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**U. S. NAVAL SUBMARINE
MEDICAL CENTER**

Submarine Base, Groton, Conn.

MEMORANDUM REPORT NO. 66-9

SEALAB I: A PERSONAL DOCUMENTARY ACCOUNT

by

LCDR Robert E. Thompson, MC, USN

Bureau of Medicine and Surgery, Navy Department
Research Work Unit MF011.99-9003.05

Approved and Released by:

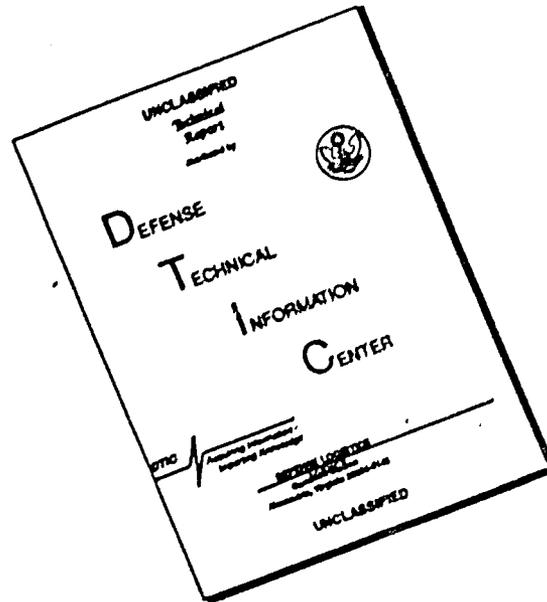
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COMMANDING OFFICER
U.S. Naval Submarine Medical Center

30 March 1966

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U. S. NAVAL SUBMARINE MEDICAL CENTER
U.S. Naval Submarine Base New London
Groton, Connecticut

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Approved by:

Jack L. Kinsey
CAPT MC USN
Dir., SubMedResLab

Approved and Released by:

Charles L. Waite
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Commanding Officer, SMC

PREFACE

This is a day by day account of the experiences and problems encountered by the author during the preparation for and the experiences during the SEALAB I experiment. These opinions do not represent Naval Department opinions or conclusions. Any statements presented here are wholly those of the author.

The travel experiences related here were sponsored by the Office of Naval Research and the Special Projects Office of the Bureau of Weapons. This author was selected because of his previous training in the fields of marine biology and diving medicine.

SEALAB I: A PERSONAL DOCUMENTARY ACCOUNT

INTRODUCTION

Tuesday - April 28, 1964

Left New London for Washington, D.C. Met in ONR with Al O'Neal, Art Gross and others on SEALAB proposed projects. Scott Carpenter stopped by and as this was our first meeting together discussed only simple basic SEALAB concepts.

Wednesday - April 29, 1964

Met in AM in ONR Main Navy 0900 for discussion with BUSHIPS representatives on proposals for SEALAB II. With the broad outline as presented by CDR Williams, future SEALAB-like prospects appear to be most necessary as there are many operational uses for deep staging stations.

Met with Sid Galler of the Biology Branch of ONR so as to outline our potential in the SEALAB I for doing biological studies. Dr. Galler said he will then submit an outline for proposed shark studies.

Left for Miami, Florida, this PM.

Thursday - April 30, 1964

Met with Dr. F.G. Walton Smith, Director of University of Miami Marine Laboratory. Explained to him my reason for wanting inputs from professional marine biologists so any studies done during SEALAB bottom stay would have good management and produce valid data. Met with Dr. Warren Wisby on shark behavior studies.

1 May 1964

More discussions with Warren Wisby and others on Marine Lab. Observed shark behavior studies in pond in Lab area. Low frequency sounds used to attract Lemon Shark. Electric shock used to repel him.

2 May 1964

Visited Jackson Memorial Hospital. Then visited Dr. John C. Lilly's Lab with Dr. Eugene Hagel. The studies with Dolphins and

the neuronatomy studies are most interesting and should provide useful data.

3 May 1964

Went skin diving and spear fishing off of Key Biscayne and Soldiers Key in the coral reefs.

4 May 1964

Again to Marine Lab. Connected up with the World Wide telephone conference call of all the members of the "Shark Panel." Proposals for shark behavior studies were agreed upon by all with the limitations as suggested by me as far as SEALAB is concerned.

5 May 1964

Met with Warren Wisby to go over his proposals and add suggestions. Took plane for Jacksonville.

6 & 7 May 1964

Arrived Panama City, Florida, U.S. Naval Mine Defense Lab. Began working with Barth, Anderson, and Manning on the SEALAB and related projects.

During the ensuing several days we organized our thoughts for SEALAB and began our physical training. Much of the time was spent following up the construction of systems in the SEALAB and procuring equipment for the SEALAB.

12 May 1964

Out to Stage I & II off Panama City with scientists from Scripps Institute of Oceanography, California and others. SCUBA diving 105/62 for observation and familiarization of area.

13 May 1964

Continue work on SEALAB (referred to hereinafter as SL).

14 May 1964

News conference at base theater. Scott Carpenter, Bob Barth, Tiger Manning, Andy Anderson and myself along with CAPT Bond and Roy Lanphear as principal speakers. PIO gave out press kits. We then toured press through SL.

15 May 1964

More checks of fixes. Cleaned up SL and set up for Armed Forces Day tomorrow.

16 May 1964

Armed Forces Day. Barth and myself sat in SL from about 1100-1700 as about 4,000 persons looked in through the open portholes, asked questions and some even volunteered to go down with us.

SL is over 95 per cent complete now and should be ready for sea within a week.

18 May 1964

Work continues and HP gas systems are shaping up. SL picked up and moved to edge of dock. This is a good-sized job for the two medium-sized cranes here. SL not ballasted weighs 62,000 pounds.

This afternoon, another press conference at pool-side at Holiday Lodge. Then out to sea off Stage II for indoctrination dives with Scott, Andy, Barth, Campoli (Navy Photographer) and myself down to 62 feet to inspect moorings for next week's SL dunking.

