209 Schibly	36	c/o mild right frontal sinus congestion, no pain, but states it's "irritating," feels well otherwise, no Sudafed available, sent Dimetapp and aspirin to be used aid prn basis
		1934 Schibly	35	diarrhea resolved - last Kaopectate at 1400 with no further loose stools. No abd pain. Feels well
			36	sinus congestion resolved; no further problems
				Other divers, no complaints; food good, galley clean
	18Mar93	0800 Gummin	35	no problems; diarrhea resolved
			36	no problems
			34	no problems; dry skin resolved
			31	no problems
			33	no problems
			32	no problems
				Generally, divers doing well and in good spirits; all state they can clear ears, sinuses for surfacing
#6 20 fsw	29Mar93	2000 Gummin	26	no problems
			30	no problems
			27	no problems
			25	no problems
			28	no problems
			29	no problems
				Overall subjects doing well and in good spirits
	30Mar93	1930 Moore		All divers OK, in good spirits
#6 20 fsw	31Mar93	no time Thalmann		All divers well and in good spirits.
				Galley satisfactory
	01Apr93	0834 Ball	30	has mild low mid-back pain which is unchanged from yesterday while under pressure
			28	has mild medial right knee pain which is unchanged from yesterday while under pressure
				Divers surfaced; all divers OK; no fatigue

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#6 20 fsw	93Apr01	1110 Ball	28 & 30	All divers OK at 2 hr check Both reported back and knee pains unchanged as noted above
#7 20 fsw	26Apr93	1551 Schibly	37 40 38 41 39 42	OK OK OK OK OK c/o mild frontal H/A with no other Sxs; feels generally well; Imp: mild frontal sinus HA; 2 Tylenol PO now, may repeat in 4 hr if persists
#7 20	93Apr26	1940 Schibly	37	c/o slight twinge in back from exercise bike but generally well; rest of crew well, food great, galley clean
	27Apr93	0740 Robinson		All divers OK galley inspection satisfactory
	28Apr93	0720 Robinson		All divers OK galley inspection satisfactory
		2005 Thalmann		All divers in good spirits galley satisfactory
	29Apr93	1110 Ball	39	All divers OK post dive except Diver 39 who c/o transient (secs), intermittent pain behind right knee; none now; A/P normal post dive except Diver 39 who may have had niggles, observe for 24 hours
#8 20 fsw	10May 93	0740 Gummin 1230 1710	5,6, 10,11, 43,44	diver pre-check conducted; all divers fit to dive lunch served; adequate in quality & quantity evening meal served; adequate in quality & quantity
		1945 Gummin		All divers doing well; no problems
	11May 93	0910 Robinson	43 10	c/o mild LBP from switching out sink yesterday c/o rash beginning last evening at right antecubital fossa and over left fourth MCP; says was trimming bushes last weekend; possible contact dermatitis, if worsens may use topical steroids All other divers OK
		1934 Robinson	43 10	no complaints, including any concerning LBP rash clearing All other divers OK; galley inspection satisfactory

Protocol 92-09

Notes from Dive Log

Dive #	Date	Time DMO	Divers	Remarks
#8 20 fsw	12May 93	0905 Thalmann	10	small area rash right arm and hand probably from pre-dive gardening; no Rx now, will surface in a.m. All other divers well.
		2025 Thalmann		All divers well. Galley satisfactory
	13May 93	1110 Ball		Divers surfaced at 0842; all divers OK

Appendix B

Typed dive log extracts, 6 pages, "Notes from Medical Records"

