

Memo

FROM THE DESK OF

CAPTAIN CARL E. PRUETT
MC, USN

17 July 66

For Sec Nav Ass't for Adm.

I would appreciate notification when the Secretariat's Office has approved this so that I can expedite the notification of Project personnel at the Experimental Diving Unit.

Respectfully

Carl E. Pruett

Assistant for
Medical and Allied Sciences
DCNO (DEV) OPO7E
The Pentagon, Room 5C1271
Washington, D. C. 20350
(202) OXford 5-7949

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THIRD ENDORSEMENT on OinC NAVDIVINGU ltr EDU;EDW:ba 3900 Ser 171 of
4 Aug 1966

From: Chief of Naval Personnel
To: Secretary of the Navy
Via: Chief of Naval Operations

Subj: Human Subjects in Research Projects; request for approval to use

1. Forwarded, recommending approval.

J. F. GILLOBY
By Direction

Copy to:
OinC NAVDIVINGU
Director DSSP
BUCGD

1 SEP 1966

ROBERT A. FROSCHE
Assistant Secretary of the Navy
(Research and Development)

5

FORWARDED TO ORIGINATOR FOR
ACTION ON THIS DATE 7/12/66

Aug 7 40-8/21
8/23 1120
ASN(4-1) 7 4 2755
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BUMED-71:sgb
5 August 1966

SECOND ENDORSEMENT on OinC NAVXDIVINGU ltr EDU:RDW:bn 3900 Ser 171
of 4 Aug 1966

From: Chief, Bureau of Medicine and Surgery
To: Secretary of the Navy
Via: (1) Chief of Naval Personnel
(2) Chief of Naval Operations

Subj: Human Subjects in Research Projects; request for approval to use

1. Forwarded, recommending approval.
2. In accordance with reference (a), permission is requested to use human volunteers in experimental diving procedures preparatory to the operation of Sea Lab III as described in the basic letter and enclosures thereto.
3. Subjects will be selected from experienced divers who meet the physical and mental qualifications prescribed by existing regulations. All subjects will be volunteers.
4. There is a definite risk and some danger to the health and life of the volunteers at the diving pressures which will be encountered. Necessary precautions and protective measures will be taken and experienced medical and rescue personnel will continuously monitor the experimental divers.

R. B. BROWN

Copy to:
OinC NAVXDIVINGU
Director DSSP

DSSP-002/GFB:las

3900

DSSP-356-66

4 AUG 1966

ENDORSEMENT on EDU:RDW:ba, 3900, Ser 171 of 4 Aug 1966

Director, Deep Submergence Systems Project

Secretary of the Navy

(1) Chief, Bureau of Medicine and Surgery

(2) Chief of Naval Personnel

(3) Chief of Naval Operations

: Human Subjects in Research Projects; request for approval to use

Forwarded, strongly recommending approval.

The Director, Deep Submergence Systems Project, is convinced that the in-house experimental program proposed for approval is essential to the safe and successful completion of Operation SEALAB III. It has been adequately documented that a meticulous and stepwise approach, through controlled experimental conditions, is the only safe and productive avenue to an effective operational complex. For nearly a decade, this technique has governed the Navy program, resulting in current successes to depths in excess of 200 feet; the formula should be maintained.

3. It is to be noted that the test program outlined in the basic correspondence is rigidly constrained with respect to its time schedule. Since any delay in judgment on this request will inevitably result in serious slippage in the SEALAB III program, it is respectfully requested that this correspondence receive priority attention.

JOHN P. CRAVEN

Copy to:
EDU

U. S. NAVY EXPERIMENTAL DIVING UNIT
WASHINGTON NAVY YARD
WASHINGTON, D.C. 20390

EDU:RDW:bn
3900
Ser 171
4 August 1966

From: Officer in Charge, U. S. Navy Experimental Diving Unit
To: Secretary of the Navy
Via: (1) Manager, Deep Submergence System Project
(2) Chief, Bureau of Medicine and Surgery
(3) Chief of Naval Personnel
~~(4)~~ (4) Chief of Naval Operations

Subj: Human Subjects in Research Projects; request for approval to use

Ref: (a) Article 1-11, Manual of the Medical Department
(b) Article 15-30, Manual of the Medical Department
(c) DSSP/NAVXDIVINGU Conference of 15 February 1966
(d) NAVXDIVINGU ltr 3900/(7000) ser 61 of 16 March 1966
(e) NAVXDIVINGU ltr 3900 ser 185 of 18 July 1966

Encl: (1) Man-In-The-Sea Experimental Plan
(2) Support Diving Schedule FY 1967
(3) Saturation-excursion dive schedules 100 to 200 feet,
200 to 300 feet, 300 to 450 feet, and 450 to 600 feet

1. In accordance with reference (a), it is requested that approval be granted for the use of human subjects as outlined in enclosures (1), (2), and (3). All subjects will be volunteers. The subjects will meet the physical standards as established in reference (b), including an electrocardiogram. Medical officers with extensive experience in diving medicine will continually monitor the experimental dives.