Scott with his extensive experience with test flying, orbiting, etc., said diving with us in the dark, .2-.3 foot visibility at the bottom, was a "very harrowing experience." He suddenly gained considerable respect for the divers.

19 May 1964

More indoctrination, swimming and diving. We have been utilizing a local 50-yard pool for checking out the Mk VI, the hookah gear and cooperating with the underwater photographers for some Navy, Saturday Evening Post and USN/USL photos.

Went to Morrison Springs about 50 miles from here to dive in an underwater cave 92 feet down. Barth, Carpenter, Tuckfield, Sheets and myself explored the cave. The H₂O is quite clear and boils out from the underground spring at 3-5 liters per minute. There are two caves and underwater photographers covered our coming out of the lower one and up into the upper one. Good day for diving and Scott says he now feels more confident living with no air. In turn, we feel more confident as he learns.

20 May 1964

Launched SL. Set in water beautifully. We thought of breaking a bottle on it but considered if it just sets as calculated, that's good enough. Immediately following the launch by cranes picking it up and setting it in the H₂O, ballasting began under Bob Sheets' direction. This went smoother than we had thought it would, as heaving around heavy steel under water is no simple task. But the vast experience of the SEALAB divers perhaps was not taken into account. Fellows like Tuck, Jöhler and the like, under Sheets' directions, are few and far between.

21 May 1964

Ballasting continues and is completed for sea tow early.

22 May 1964

Underway for sea. YFNB-12 is towed out and SL towed by a smaller boat. Four-point moor set by the YFNB-12 and SL brought alongside approximately 1300.

Made four skin dives into SL for checking air system, electronic checks etc. Initially the air in the Helium Chamber was quite contaminated with volatile fumes from recent painting with oil-based paints. Andy and I checked the cables before securing for the day and find we need to hook up and stuff the TV and communications cables yet. We can probably do that in the AM while ballasting for negative buoyancy is being done. There are many medusae (Jellyfish) and man-o-war in the water here now. The temperature of the H₂O is about 72 (same as off Bermuda) and today visibility was in the range of 20 feet. We should have SL on the bottom by noon. Then I'll recheck atmosphere and begin to set out equipment again.

23 May 1964

Ballasting continues in AM. Made several dives into SL to check equipment etc. By PM sufficient ballast was added to produce negative buoyancy and SL departed from the surface, --too rapidly for adequate control by the heavy nylon line. Much of the difficulty in this casualty was due to the heavy sea and strong current. SL settled on the bottom at 60 feet, causing damage to electrical systems, i.e., transformers and some electrical connections. This repair will result in several days delay for replacements but expect to depart Bermuda on time or thereabouts and continue sea trials in Bermuda area. More checks for possible damage this PM. We will try to return to MDL tomorrow.

24 May 1964

Deballasting starting early in AM and SL raised. Hatches opened and umbilical connections removed. SL towed back to MDL for checkout and repair. Upon return to MDL, SL deballasted for placing on dock and electricians checked for electrical damage. They are very optimistic.

25 May 1964

Cleanup and repair of SL continues. I went to School of Aviation Medicine, Pensacola for discussion with CAPT A. Graybiel, head of Research Branch. He routed me to several departments. Most interesting were the studies on vestibular disturbances and adaptation. Rode the Spinning Chair and observed other studies. Returned to MDL and found concern by ONR etc. in D.C. had resulted in recall of Roy Lanphear for discussion.

26 May 1964

Roy Lanphear and Tom Odom called from D.C. with go ahead full. The basic electrical circuitry has been checked OK and we can put SL back in the water, by-passing the transformers and using 115V from the portable generator on the YFNB-12. This is only a temporary hookup and is adequate for the sea trial. The SL was put back in the bay quite smartly this time and re-ballasted by our divers in record time. She was then towed by the YSD-77 out to the mooring area where YFNB-12 is situated. SL was then placed in the control position and work ceased until AM. We will start the day at 0500 tomorrow and should have SL berthed on the bottom by noon. I will wrap the communications and TV cabling, hoping for no sea water leaks to the plugs although I believe the TV was probably soaked with sea H₂O last time.

27 May 1964

Reville at 0500. Ballasting of SL begun by 0500 until message from Roy Lanphear on the beach said discontinue all work until he arrives on YFNB-12 to give details of D.C. trip. Meeting with SL Personnel by 0900 with LCDR Lanphear. Roy stated the fate of SL-I hangs by a hair with authorities in BUSHIPS adverse to the project. Persons from other bureaus, departments, etc. are quite concerned over safty (rightly so). So orders have modified our procedures for this sea trial. Also, no support financially from those who want to have some say, other than ONR. No time lapse allowed either, so we will just have to work faster and longer in order to meet the deadlines established. It is a shame that those who complain or offer

advice don't throw some more support to this worthwhile project. It would be considerable support to have an ASR with its gas capabilities alongside YFNB-12 in Bermuda, especially with the requirement of two SDC's and SL to supply gas to. The YFNB-12 is barely capable of supply as she stands now.

SEALAB berthed on the bottom with no difficulties. Barth and I dive to remove hatches on He and Air compartments. All looks fine inside SL. We made a tour around outside of SL. Checked window ports etc. No problems noted. SL raised again for practice. No problems. Umbilical attached by Barth and myself inside Airspace and SL lowered again to 64 feet. Communications excellent but some grounds on electrical system noted. LCDR Lanphear and Bob Sheets went down to check electrical connections and found grounds mostly in lighting system. One heater and both dehumidifiers turned in. We will wait a few hours and check the system again. Should dry out some by then. No water of any kind has spilled into SL in the two lowerings today so the grounds are either from the previous soaking which dried out and did not become conductive (insulation) as the humidity increased today, or in some manner, pressure forced some pockets of sea H₂O up into areas that were dry. The latter seems unlikely.