Protocol 92-09

Notes from Medical Records

Dive Dates	Diver	Medical Record Notes	Dx
25-28Jan93 #1, 22 fsw	4	Pre-dive cleared by DMO Gummin Post dive interview 29 Jan by Gummin; 1600-1800 28 Jan noted some itching on dorsum of hands, on and off 3-4 times, lasting 7-8 min each. Developed hematoma on the penis, unrelated to dive; has had similar problem in past; presented with this problem to NMRI medical this morning and was immediately referred to Acute Care Clinic. Was seen by the urology service and underwent surgery this afternoon (DMO Moore); Note 05 [Feb] 93 post-series interview, subject recovering post -op from penile hematoma evaluation 29 Jan 93; no symptoms c/w DCS in post dive period; transient itching noted in interview post dive has not recurred since day of surfacing (DMO Gummin)	C
	1	no medical events (DMO Gummin, Moore)	C
	5	no medical events (DMO Gummin, Moore)	C
	3	Note dtd 28 Jan by Gummin: "Niggles" retropatellar left knee pain post dive @ ~1600 ; also right wrist and left 2/3 MP transient pain in PM post dive; All Sx were transient, resolving w/in minutes and prior to seeking eval. Post dive interview 29 Jan by Gummin: transient left knee pain lasting <1 min in evening (~ 8 hr post surfacing); Sx were c/w previous Sx of PFS. Also c/o fleeting right wrist and left 2,3 MP joint pain in PM post dive. No recurrence or other symptoms since. Post dive interview 29 Jan by Moore: ...noted transient left knee pain yesterday ~1600 while descending stairs - has prior problem with retropatellar stress; also yesterday noted very fleeting pains in right wrist, left 2,3 MP joints; this morning woke with headache right sided, pounding, "hangover" type. Has had similar mild headaches in the past. Exacerbated by moving around, it is minimal at present time (r 98.2, P 78, BP 110/62)... equivocal niggles, minimal vascular cephalgia; Rx aspirin & follow-up. Post dive interview 02 Feb by Gummin: subject developed left 3rd digit "dull pain @ MP joint "when picking things up" - applying palmer stress @ MP joint. Pain present <u>only</u> when stressed. No other Sx. Sx developed ~ 4 days post dive, denies trauma. Px - tenderness elicited with active resistance in dorsal direction @ left 3rd MP joint, NT to passive ROM or palpation; neuro completely intact; A: left 3rd MP arthralgia, <u>unlikely</u> decompression related in origin; P: observation. Pt counseled on progression of Sx or new Sx which may occur - instructed to call immediately. Note dtd 02 Feb by Ball: Esophageal bloom inserted thru left nare with 2% lidocaine with difficulty; diver tried 4 times. LT Carlson asked for Dr. Ball (DMO), diver agreed; Dr. Ball interviewed subject, and decided to go ahead with the submax study without the esophageal bloom insertion; Carlson agreed.	A2
	2	no medical events (DMO Gummin, Moore)	
	6	Post dive interview 29 Jan by Moore: developed wrist pain ~0500 this AM awakening him from sleep, described as deep boring pain in left wrist; resolved complete within ~3-4 min and has not recurred; he has had similar niggles during past dives, but has never had frank decompression illness Post Dive note 29 Jan by Gummin: subject noted left wrist pain at 21 hrs post surfacing; Sx were transient, lasted 3-5 min and resolved prior to pursuing evaluation; no other Sx or subsequent Sx; was normal in AM post surfacing; A: "niggles"	A2