2. In reference (c) a preliminary conference was held to discuss specific requirements of the Man-In-The-Sea Program, and the areas and degree in which the NAVXDIVINGU might support these requirements in a coordinated effort with DSSP. Reference (d) stated tasks in direct support of Operation Sea Lab III to enhance the overall Man-In-The-Sea Program. Reference (e) submitted a specific schedule of effort and detail of the various dive schedules proposed by the NAVXDIVINGU to the Manager, Deep Submergence System Project for approval. These schedules are contained in enclosures (2) and (3).

3. The physiological information and the training experience to be derived by participating Man-In-The-Sea personnel are critical to the DSSP Program, Man-In-The-Sea, in preparation for the successful prosecution of Operation Sea Lab III. The details of the experimental plan to

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be followed in these studies are submitted in enclosure (1) in justification of the approach and method to be used. This is based on previous research effort in the U. S. Navy in related studies supporting the DSSP Program, Man-In-The-Sea.

4. Since the diving program to provide training of 32 Man-In-The-Sea divers, as detailed in enclosure (2), must begin in September 1966 to meet Operation Sea Lab III requirements, expeditious handling of this correspondence is respectfully requested.



W. R. LEIBOLD

Each dive team will make a 30 minute excursion dive. Upon completion of a one hour observation period, ascent to the surface will begin at a fixed rate with 2 foot decrements of depth.

The series of dives progresses to increasing depth for each team of divers with one week intervals between saturation-excursion dives. The saturation dive depths start at 100 feet and progress to 450 feet as outlined in Enclosures (2) and (3) of the basic letter.

Method

4. Dive Exposures

(1) Experimental pressure exposures will be conducted in the climatized pressure complex of wet and dry chambers within the facilities of the NAVXDIVMCGU. The exposure atmosphere will contain 0.3 atmosphere (228 mm. Hg.) of oxygen, 0.8 atmosphere (600 mm. Hg.) of nitrogen, and the remainder helium to make up the total pressure. To avoid risk of combustion of materials in the chamber, oxygen percentage will not be permitted to exceed 15, which is equal to 0.3 atmosphere (228 mm. Hg.) at 14 feet gauge depth.

(2) Four diver subjects will be exposed on each saturation-excursion dive. One pair of divers will make the excursion dive at one time in the wet chamber, the other pair remaining as tenders in the dry chamber to open and close the pressure hatch between these chambers.

(3) In addition, eight divers will be trained in surface support dives of 30 and 60 minutes to depths between 100 and 450 feet, simulating the technique of the submersible decompression chamber using the deck decompression chamber technique.

5. Atmosphere Analysis. Atmosphere monitoring devices will be maintained external to the pressure chamber complex and will consist of the following instrumentation:

(1) Oxygen Analysis

(a) Beckman paramagnetic analyzer model 83 with 0-5% and 0-25% ranges, 1% full scale error.

(b) Polarographic oxygen electrode sensor - control system (Hirasberg and Chemtronics types)

(c) Carbon Dioxide Analysis. Beckman IR-215 and IR-1 infrared gas analyzers. The IR-215, with proper calibration gases, will give 0.30% accuracy.

(d) Helium and Nitrogen Analysis. Perkin-Elmer vapor fractionator used with argon carrier gas.

(e) Hydrocarbons and Trace Contaminants. Gas chromatograph and mass spectrograph techniques of Chemistry Branch, U.S. Navy Research Laboratory, on gas samples provided to them from the chamber atmosphere.

as studies in helium atmosphere on selected subjects and
of comfort zone of temperature and humidity in helium atmosphere.

Real testing. Measurements of performance decrement while exposed
during wet dives and in dry chamber will include manual dexterity,
reaction time and hand steadiness.

Ascent

Decompression schedules for the intended exposures will be based upon
data to be safe for saturation dives. These employ a continuous ascent
rate of 15 minutes per foot, dependent upon the O_2 maintained. Depth
decrements of two feet at rates used in continuous ascent have also
been successfully and are somewhat simpler to carry out by control personnel.
Accurate depth gauges and pressure control valves are installed on the
decompression chamber.

Excursion depth increments have already been confirmed for a hour
excursions to 600 feet in numerous dives performed by personnel of the Royal
Navy Physiological Laboratory, as well as in one hour exposures at NAVY DIVISION.