28 May 1964

SEALAB on the bottom all night with no problems. Recheck of electrical systems this AM indicates the grounding was in the low light in the berthing area. This was isolated and no problems existed thereafter. With lights on and all systems go, we awaited the arrival of the press, as today is designated press and photo day. Representatives from Saturday Evening Post, Sports Illustrated, Life, National Geographic and Skin Diver magazines were present in addition to the Navy photographers groups. When all the underwater photographers were ready and had the regulations in mind, as set forth by Dr. Bond and Bob Sheets in the meeting upon their arrival, Andy, Barth and myself hit the water. We dove to SL and proceeded to spend the next 50 minutes posing, swimming etc. for the underwater photographers. The visibility was not too good and decreased as the divers stirred up the sediment at the bottom. I went inside for a brief period and rechecked. All seemed OK and soon our bottom time had lapsed and we all came to the surface. We had some brief interviews and surface photos. Then by 1500 all photographers and press left the YFNB-12 for shore. Impending strong winds and increasing sea state led us to decide to raise the SL off the ocean floor about 15 or 20 feet so that as the YFNB-12 drifted with the wind, there would be no drag on SL. This operation was carried out with outstanding success.

29 May 1964

0500 is reveille and the sea is still quite rough. During the night rough seas shifted the SDC on the 0-1 deck by about six feet. Had to be secured. Since the sea is hitting by our starboard beam, the ship is rocking too much to handle deballasting adequately. So ship's Captain, Mr. Hollingsworth, is trying to slip the moor to head into the sea before we continue to raise SL and deballast. The port aft moor was dropped and the line became tangled around the buoy. Tuck and Sheets swam out in the rough sea and disconnected it. Good job; but they really worked up an appetite for breakfast. Tuck said, "It sure was a strain."

SL towed in and put on dock at MDL. Deballasting and lifting was very smooth. This was good, since photographers from Life, National Geographic, Sports Illustrated, Saturday Evening Post, etc. were photographing this particular phase. Unbuttoned SL and all seemed high and dry inside. Went through electrical circuits with electrician and also received training on how to by-pass transformers if they should short-out while on the bottom. We would then reduce inside load and supply 120V 3-phase from topside. Later in the afternoon, a call came in from ONR with a request passed on from Ed Link for some hookah gear. He seems to be shunned by the Emerson people and is trying to pick up the equipment through the Navy. They also mentioned Ed Link was in Miami with his Sea Diver so I gave him a call and arranged for Roy and I to meet with him on Sunday to discuss his facilities for possible joining of forces or utilizing his surface complex. At least we thought we should check it out. Roy and I then took the 1915 plane for Miami and stayed at the hotel across the street from Ed Link's.

30 May 1964

Met with Ed Link at 0800 for breakfast. We discussed our mutual problems. I found out one of his workers is Ed Wardwell who served on the NATHAN HALE (SSBN-623) with me before he resigned from the Navy. Roy, Ed L., Ed W., and I then met on the Sea Diver in the Miami Shipyard. Went over all his equipment thoroughly. Ed Link is quite a personable person. But in spite of some of his excellent equipment, he has some major obstacles to overcome to satisfactorily place two men down 400 feet in a rubber igloo. His igloo is quite susceptible to being swamped with its large bottom opening. He has lost or sunk two already. I can see he would have a difficult time with his limited gas capabilities and lifting capabilities. I wished him best success and brought up problems he may run into. Ed was quite grateful and offered all or any of his facilities to us after July 1st. His high pressure O₂ and CO₂ analyzers by Beckman would be most useful, and I

checked one of them out (cost \$20,000). I told him we will willingly accept them for use in SL. Possibly he will fly them to us in Bermuda. His Submersible Decompression Chamber (SDC) will marry up to his recompression chamber. This idea is good, but it will only take two men. He has offered it also, if he completes his run in June. All in all, I believe we both had a fruitful exchange of information.

I proposed to Roy that in Bermuda, since the-powers-that-be in Washington are skeptical of our capabilities of raising SL with personnel inside, that we do a dry run of lowering and raising to prove the point. This would not have to follow a decompression schedule, since no one would be inside. We would accomplish two feats this way (even though we might delay putting people on the bottom a couple of days):

1. We could prove our capability of handling SL from depths of 200 feet upward with stops.
2. We would give the deck force on YFNB-12 practice in handling this critical portion of the operation.

Roy agreed. So tomorrow we will propose this, or I will demand this procedure be done, to ONR. It is only logical this should be done. If that goes successfully, we will have no problem in persuading ONR that the SL inhabitants can ride SL to the surface. This is far better than living cramped in an SDC. At 1300 on the plane for D.C.

1 June 1964

To ONR to see Al O'Neal in AM and discussed visit with Link. Roy Lanphear had just phoned his report from Panama City. Told Al O'Neal of my feelings about coming up inside SL. I indicated I thought that the best way to decompress, if trials in Bermuda of lowering and raising SL are quite successful. He agreed. We also discussed possible spring-release hatch for SL trunks, so we could come up with hatches spring-closed, i.e., 5 lbs. tension. Also discussed design for SL-II structure. We all seem to agree on a more vertical type handled from the middle of a ship with a center hole.

Visited with LT Hugh Golightly, ONR PIO, and brought him up to date on latest developments with SL. Called BUMED and found out orders were going out this day for my residency in San Diego. Also gave BUPERS a jingle and discovered my promotion letter went out on 18 May with date of rank for LCDR on 1 May.

Visited Bob Gilka, director of photography for National Geographic. He requested I take some photos for them while living in

SL. I could see no reason to refuse. So he is furnishing camera, film, flash, etc. and will mail all to my home this week. I have always admired the photography in National Geographic and hope with some practice I can furnish good undersea photos for a forthcoming issue.

Heading for Groton now and should meet my family for the first time in well over one month.

2-14 June 1964

At home with intermittent jobs for SL to do at MRL.