Protocol 92-09

Notes from Medical Records

08-11 FEB 1993 #2, 22 fsw	11	Post dive note 11 Feb by Moore: no symptoms since surfacing; had some upper respiratory congestion during the dive; took some Sudafed this morning Post dive note 12 Feb by Gummin: had transient (<1 min) right ankle sharp pain in AM yesterday post dive; no recurrence or residual Sx; pain not c/w DCS	C
	7	no medical events (DMO Gummin, Moore)	C
	12	Post dive note 11 Feb by Moore: no symptoms since surfacing; developed URI during the dive, took Sudafed and ASA this AM. Post dive note 11 Feb (1430) by Gummin: diver presented following onset of visual disturbance at ~1300, lasting about 10 min; while reading the paper he happened to note a "blind spot" in his left eye "?" left visual field - like looking at the sun; notes associated jagged bright line; has never had similar symptom in the past; denies headache, though he feels generally run down due to poor night of sleep last night and head cold; no other neurologic symptoms; problem resolved totally; no joint pains no other Sx; acephalgic migraine, no basis for recompression at the present time; dubious that above is related to decompression Post dive note 12 Feb by Gummin: migrainous Sx yesterday have completely resolved and no recurrent or new Sx since surface 24 hrs ago; completely normal; no neuro findings, Fundi difficult to visualize ???OU???, but no other findings; classic migraine post dive	C
	10	no medical events (DMO Gummin, Moore)	C
	9	Post dive note 11 Feb by Moore: No symptoms since surfacing; had minor contusion to right ankle during the dive with ~10 min of discomfort; no long term Sx. Post dive note 12 Feb by Gummin: no pain or other Sx since surfacing 24 hrs ago; right LE contusion resolving	C
	8	Post dive note 11 Feb by Moore: no Sx since surface; no problems during dive Post dive note 12 Feb by Gummin: few fleeting pains in right shoulder, right ankle, and left foot yesterday PM; pain described as "darting", lasted <1 sec; no other Sx; pain not c/w DCS	C
22-25 FEB 1993 #3, 22 fsw	18	Dx: musculoskeletal DCI Summary by Broome: presented 24 hrs after surfacing c/o right shoulder and wrist pain, deep and constant in character, unrelieved and not exacerbated by position or movement. No neurological symptoms or signs; treated by recompression to 60 ft. Partial relief at 60' reduced to minimal symptoms after one O ₂ breathing extension at 60'. Patient reported complete relief of Sx during second O ₂ period at 30'. Uneventful decompression to surface on USN TT6 with 1 ext at 60 fsw.	A1
	13	Post dive note 25 Feb by Schibly: experienced 5 sec of lightheadedness and ringing in ears ~ 50 min post surfacing, was seated at the time; Assoc with tachycardia; resolved with no ??????? problem. Post dive note 26 Feb 0900 by Broome: slept well, feels fine, slight positional stiffness lower back, otherwise well.	C
	16	no medical events (DMO Gummin, Schibly, Broome)	C
	14	no medical events (DMO Gummin, Schibly, Broome)	C
	15	Note by Broome 22 Feb: at evening sick call reports "unusual" feeling feels slightly distant and withdrawn; no specific symptoms - headache° numbness° weakness° vision°; all systems - NAD; no early symptoms of SRTI or viraemia, sweating° fever° temp - comfortable for him and eating OK. Imp: reaction to first dive for some months; reassured - encouraged to keep himself busy and avoid introspection if possible. Review ???	C
	17	has a med folder, but there are no sheets from this dive included	A1

Protocol 92-09

Notes from Medical Records

09-12 MAR 1993 #4, 20 fsw	19	cleared for dive DMO Moore post dive note 12 Mar by Broome: fine asymptomatic, full neuro NAD, chest OK ears OK, *small umbilical hernia post dive note 15 Mar by Ball: no problems at 24 hr post dive	C
	24	pre-dive note 08 Mar by Gummin: on Septra for ongoing prostatitis; pre dive note 08 Mar by Moore: repeats prostatitis descrip, past Hx of Type II DCS, subsequently has recurrent symptoms of sensory disturbance on left face, arm and/or leg. He is taking ASA for this and it seems to be having a beneficial effect in fewer number of spells of the sensory symptoms; clear for protocol dive. During dive he is to continue present regimen of Septra and ASA; also cleared to dive by DMO Ball in-dive note 11 Mar by Gummin: c/o productive cough, sinus cong, frontal "pressure" HA, PND since last PM. States no SOB or CP, no fever but states increased sweating last PM. Currently on Septra for prostatitis ??? "strep" prostatitis 2 wks ago; min nasal cong, no sinus tend or D/C, no PND. Tms clear. Pharynx clear, Neck, no lymphadenopathy; Lungs min. "B" basalar wheezing - symmetric Cor - RRR without "M". A: acute bronchitis while on TMP/SMX; likely viral in etiology. P: increase PO fluids, Tylenol 650 q 4° PRN, sputum Cx, will decompress on decongestant in AM if still congested, follow closely will change Abx if condition worsens post dive note 12 Mar by Broome: right temporal headache remains with URTI symptoms - Rx Dimatapp, otherwise asymptomatic; Chest, few medium ??? both lower zones posteriorly Pn R = L; ears OK; URTI symptoms, otherwise NAD late entry 15 Mar by Ball: Phone interview 24 hr post dive subject reports niggle in right foot ~12 hr after surfacing; at 24 hrs asymptomatic; his URI symptoms are persisting with HA rash on neck, blister on lips and 1 ??ingrown??. unable to exam due to snowstorm. A/P: 1. post dive niggle 2. URI	A2
	21	Cleared for dive by DMO Gummin & Ball 08 Mar Pre-dive note 09 Mar by Moore: feels well, has some flatulence, but no diarrhea or colic. No other new problems; able to clear, feels ready to make dive. On no meds. Post dive note 12 Mar by Broome: feel fine, no problems/symptoms late entry 15 Mar by Ball: no problems during 24 hrs post dive period	C
	20	cleared for dive DMO Gummin, Ball, Moore Post dive by Broom and 24 hr check by Ball: no problems, asymptomatic	C
	23	Cleared to dive by Gummin & Ball; pre dive note by Moore indicated diver certain she is not pregnant and expects next menstruation in ~ 3 days Post dive note 12 Mar by Broome: asymptomatic, feels well Late entry 15 Mar by Ball: phone interview due to snowstorm at 24 hrs revealed subject had transient pain between 10 and 12 hrs post dive in her right shoulder lasting seconds and going away completely; at 24 hrs she was asymptomatic. A/P post dive niggles now resolved late entry 16 Jul by Gummin: same as Ball's above	A2
	22	Cleared for dive by Gummin, Ball, Moore post dive note 12 Mar by Broome: well. Asymptomatic late entry 15 Mar by Ball: no problems during 24 hr post dive	C
15-18 MAR 1993 #5, 20 fsw	34	Cleared for dive by Robinson post dive note 18 Mar by Gummin: subjective decrease distant VA immediately post surfacing, but nl near and otherwise nl neuro exam. Subjective Sx <u>significantly</u> improved (essentially resolved) on re-exam @ 1100 (~2.5 hr post surface) Sx most likely due to inability to accommodate after leaving chamber.	C