Surface support dive schedules to 450 feet for 30 and 60 minutes have
been performed successfully by 6 divers in 2 separate dives at NAVY DIVISION.

Diving equipment

A semi-closed recirculating mixed gas (MGA) providing mass flow of gas
has been used to provide a stable, predictable breathing mixture for the diver
performing hard work to a depth of 600 feet. Carbon dioxide is removed by
chemical absorption on granular baralyme contained in a low resistance canister
in circuit with inspiratory and expiratory breathing bags. Full face mask,
containing a low dead space oronasal mask, insures continuity of respirable
gas supply. Small, pressure-compensated microphone is contained within the
respiratory mask to provide communication with the surface. Surface to diver
communication is both by tone conductor transmitters on the headstraps of the
mask, and by hydrophone in the wet chamber.

Divers are able to be observed in the dry and wet chambers or closed
circuit television with cameras in the above mentioned chambers.

Treatment of decompression sickness. In the event that decompression
sickness should develop in subjects following excursion dives, or at any time
during ascent to the surface, the following tested procedures will be employed:

- a. decompress chamber complex to depth of relief by addition of helium.
Ensure complete freedom from signs and symptoms.
- b. remain at this depth for a minimum of 1 hour before ascent is again
resumed.
- c. ascent rate to the surface at 20 minutes per foot or 30 minutes per
foot stops will be employed.

Enclosure (1)

SUPPORT DIVING SCHEDULE FISCAL YEAR 1967

WEEK
BEGINNING

SEP 5

12 I 300/20 AM:PM THURSDAY

19 I 300/20 AM:PM TUESDAY

I 350/30 THURSDAY

26 I 400/30 TUESDAY

I 400/30 THURSDAY

OCT 3 I 450/30 TUESDAY

I 400/60 THURSDAY

10 I 450/30 TUESDAY

I 450/60 THURSDAY

17 I 400/60 TUESDAY

I 450/60 THURSDAY

24 I SE* 100 TO 200 TUESDAY

I SE* 100 TO 200 THURSDAY

31 I SE* 200 TO 300 MONDAY-FRIDAY SHORT

NOV 7

14 I SE 300 TO 450 MONDAY-FRIDAY LONG

21

II SE 100 TO 200 THURSDAY

28 I SE 450 TO 600 MONDAY-SATURDAY LONG

DEC 5

II SE 100 TO 200 THURSDAY

12 I SE 450 TO 600 MONDAY-SATURDAY SHORT

19

II SE 100 TO 200 THURSDAY

26 CHRISTMAS

JAN 2 II SE 200 TO 300 MONDAY-FRIDAY SHORT

9

III SE 100 TO 200 THURSDAY

16 I SE 300 TO 450 MONDAY-FRIDAY SHORT

23

III SE 100 TO 200 THURSDAY

30 II SE 200 TO 300 MONDAY-FRIDAY SHORT

FEB 6

III SE 100 to 200 THURSDAY

13 II SE 450 TO 600 MONDAY-SATURDAY SHORT

20

27 II SE 450 TO 600 MONDAY-SATURDAY SHORT

MAR 6

13 III SE 200 TO 300 MONDAY-FRIDAY SHORT

20

IV SE 100 TO 200 THURSDAY

27 III SE 300 TO 450 MONDAY-FRIDAY SHORT

APR 3 IV SE 100 TO 200 THURSDAY
10 III SE 450 TO 600 MONDAY-SATURDAY SHORT
17 IV SE 100 TO 200 THURSDAY
24 III SE 450 TO 600 MONDAY-SATURDAY SHORT
MAY 1
8 IV SE 200 TO 300 MONDAY-FRIDAY SHORT
15
22 IV SE 300 TO 450 MONDAY-FRIDAY SHORT
29
JUN 5 IV SE 200 TO 300 MONDAY-FRIDAY SHORT
12
19 IV SE 450 TO 600 MONDAY-SATURDAY SHORT
26
JUL 3 IV SE 450 TO 600 MONDAY-SATURDAY SHORT
10

*SE = saturation-excursion dive

I, II, III, and IV are team numbers

300/20 is 300 feet for 20 minutes exposure

PARTIAL SATURATION DIVE ON AIR TO 100 FEET WITH EXCURSION TO 200 FEET
 ON HELIUM-OXYGEN MIX

	100 FEET	2 HOURS	AIR	
	200 FEET	1 HOUR	85% He 15% O ₂	1ST PAIR
	100 FEET	4 HOURS	AIR	
ASCENT	100 TO 50	3 MINUTES	AIR	
	50 TO 0	12 HOURS	AIR AND O ₂	
TOTAL		19 HOURS		