15 June 1964

Most of SL personnel to Bermuda by plane today. Arrived in Bermuda about 1800. An uneventful trip.

16 June 1964

Began checking equipment in SL and support facilities. Checked Roy Lanphear and noted his allergic Rxn is becoming more severe. This is thought to be possibly due to the penicillin received for Rx of infection in connection with his fx finger. Believe he is becoming worse so admitted him to USAF hospital at Kindley AFB. Will call in AM to check on the trend of his recovery.

17 June 1964

Called AFB Hospital. Roy Lanphear doing well on epinephrine regimine. Urticaria almost cleared. It is planned to recase his finger, re-xray and adjust K-wire then return to duty in about two more days.

Diving today. Open circuit with Barth and Manning on Mk VI. Followed them and checked their gear under water. Went skin diving with Sheets and Tuckfield for an hour or so and swam about 3/4 mile around the point while collecting. Continual SL check off and stowing. Plan to get underway tomorrow for Argus Island while confirming same.

18 June 1964

Up and underway at 0400, heading for Argus Island. Continuing check outs on SL. Find Spirometer in very poor condition but other atmospheric and monitoring equipment in good shape. Took EKG of Dr. Miles for initial test of our new Sanborne EKG unit. Arrived at Argus Island about 1680 and crew dropped anchors. We are now standing

by for AM when we will tie up to other embedment anchor when the broken line on it is found. We will then drop in place the other two embedment anchors and complete the four-point moor. If all goes well we can be heading back in a couple of days.

19 June 1964

In Argus Island area for mooring sets. Sheets and Tuck dove 200 feet, checked in place embedment anchor strands - 11 of 12 intact. Bart and Manning dove and tied line to lost embedment anchor after Ilay and Jöhler found it on their first dive. Anderson and I dove 200 feet and established cable to old embedment anchor with new cable buoy and shackle. Bottom visibility fair with not much sea life noted. Andy rigged up new embedment anchor, YFNB-12 jocked into place and anchor dropped. Eaton and Mazzone went and checked and found it tipped. We raised it again and set it upright. It was fixed and placed satisfactorily. That completed the day's work as all divers used up their bottom time. We had popcorn and a good western movie and turned in.

20 June 1964

Up at 0500. Dynamometer transferred to other ship. Embedment anchors, all except one, checked out at ship ax pull of 41,000 lbs. The last embedment anchors placed smoothly. Fired and successfully embedded. In AM, psychologist Mike Greenwood did baseline studies on Anderson and myself. At 1200 headed back for Bermuda Naval Station. Arrived about 1900. To Hamilton for liberty by most hands.

21 June 1964

More of an R&R day and check on mission items so we can call MRL in AM and have needed equipment sent on the USS BRATTLEBORO Tuesday.

22 June 1964

Called Bermuda Biological Station. Bill Sutcliff and I made arrangements for a visit. Arrived Biostation about 1030. The station is on the other end of the islands and driving takes almost an hour through their narrow Bermuda roads. Bill gave me a quick tour of the station, arranged for me to eat there, then left me to my own to visit the various research laboratories. Their course in experimental embryology is in full swing with graduate students from many eastern and S.E. universities. The facilities seem to be quite good. With the climatic conditions and the most abundant marine life in the immediate area, this place is ideal for studies of marine biology. I

hope I can continue my interests in oceanography, marine and otherwise, and come back here for some useful research problems someday. I particularly enjoy the way of life in this type of area and the persons involved with ocean studies always seem much less formal and therefore more friendly.

23 June 1964

SEALAB is really shaping up inside. We have added more items for comfortable living and Bob Barth and Andy have put up a few choice pin-ups for future morale boosts. I think we may have to devise a sort of cover for some of these that are in the view of the TV camera since Videofilm for newcasts will be coming from these areas.

The YFNB-12 is getting underway at 1600 today for Argus Island to put down another large anchor to replace the one embedment anchor that pulled loose. We will also set down more OCEANO clumps for the Navy Sound buoys.

Called Washington, D.C., National Geographic, and received more information on photography.

1600 - Underway for Argus Island. Tuckfield acting senior diver. Bob Sheets on leave to be with his wife in Bermuda a few days. He had not seen her since late April. Chief Iley sent to hospital to utilize the physical therapy to get rid of his recently developed low back pains.

We continue to have problems with leaks of the valves and high pressure lines in the water jammer system. Evidently some of the new HP 6000# test hose line is not too good.

2330 - The tow is slow, 3 knots, since we have the two large anchors dragging over the fantail. But there is no need to get there before daybreak anyway. We'll hit the deck at 0500. The briefing meeting tonight brought out the point that we have only a little over one week until we get underway for the final dunking of SL. So we are all beginning to experience more of an awareness and tensing up of activity, with the feeling that we had better check and double-check lest we are forgetting something.

24 June 1964

Events to be accomplished today are as follows: (1) Locate and buoy north cable; (2) Install west moor; (3) Complete Nav Oceans Clump installation; (4) Clear port cable well; (5) Continue to get SL ready to set ashore 0700 Friday.

These jobs will require 314 dives to the 200 feet plus level. The diving teams for today are:

- I Anderson and Tuckfield - locate cable
- II Thompson and Barth - search for clump
- III Jöhler and Eaton - search for clump and shackle line to clump
- IV Mazzone and Manning - shackle cable to clump

The senior diver today with Bob Sheets ashore will be Manning.

We attempted diving beginning at 0630 but found visibility poor, so will curtail operations an hour or so to wait for the sun to get overhead.

1700 - The above projects were completed. During the dives we noted about a 1-knot current on the bottom. This was apparently more than the current on the surface. The bottom was viewed much better this time since we were doing searching. I noted several different species of tropical fish that were quite colorful. In addition, there were groupers and barracuda in abundance. Some soft corals were noted. In fact, the one variety that grows to 18-24 inches high, caused snagging of our circling line while we were searching the bottom.