Protocol 92-09

Notes from Medical Records

15-18 MAR 1993 #5, 20 fsw (con't)		Unlikely decompression -related. 24 hr post dive check 19 Mar 0730 by Ball: no problems 18 Mar 0850 by Gummin: subject c/o blurring of distant vision noted immediately on exiting chamber post dive; no vertigo or other c/o; no problems noted during d/c; Px-vs-WNL EOMI, PERRL, near Swellen 20/20 OU, Fundi benign. Vis. fields intact (confrontation) sens/motor intact throughout coordi./cbm - intact. DTRs intact throughout MSE- clear. A: "B" ciliary m. paresis - lack of accommodation P: monitor, patient reassured that accommodation should return over course of today	
	32	Cleared for dive by Robinson post dive 18 Mar by Gummin and 24 hr check by Ball: no problems	C
	36	no forms for this protocol in folder	C
	33	Cleared for dive by Robinson post dive 18 Mar by Gummin and 24 hr check by Ball: no problems	C
	35	Cleared for dive by Robinson sick call note 17 Mar 1932 by Schibly: last dose of Kaopectate @ 1400 - no loose stools since, no abdominal pain, no other problems, feels well. A; transient diarrhea, apparently resolved post dive 18 Mar by Gummin and 24 hr check by Ball: no problems	C
	31	Cleared for dive by Robinson post dive 18 Mar by Gummin no problems 24 check 19 Mar 0735 by Ball: no problems except for some soreness in both calves in evening probably due to returning to normal activities after relative inactivity in chamber: no joint pains. Calf soreness gone this a.m.	C
29 MAR - 01 APR 1993 #6, 20 fsw	29	cleared for dive by Gummin post dive note by Ball: CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl 24 hr check 02 Apr by Broom: asymptomatic, nothing to report	C
	27	cleared for dive by Gummin post dive note by Ball: CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl 24 hr check 02 Apr by Broom: asymptomatic, nothing to report	C
	28	pre-dive note by Gummin: right knee stiff from fall 2 days ago, Px - minimal MJLT right knee, c/w nl exam; fit to dive post dive note 01 Apr 1040 by Ball: no c/o except pain medial aspect right knee from knee-injury prior to dive; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; knee with bruise over medial aspect tender to palpation 24 hr check 02 Apr 0815 by Broome: reports general malaise and slight nausea this a.m. - otherwise well; no dive related symptoms; ears OK, joints NAD (bruise right knee) chest OK, no weakness/numbness, mental state & higher function-NAD Ap????? "???" early viral infection"???; not diving related, instructed to report any progression or change/deterioration of sumptuous	C
	30	pre-dive note by Gummin: LBP intermittent, increases with exercise; Px - WNL; left heel tender @ point of bone spur; fit to dive post dive note 01 Apr 1050 by Ball: c/o mild low back discomfort which is a chronic problem and has not changed; he also c/o mild fatigue; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; 24 hr check 02 Apr by Broome: asymptomatic, nothing to report	C
	26	no medical folder, nothing, on Diver 26	C