Enclosure (2)

200 FOOT SATURATION DIVE WITH EXCURSIONS TO 300 FEET. ATMOSPHERE OF SATURATION EXPOSURE 96% He 4% O₂; OXYGEN PARTIAL PRESSURE .382 ATA

SHORT SCHEDULE:

SATURATION	200 FEET	12 HOURS		
EXCURSION	300 FEET	1 HOUR	90% He 10% O ₂	1ST PAIR
	200 FEET	4 HOURS		
EXCURSION	300 FEET	1 HOUR	90% He 10% O ₂	2ND PAIR
	200 FEET	4 HOURS		
DECOMPRESSION	200 TO 0	42 HOURS	VARIABLE 0.3 ATA O ₂	
	TOTAL	64 HOURS (2 DAYS 16 HOURS)		

LONG SCHEDULE:

SATURATION	200 FEET	12 HOURS		
EXCURSION	300 FEET	1 HOUR	90% He 10% O ₂	1ST PAIR
	200 FEET	4 HOURS		
EXCURSION	300 FEET	1 HOUR	90% He 10% O ₂	2ND PAIR
	200 FEET	18 HOURS		
EXCURSION	300 FEET	1 HOUR	90% He 10% O ₂	1ST PAIR
	200 FEET	4 HOURS		
EXCURSION	300 FEET	1 HOUR	90% He 10% O ₂	2ND PAIR
	200 FEET	4 HOURS		
DECOMPRESSION	200 TO 0	42 HOURS		
	TOTAL	88 HOURS (3 DAYS 16 HOURS)		

300 FOOT SATURATION DIVE WITH EXCURSIONS TO 450 FEET. ATMOSPHERE OF SATURATION EXPOSURE 92% He 8% O₂; OXYGEN PARTIAL PRESSURE .303 ATA

SHORT SCHEDULE:

SATURATION	300 FEET	12 HOURS		
EXCURSION	450 FEET	1 HOUR	92% He 8% O ₂	1ST PAIR
	300 FEET	4 HOURS		
EXCURSION	450 FEET	1 HOUR	92% He 8% O ₂	2ND PAIR
	300 FEET	4 HOURS		
DECOMPRESSION	300 TO 0	63 HOURS		
	TOTAL	85 HOURS	(3 DAYS 13 HOURS)	

LONG SCHEDULE:

SATURATION	300 FEET	12 HOURS		
EXCURSION	450 FEET	1 HOUR	92% He 8% O ₂	1ST PAIR
	300 FEET	4 HOURS		
EXCURSION	450 FEET	1 HOUR	92% He 8% O ₂	2ND PAIR
	300 FEET	18 HOURS		
EXCURSION	450 FEET	1 HOUR	92% He 8% O ₂	1ST PAIR
	300 FEET	4 HOURS		
EXCURSION	450 FEET	1 HOUR	92% He 8% O ₂	2ND PAIR
	300 FEET	4 HOURS		
DECOMPRESSION	300 TO 0	63 HOURS		
	TOTAL	109 HOURS	(4 DAYS 13 HOURS)	

450 FOOT SATURATION DIVE WITH EXCURSIONS TO 600 FEET. ATMOSPHERE OF
SATURATION EXPOSURE 98% HELIUM 2% OXYGEN. OXYGEN PARTIAL PRESSURE .292 ATA

SHORT SCHEDULE:

SATURATION	450 FEET	12 HOURS		
EXCURSION	600 FEET	1 HOUR	94% He 6% O ₂	1ST PAIR
	450 FEET	4 HOURS		
EXCURSION	600 FEET	1 HOUR	94% He 6% O ₂	2ND PAIR
	450 FEET	4 HOURS		
DECOMPRESSION	450 TO 0	94 HOURS		
	TOTAL	116 HOURS	(4 DAYS 20 HOURS)	

LONG SCHEDULE:

SATURATION	450 FEET	12 HOURS		
EXCURSION	600 FEET	1 HOUR	94% He 6% O ₂	1ST PAIR
	450 FEET	4 HOURS		
EXCURSION	600 FEET	1 HOUR	94% He 6% O ₂	2ND PAIR
	450 FEET	14 HOURS		
EXCURSION	600 FEET	1 HOUR	94% He 6% O ₂	1ST PAIR
	450 FEET	4 HOURS		
EXCURSION	600 FEET	1 HOUR	94% He 6% O ₂	2ND PAIR
	450 FEET	4 HOURS		
DECOMPRESSION	450 TO 0	94 HOURS		
	TOTAL	140 HOURS	(5 DAYS 20 HOURS)	