Unfortunately, the USS SEGAMORE parted one of our mooring cables while she was de-mooring. This may require us to remain out here tonight and hook up a new cable in the AM. We can't do it now since all the divers have used up their bottom time.

25 June 1964

Heading in toward Naval Station. Today the SL divers will assist the Artemis Project by locating and tying on to a 7-mile-long cable in wet storage. This cable is laid out in the channel on the north side of Bermuda.

Divers for today are Barth and Tuckfield, search for cable; and Thompson and Jöhler, find end and shackle on nylon line so it can be brought aboard.

Although the water was somewhat murky (milky white), the above job, that is the diving aspects, was completed by about 1000, and the YFNB-12 began bringing the 7-mile-long cable in and storing it in their port hold. We will continue bringing in this cable for the next 10 to 20 hours, then go into port and take SL off the YFNB-12.

We are all busy putting final touches on SL and Barth is busy also adding some morale factors in the way of pin-ups.

1700-2100 - Barth, Eaton, Stagg, Johler and myself took the motor raft and went to the offshore cliffs near Ft. St. Catherine and went skin diving. Coot Port area. The fish were abundant and colorful, as were some of the flora and corals. Barth caught a large Spanish lobster and we returned to the YFNB-12 about 1900 and cooked it. Sure was tasty. More than one-half of the 7-mile cable is in the hold now and we are in the area of Murray's Anchorage.

Barth and I just completed more check offs. I suggested since there are a few extra leads previously designated to zoom the TV reel that we utilize those for placing an extra speaker in SL to pipe down some entertainment--i.e., radio, tapes.

26 June 1964

Visited Bermuda Biological Station.

27 June 1964

Charles Aquadro working with CAPT Cousteau in Monaco arrived today. We got together and discussed old times in the Polaris Submarine program. The others and I gave him a rundown on SL. He was quite impressed and indicated our organization may be somewhat better than their present setup.

Charlie and I went to the RB Yacht Club (RBYC) and visited Melville Grosvenor's ship. Later we went to the awards presentation at the Bermudiana Hotel. There met Dick and Tina Lemmerman. Tina is Melville Grosvenor's daughter. Other members of the Grosvenor yacht crew were present also.

28 June 1964

Following more check ups on the YFNB-12 until about 1300, then went to the Non-Mariners boat race. Then to the Yacht Club again and met Charlie Aquadro. Discussed more of CAPT Cousteau's plans and project over a couple of swizzles. Returned to YFNB-12.

29 June 1964

SEALAB off-loaded from the YFNB-12 onto the dock.

About noon on the other side of the island two Air Force para-reserve planes, a C-97 and a C-54, collided in mid-air over the south coast of Kindley AFB sinking with most men aboard. Our SL diving teams immediately reported they were ready for diving, rescue or salvage.

Barth, Andy, Tiger and myself continued readying SL, and I obtained 440 power from the pier.

30 June 1964

It appears the plane crash was in about 210 feet of water, about the depths we have been diving in the past couple of weeks, so the Air Force has asked our SL diving team to come and recover the 12 bodies in the ocean. This will put some delay on the SL initial time underway, but we can scarcely refuse this call for aid especially when we have some of the best divers, the Navy underwater photo team and an underwater TV set all ready to go. In addition, we are equipped with decompression chambers and probably the only diving doctors in the area.

1700 - Underway for the crash area.

1 July 1964

YFNB-12 over area of crash of the C-97 and C-54 by 0730 and underwater TV in operation. A bottom search in the area of the buoy dropped by the Coast Guard revealed many broken parts from the planes. About 1100, the tailpiece of one plane was spotted. The word RESCUE was clearly seen. It appears that the depth of most of the debris is in the area of 150-250 feet or the similar depths we have been diving in while preparing for Project SEALAB. Discussion during noon meal indicates much feeling is being generated for consideration to set SL down here and

- (1) Accomplish our basic research mission,
- (2) Locate and recover the bodies, and
- (3) Salvage plane parts.

It is somewhat of a coincidence that our SEALAB project with all the equipment ready to go to prove the feasibility of this sort of work, was Johnny-on-the-Spot when the casualty occurred.

Many of the C-97 and C-54 plane parts were seen on TV by noon. At 0140 the main parts of the C-54 were located and buoys attached. Eaton and McClinney on the 4th dive located one and possibly two bodies.

About ten officers from Kindley AFB and connected with the Rescue group arrived on board. We gave them a rundown on findings and SL Team capabilities while they viewed wreckage on the TV. They furnished a short film of the crash and drop into the area of search.

On this same boat out to the YFNB-12 was LCDR M. Scott Carpenter to join us for the rest of SL experiments. He moved in with me and we discussed the events that occurred while he was away.

1800 - Diving operations secured due to lack of visibility. We will circle and begin in AM utilizing the SDC for recovery operations.

2 July 1964

Returned to initial buoyed positions by 0800. Several dives made on wreckage. C-54 and C-97 identified and several bodies noted by nocntime. One almost intact body was recovered at 1205; dismembered foot and lower leg recovered at 1345 and sent to Kindley AFB. These diving operations are unique in that they have been carried out in open sea at 200 feet in somewhat hazardous conditions and so far, except for Bob Sheets suffering a 1-1/2-inch laceration of his left palm, there has been no incident of diver trouble.

The question still remains as to the status of SL's time schedule in view of our delay on this recovery job. We expect word soon on the possibility of remaining here, 2 miles off Bermuda, with SL or discontinuing this operation and go ahead with our planned schedule. I somewhat favor continuing our SL schedule but feel if we do not become too obligated with the recovery job, that this area has some advantage over Plantagenet Bank.

1600 - Next set of divers starting down. Divers reviewed bottom scene and decided not to remove remaining body parts and returned to surface after making a brief visual survey.