Protocol 92-09

Notes from Medical Records

29 MAR - 01 APR 1993 #6, 20 fsw	25	cleared for dive by Gummin post dive note 01 Apr 1030 by Ball: no c/o; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl 24 hr check 02 Apr by Broome: asymptomatic, nothing to report	C
26-29 APR 1993 #7, 20 fsw	39	cleared for dive by Gummin post dive note 29 Apr 1037 by Ball: c/o intermittent brief (secs) 1/10 pain behind right knee since decompression, none now; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: possible niggle - observe carefully RTC if pain worsens 24 hr check 30 Apr by Broome: had discomfort on weight bearing right knee yesterday - now completely well; no problems	A2
	41	cleared for dive by Gummin, Schibly post dive note 29 Apr 1045 by Ball: c/o low back soreness since 2nd day of dive from sleeping on deck, no other joint pains, mild fatigue now; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive RTC ??? 24 hr check 30 Apr by Broome: had a good night's sleep - no back soreness now - feels fine; completely asymptomatic now.	C
	37	cleared for dive by Gummin, Schibly sick call note 26 Apr 1947 by Schibly: slight twinge in back from riding bike but otherwise fine post dive note 29 Apr 1100 by Ball: No c/o joint pains, fatigue or other problems; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive RTC ??? 24 hr check 30 Apr by Broome: remains completely asymptomatic	C
	40	cleared for dive by Gummin, Schibly post dive note 29 Apr 1052 by Ball: c/o right ear pain during decompression, no joint aches or fatigue, 0 TM's - without injection; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive RTC with ??? 24 hr check 30 Apr by Broome: asymptomatic now; can clear ears this morning - painless; both drums are slightly pink but no problems now	C
	42	cleared for dive by Gummin, Schibly sick call note by Schibly 26 Apr (no time): c/o mild frontal H/A. no other Sxs; no sinus congestion. feels generally well; requests ASA; A - prob mild sinus HA; R - 2 Tylenol po now / repeat in 4h p/r advised to report development of any other Sxs. post dive note 29 Apr 1055 by Ball: no c/o pain or other problems; CNII-XII intact (except slight asymmetry in smile); sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive RTC ??? 24 hr check 30 Apr by Broome: remains completely asymptomatic	C
	38	cleared for dive by Gummin, Schibly post dive note 29 Apr 1030 by Ball: no complaints; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive RTC ??? 24 hr check 30 Apr by Broome: remains completely asymptomatic post dive	C
10-13 MAY 1993 #8, 20 fsw	11	cleared for dive by Gummin post dive note 13 May 1040 by Ball: no c/o; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive	C

Protocol 92-09

Notes from Medical Records

10-13 MAY 1993 #8, 20 fsw (con't)		24 hr check 14 May by Moore: no symptoms at all	
	43	cleared for dive by Gummin post dive note 13 May 1105 by Ball: no c/o, old numbness left thigh, right knee from scars; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive. 24 hr check 14 May by Moore: no symptoms at all	C
	5	cleared for dive by Gummin post dive note 13 May 1055 by Ball: no c/o; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg neg, tandem gait nl, heel/toe walk nl; A/P: normal post dive 24 hr check 14 May by Moore: no symptoms at all	C
	10	cleared for dive by Gummin post dive note 13 May 1100 by Ball: no c/o except itching left hand since before dive; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg neg, tandem gait nl, heel/toe walk nl; A/P: 1. normal post dive 2. dermatitis - unknown etiology HC 18 QID X 7 days 24 hr check 14 May by Moore: has small area of contact dermatitis ("poison ivy") on dorsum of left hand - not infected. no other symptoms	C
	44	pre-dive note 10 May 0735 by Gummin: mild intermittent left shoulder pain; has intermittent mild all. rhinitis and had chronic sinusitis 1/93; cleared with Abs and no probs since, no rhinorrhea pain or D/C @ this time post dive note 13 May 1500 by Ball: no c/o; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg neg, tandem gait nl, heel/toe walk nl; A/P: normal post dive 24 hr check 14 May by Moore: noticed some mild feeling of "being out of focus", but no specific problems; he had plenty of energy and spent the afternoon doing chores; retired ~2300. Good night of sleep; feels well today; no pain or other symptoms	C
	6	cleared for dive by Gummin post dive note 13 May 1044 by Ball: no c/o; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: normal post dive 24 hr check 14 May by Moore: no symptoms at all	C

Appendix C

Typed dive log extracts, 3 pages, "Decompression Sickness Notes"

Protocol 92-09

Decompression Sickness Notes

Protocol 92-09

18 man-dives at 22 fsw; 30 man-dives at 20 fsw (72 hours)

Dive Dates	Diver	Medical Record Notes	Dx
25-28Jan93 #1, 22 fsw	3	Note dtd 28 Jan by Gummin: "Niggles" retropatellar left knee pain post dive @ ~1600 ; also right wrist and left 2/3 MP transient pain in PM post dive; All Sx were transient, resolving w/in minutes and prior to seeking eval. Post dive interview 29 Jan by Gummin: transient left knee pain lasting <1 min in evening (~ 8 hr post surfacing); Sx were c/w previous Sx of PFS. Also c/o fleeting right wrist and left 2,3 MP joint pain in PM post dive. No recurrence or other symptoms since. Post dive interview 29 Jan by Moore: ...noted transient left knee pain yesterday ~1600 while descending stairs - has prior problem with retropatellar stress; also yesterday noted very fleeting pains in right wrist, left 2,3 MP joints; this morning woke with headache right sided, pounding, "hangover" type. Has had similar mild headaches in the past. Exacerbated by moving around, it is minimal at present time (r 98.2, P 78, BP 110/62)... equivocal niggles, minimal vascular cephalgia; Rx aspirin & follow-up. Post dive interview 02 Feb by Gummin: subject developed left 3rd digit "dull pain @ MP joint "when picking things up" - applying palmer stress @ MP joint. Pain present <u>only</u> when stressed. No other Sx. Sx developed ~ 4 days post dive, denies trauma. Px - tenderness elicited with active resistance in dorsal direction @ left 3rd MP joint, NT to passive ROM or palpation; neuro completely intact; A: left 3rd MP arthralgia, <u>unlikely</u> decompression related in origin; P: observation. Pt counseled on progression of Sx or new Sx which may occur - instructed to call immediately. Note dtd 02 Feb by Ball: Esophageal bloom inserted thru left nare with 2% lidocaine with difficulty; diver tried 4 times. LT Carlson asked for Dr. Ball (DMO), diver agreed; Dr. Ball interviewed subject, and decided to go ahead with the submax study without the esophageal bloom insertion; Carlson agreed.	(A2)
25-28Jan93 #1, 22 fsw	6	Post dive interview 29 Jan by Moore: developed wrist pain ~0500 this AM awakening him from sleep, described as deep boring pain in left wrist; resolved complete within ~3-4 min and has not recurred; he has had similar niggles during past dives, but has never had frank decompression illness Post Dive note 29 Jan by Gummin: subject noted left wrist pain at 21 hrs post surfacing; Sx were transient, lasted 3-5 min and resolved prior to pursuing evaluation; no other Sx or subsequent Sx: was normal in AM post surfacing; A: "niggles"	(A2)
22-25Feb93 #3, 22 fsw	18	Dx: musculoskeletal DCI Summary by Broome: presented 24 hrs after surfacing c/o right shoulder and wrist pain, deep and constant in character, unrelieved and not exacerbated by position or movement. No neurological symptoms or signs; treated by recompression to 60 ft. Partial relief at 60' reduced to minimal symptoms after one O₂ breathing extension at 60'. Patient reported complete relief of Sx during	(A1)