1635 - Message to all SL and YFNB-12 crew from Chief, BUSHIPS and CNO piped through MC system, congratulating and commending all of our crew for outstanding performance and service. CNO directed cessation of the search and recovery operations and ordered abandonment of the area and removal of marker buoys. YFNB-12 and SL crew complied and soon headed back for New Station. Scott Carpenter and I caught the Army boat to Kindley AFB, had a few drinks with some test pilots and went to the Pompano Club for supper with Life Magazine representatives. I gave some more of the details of the wreckage location to the investigating committee at Kindley before we departed.

3 July 1964

Meeting in AM with Life and other news representatives and discussion of photograph pool.

1330 - All SL teams in the water for photos and rest of the day spent on more final checks on equipment and supplies.

4 July 1964

More checking of SL and umbilical cord. Continued more discussions on photo coverage, and spent time with CAPT Mazzone on atmosphere analysis. Scott, Bob Barth and myself headed for the Chief's Club by 1800 and had a few drinks. Called my family in Connecticut and wished my daughter happy birthday on her 14th.

5 July 1964

Commandant Alinat, J. Cousteau's right-hand man, arrived during the night. I met him this AM and after guiding him for a tour of the facilities, had lunch with him, Charlie Aquadro and Cyril Williams at the Pompano Club. We discussed many similar operations.

Checked out the Helium Speech frequency reducer with Mr. Williams and the mechanism seems to work adequately.

At 1330 Dr. Melville B. Grosvenor arrived on his ship "The White Mist." Met him with a small boat and conducted him on a tour of SL and the supporting facilities. He was apparently somewhat impressed.

Later in the PM, following MBG's departure and more SL checks completed, I met with Gerry Greenberg for laying out plans for the underwater shots. In the process of this I have become more educated in the principles of photography in the past few days than in all my previous life.

1900 - Scott, Charlie, CAPT Alinet and myself had supper at the "O" Club; then Scott and myself departed for the barge to view the two outstanding underwater films by Elgin Chiampi and Owen Lee. Each film was produced and photographed by these men and it was indeed a treat to see the film in the company of the originators with side comments on the techniques given by Chiampi and Lee.

6 July 1964

All SL personnel and support teams met for group pictures in front of SL. We then departed for the Base library for a press conference.

Following more checks of SL equipment and complying with some of the photographers' desires, we halted all visiting to SL for the remainder of the check-out period before departing.

1930 - SL team and support divers arrived at the Mizzen Top Guest House for a party sponsored by the Saturday Evening Post. It was relaxing to get away and just discuss, much of the time, subjects not connected with SL. A tasty dinner topped off the party. Bob Sheets, who strongly believes that all basic knowledge is acquired through conversation with others, especially if a debate can be instigated, stated he thought that TV was basically an evil instrument and leads to the dilution of a person's creative thinking. I took the challenge to his dogmatic statement and the debate was soon in progress. The night ended late with Bob Sheets and myself playing chess about one AM after we returned to the Base.

7 July 1964

Final check-out on SL and button up followed by pressurization with about nine lbs. air. SL lowered into the bay at 1200. Ballasting began at 1300 and completed by 1600. SL now ready for the long journey out the bay through the north channel along Bermuda, around Ft. St. Catherine and SW to Plantagenet Bank. As we passed with our YFNB-12 and SEALAB Control Center, backed with advanced scientific gear, we passed by ten tall-masted sailing ships from the past. These were the ten ships representing many foreign countries sailing the Bermuda-New York Race.

The winds seem to be increasing.

8 July 1964

At 0400 we turned back due to increasing winds and adverse weather reports. One report indicated a possibility of winds up to 50 knots.

At 1400 we were entering NOB. Unable to dock, so we must anchor in the harbor and use the small boat to get ashore.

Supper at Fourways.

9 July 1964

YFNB-12 in to the NOB pier since the weather report does not seem favorable for any return to Argus Island area during the next 36-48 hours.

Went to Hamilton for Liberty and found it almost completely closed down as is their custom on Thursday afternoons.

10 July 1964

We are all just awaiting clear weather. Some men given liberty. SL pulled around to Fantail of YFNB-12, unbuttoned and checked by SL team and CAPT Mazzone. I found He space in excellent condition, dry and good atmosphere for being shut up for three days. We hooked up the umbilical cord and found 0 ground in one 440 cable. Umbilical then disconnected and aux 440 line sent down. All systems seem A-OK. Power left on all night. We had Scott helping this time with hookup for training and familiarity.

11 July 1964

0830 - Began to hookup umbilical again when a good weather report indicated we should leave today. We then buttoned up SL, pressurized it and departed for SL site at 1600. The YTM will tow SL out beginning 0330 tomorrow with CAPT Bond and Andy riding.

12 July 1964 (Sunday)

YFNB-12 in place over SL site area and foul weather anchor put in place. Two divers over the side to search for lost anchor from previous moor setting. Anchor found on first dive approximately 200 feet depth. Buoy placed on anchor and YFNB-12 set in 1-point moor awaiting arrival of SL. Weather reports indicate possible squall tonight so probably won't place SL under stern tonight but await passing of squall. Scott, Bob Barth, CAPT Mazzone, Eaton and myself took small rubber boat to Argus Island for a visit. Following an interesting tour of the sound array inputs and computers, we had a small snack, a brief movie and returned to YFNB-12. Under the Argus Island were innumerable large fish--mackerel, tuna, jacks, etc. Soon following our return, Sheets, Tuck, and Walt Mazzone caught some fairly good-sized fish with the bait furnished from Argus. We sliced it up and with Tuck's home-made Sashimi sauce had a few raw fish for a snack.

About 0900 one of the YFNB-12 crew caught his foot in a ladder and caused subluxation of his 2nd metatarsal/tarsal joint. Following 25 mg. Demerol X2 attempt at reduction unsuccessful and recommended man be sent back to Naval Station for Rx.

Because of the rough seas I did not allow the man to be transferred tonight but will await better weather in the AM.