Protocol 92-09

Decompression Sickness Notes

22-25Feb93 #3, 22 fsw (con't)	18 (cont)	second O ₂ period at 30'. Uneventful decompression to surface on USN TT6 with 1 ext at 60 fsw.	
22-25Feb93 #3, 22 fsw	17	Post-dive note 25 Feb 93 by Schibley: Post dive exam - no post dive problems. Neuro exam performed completely WNL. Post-dive note 25 Feb 93 by Moore: 1900 Pt presented with c/o pain both ankles, both knees, deep and boring in character, aggravated by joint movement. Onset first in ankles today, progressive over several hours, then involving knees. No other explanation for pain - has not done any PT. Feels well otherwise. Pain at present time is sufficiently severe that he is having difficulty walking. Has no other symptoms, no weakness, no numbness, no bowel/bladder Sx. Joints full range of motion without crepitus, not inflamed. Detailed neuro exam is normal. A(1) s/p experimental saturation dive (2) pain only decompression illness P(1) Recompress 60 fsw; Note: pain promptly and completely relieved on reaching depth. Recommend bring him out on TT6 with at least 1 O₂ ext at 60 fsw and 1 at 30 fsw. Note 26 Feb 93 by Moore: 0130 Surfaced from TT6 with 1 extension at 60 fsw and 1 extension at 30 fsw. Diver notes minimal substernal burning discomfort on inspiration, has no joint discomfort. Lungs clear. Note 26 Feb 93 by Broome: 0810 Treated for pain only musculoskeletal DCI last night. Now symptoms free but tired. note 29 Mar 93 by Gummin: Subject had no symptoms after TT6. About one week later noted intermittent, occasional pain with varus stress of left knee. No other symptoms. No symptoms at rest. Pain recurs only with varus stress, intermittent & rapidly self-limited. incident summary by Moore: Presented 11 hours after surfacing from a 22 foot air saturation dive complaining of bilateral ankle and knee pain, deep and boring in character, aggravated by joint movement. No other symptoms or signs. Diagnosed as pain only decompression sickness. Treatment by recompression to 60 FSW. Total relief of pain upon reaching depth. Uneventful decompression to the surface on USN TT6 with one extension at 60 FSW and one extension at 30 FSW. On surface normal to examination	(A1)
09-12Mar93 #4, 20 fsw	24	pre-dive note 08 Mar by Gummin: on Septra for ongoing prostatitis; pre dive note 08 Mar by Moore: repeats prostatitis descrip, past Hx of Type II DCS, subsequently has recurrent symptoms of sensory disturbance on left face, arm and/or leg. He is taking ASA for this and it seems to be having a beneficial effect in fewer number of spells of the sensory symptoms; clear for protocol dive. During dive he is to continue present regimen of Septra and ASA; also cleared to dive by DMO Ball in-dive note 11 Mar by Gummin: c/o productive cough, sinus cong, frontal "pressure" HA, PND since last PM. States no SOB or CP, no fever but states increased sweating last PM. Currently on Septra for prostatitis ??? "strep" prostatitis 2 wks ago; min nasal	(A2)

Protocol 92-09

Decompression Sickness Notes

09-12Mar93 #4, 20 fsw		cong, no sinus tend or D/C, no PND. Tms clear. Pharynx clear, Neck, no lymphadenopathy;. Lungs min. "B" baselar wheezing - symmetric Cor - RRR without "M". A: acute bronchitis while on TMP/SMX; likely viral in etiology. P: increase PO fluids, Tylenol 650 q 4° PRN, sputum Cx, will decompress on decongestant in AM if still congested, follow closely will change Abx if condition worsens post dive note 12 Mar by Broome: right temporal headache remains with URTI symptoms - Rx Dimatapp, otherwise asymptomatic; Chest, few medium ??? both lower zones posteriorly Pn R = L; ears OK; URTI symptoms, otherwise NAD late entry 15 Mar by Ball: Phone interview 24 hr post dive subject reports niggle in right foot ~12 hr after surfacing; at 24 hrs asymptomatic; his URI symptoms are persisting with HA rash on neck, blister on lips and 1 ?ingrown? unable to exam due to snowstorm. A/P: 1. post dive niggle 2. URI	
09-12 Mar93 #4, 20 fsw	23	Cleared to dive by Gummin & Ball Post dive note 12 Mar by Broome: asymptomatic, feels well Late entry 15 Mar by Ball: phone interview due to snowstorm at 24 hrs revealed subject had transient pain between 10 and 12 hrs post dive in right shoulder lasting seconds and going away completely; at 24 hrs was asymptomatic. A/P post dive niggles now resolved late entry 16 Jul by Gummin: same as Ball's above	(A2)
26-29Apr93 #7, 20 fsw	39	cleared for dive by Gummin post dive note 29 Apr 1037 by Ball: c/o intermittent brief (secs) 1/10 pain behind right knee since decompression, none now; CNII-XII intact; sens intact to fine touch; motor 5/5; cerebellar FTN/HTS intact; rhomberg nl, tandem gait nl, heel/toe walk nl; A/P: possible niggle - observe carefully RTC if pain worsens 24 hr check 30 Apr by Broome: had discomfort on weight bearing right knee yesterday - now completely well; no problems	(A2)