13 July 1964

Reveille at 0530. Due to some rough seas during the night there was damage to the whale boat. Upon attempting to bring it aboard for

repairs, the handling characteristics of heavy objects on the crane lift in even underwater seas led to the question that doing the same job with the SDC is most likely unsafe. Therefore, a meeting was called to discuss some other way to handle the SDC. The SL brought to the stern of the YFNB-12 and Tuckfield, Carpenter and myself removed the bolts from the air and the space hatch covers. Scott and myself entered the airspace and hooked up the umbilical cord. All systems seem OK.

The injured man was padded into the Stoker Stretcher and bedded onto the Mark III without incident.

2300 - Increasing sea state indicates SL may be in trouble so near to the fantail of YFNB-12, so we are setting up a watch for safety. Tuck says "Deballasting in this weather sure would be sport."

14 July 1964 (Tuesday)

CAPT Bond, Roy Lanphear, Bill Culpepper and others returned from NOB on the Mark III at 0830 with news from Al O'Neal and CAPT Mellson to continue with project and modify SDC. SL ballasting began and CAPT Mazzone and myself did pre-diving check and hookup of other communications. Ballasting continued and SL became negative and went to about 30 feet with some buckling of the trunk hatch and about two and one-half feet H₂O got in bilges and a few things on the deck were soaked (my cameras, specifically and some of Scott's). SL then deballasted after the bilges in the He space drained and we are now out of the four-point moor (1830) and hooking up with USS SEGAMORE for return to NOB for drying, restocking and possible tests in the Bay.

15 July 1964

SEALAB cleaned up. Electrical checks show refrigerator, one fan, and CO₂ Scrubbers shorted out. LiOH caused some trouble inside due to caustic, but was rinsed out with fast diligent work by all hands. It appears SL is in good condition and will be ready for sea soon.

16 July 1964 (Thursday)

Started out with a serious casualty. Scott, on his return to NOB about 0600, riding his rental motor bike had an accident. He sustained a fractured (L) arm with both radius and ulna fracture in a compound comminuted fracture. Also fracture of right great toe. Scott was seen by Dr. Bohan in NOB dispensary, given first aid and transferred to Kindley AFB hospital. After consultation with Dr. Tucker, a British orthopedist on the Island, it was decided that the fracture being as severe as it was, it could not be satisfactorily handled there.

Following the events of Scott Carpenter's injury, Al O'Neal and CAPT Melson explained that SL now has a top priority for Naval Operations in this area. Modification of procedures to handle SL and SDC from Argus Island have been firmed up. The inside of SL has been restocked, stowed and most equipment in working order. The YFNB-12 sailors repainted SL International orange and Bernie Campoli repainted the letters, so SL now looks better than it has for some time. All the divers went to Buck's house for a party tonight. Good for release of tensions.

17 July 1964

Charlie, CAPT Alinet and myself, after packing up Scott's gear and personal clothes, went to Kindley AFB hospital and visited Scott. He is still quite disturbed over not being a participant now and feels somewhat depressed over the whole situation. We said our fond farewells and I gave him the best wishes from the team. We saw to it his transportation was well in hand. It appears that NASA is sending a plane and a doctor to ride back to Texas with him. Charlie, CAPT Alinet and myself stopped at the famous Swizzle Inn for a few minutes before returning to the YFNB-12. SL was being ballasted and would soon be through. YFNB-12 departed 1600 for Argus Island. SL to follow in tow by YTM 1900. Meeting of all SL personnel. And YFNB-12 leading P.O. to plan tomorrow's operations. All looks good. I'm worried about two things: (1) The handling of SL with the four buoys and (2) Divers in the water which is thickly populated with barracuda, tuna, etc. around Argus.

18 July 1964

Reveille 0530 in Argus Island area. Find that the job is to put down underwater TV (Joe Gordon, USL) and check site for SL hold-off anchor. Anchor set by 0830 and Sheets and Tuck to make inspection dive of SL site next to Argus. TV used on anchor drop to insure no cables vital to Artemis project were in the path of the anchor drop. Injury to any of these cables would be an expensive mistake.

While SL was being brought from its mooring on the south side of Argus, Dr. Aquadro and myself had a lengthy discussion concerning international aspects of underwater research. We discussed progress in Italy, France, England, Sweden, and what each of us knew of Russia's interests. This stimulating discussion gave me the idea to drop a note to each organization (i.e. to the physician or principle investigators) while I'm down inside SL. This idea is to further, I hope, my firm belief that the assault on the depths of the sea is a project for all of us--race, politics, countries, notwithstanding. A joint effort with mutual support and exchange of data will advance the state-of-the-art more safely and surely.

1430 - SL astern of YFNB-12. Ballasting has begun. Soon the four buoys are to be added for safety when SL is ballasted to negative and transferred to the Argus Island hook.

1945 - YFNB-12 getting in four-point moor. SL handled now only by Argus Island. Team over on the Island readying the air system so we can keep a pressure in SL if necessary.

All the men have done exceptional work today and since reveille was 0530, some of them are beginning to drag, but I see no loss of enthusiasm. If all goes well, Barth and myself, may still hook up the umbilical tonight so all systems can run during the next 24 hours.

When Sheets and Tuck made the first inspection dive, Sheets took along a spear and came up with a 44-inch King Barracuda.

Due to late hour and darkness, hookup of umbilical delayed until AM. SL lowered to 60 feet to ride more easily during the night.

19 July 1964 - ON THE BOTTOM

0530 was reveille. Over to Argus by 0645. Air space opened. Barth and I went down to hookup umbilical at 60-foot level. All connected by approximately 0820 and SL buttoned up and lowering began using Helium only for pressurization. Lowering was monitored by pneumofathometer on diving station on Argus, absolute pressure gage via umbilical to SL control on YFNB-12 and TV monitor observing the umbilical stuffing tube. ON THE BOTTOM 1340. The crane hook removed after inspection of setting-down site and the He space opened. All systems go except the inside TV and possibly one valve on one of the He lines. Since divers have used up bottom time, there will be no more diving except a check by Iley and CAPT Mazzone.

Crew is hooking up the SDC and, if all is still "go" by tomorrow, we will enter to begin our story. I must mention how interesting and beautiful the marine life is in the close proximity of the tower. Schools of barracuda occupy the first 30 feet or so, under them are multitudes of jacks and tuna; beneath them are scattered other fish, groupers, other jacks, etc. Interspersed around the marine life covering the legs and cross-members of the tower are innumerable species of tropical fish.

Before leaving Argus Tower this afternoon, I just had to take another swim around it to depths of about 30 feet. Being followed by a group of barracuda is probably safe, but nevertheless, I noted by the end of the swim I was heading for the ladder at a somewhat faster pace as the five-foot cuds swam beside me.

Sheets again furnished us with fresh fish for supper,--a tuna and a jack.

2000 - Following a discussion with CAPT Bond on tomorrow's plans which include SDC check, SL checks and final physical checks of the subjects by me, I had about an hour's lesson on operation of the Navy B & H movie camera by McClenny, PHC.

This night, possibly being my last night on the surface for some time, I will have to forego the movie and organize my personal belongings,--some to be packed in plastic bags to be sent below later, some just stowed away until I return to the surface next month.

20 July 1964

Reveille at 0600. This should be the day. All night watch of SL on TV showed no adverse findings. The men noticed the large grouper seemingly making the cage his domain. Estimated size of 190#. A four-foot moray eel was also noted. The balance of negative ballast is being added now, 1000.

Lester E. Anderson, Sanders W. Manning, Robert A. Barth and myself left the surface of the Atlantic Ocean 26 miles SW of Bermuda, BWI, in the immediate area of the Argus Island Tower. We descended in the SDC (Submersible Decompression Chamber) under our own control, tethered from the Argus Tower. We descended to 165 feet and, when ready, free-swam to the SL, Andy first, me second, Tiger third, and last of all, Bob, who entered the SL following his securing the SDC and returning control to topside. Our Entry was 1735. We immediately began our check-out of systems; especially communications with topside (The SEALAB Control Trailer on the YFNB-12). TV was connected ASAP and we all began the job of rearranging equipment, stores, etc., for our comfort. Equipment had been stowed in bins and cupboards for securing during the towing in the open sea and to protect against possible shaking during lowering procedures.

All systems seemed to work with the exception of the thermoelectric refrigerator and our calibrated microphone. The other means of communication, TV, divers transceivers, electrowriter and Helium speech unscrambler all work 100 per cent. By 2100 we had SL shipshape enough to set the watch;

2100-2400 - Thompson
2400-0300 - Manning
0300-0600 - Anderson
0600-0900 - Barth

At first, all of us seemed almost as though we had some nitrogen narcosis, but this wore off in a couple of hours and must have been just elation to having successfully begun our habitation at 192 feet.

About 2200 we received word that the CNO gives our project No. 1 priority and can continue as long as is appropriate. Also, by 2200 the others had settled into bed and seemed to be relaxed and apparently confident of our new home for the next ten days.

21 July 1964

Up about 0700 to assist Bob in atmosphere analysis. Bob complains of mild aching joints; others and myself also have same complaint. We ate corned beef hash, crackers and coffee for breakfast. I took a short swim outside in only my swimsuit and weight belt. It was chilly at first, but soon felt good and quite refreshing. There seem to be many fish and other varieties of sea life. Blood samples were taken on all subjects, but due to transferring procedures being not yet perfected, they did not get to the surface until quite late. Barth and Andy did a 40-minute close-in swim around SL with the Mk VI and became quite chilly and returned. Their condition was otherwise normal and their temperatures were normal.

This day is quite a tiring one with adaptations, straightening equipment around and other chores. For noon meal, Spanish Rice, tamales, applesauce. The fish are more curious and adapted to us being here now, especially the groupers who hover around our ports (more often at meal times).

Manning and myself experienced headaches this afternoon. No evidence that it was due to faulty atmosphere as far as I was concerned. Manning had run out of gas on the Mk VI while helping bring the Norden TV (outside) in from outside and had to swim, breath-holding, about 100-150 feet. So he had considerable CO₂ buildup and probably some nervous tension due to the hazard involved.

Our atmosphere control is quite unique in that we seldom bleed O₂ per se. CO₂ remains low and we have yet to add helium to the original atmosphere. Reasons;

(1) CO₂ readily absorbs in sea H₂O, therefore CO₂ scrubber utilized about one-third that in a chamber room.

(2) N₂ evidently absorbs in sea H₂O to a greater extent than does helium. In effect we are (a) supplying our own O₂ with Air blow down (b) ridding excess N₂ by sea H₂O absorption.

(3) The trunk level goes up approximately 1 inch/hour and the blowdown with air supplies sufficient O₂, He and absorption of CO₂ and H₂. We will have to follow this concept through to make sure. But according to topside instruments N₂ remains, so far, in the 17 per cent range. Ambient temperature is now about 30°C.

Following a Chinese supper, we made use of our underwater aquarium for more interesting viewing. Manning seems very interested in this and sometimes it is difficult to pull him away from the port.

22 July 1964

I have 0600 watch.

SLEEP: Barth says he dreams more than normally for him.
Andy sleeps soundly, no problems, he snores.
Manning sleeps about the same as always.
Thompson, about the same as always. After the first night which was somewhat restless because of cross-checks of the other watch-standers to make sure they understood the mechanism of atmosphere control.

Barth still complains of binding and slight pain in his left shoulder. The URI's Andy and I had the first day have practically cleared up.

1040 - Went outside on the HOOKAH for about 41 minutes. Laid out two white lines and collected three teeth from the lower jaw of a shark about four feet long. Also brought to shark cage a bathythermograph apparatus apparently lost from Argus Island.

For noon meal we had tamales, crackers, tomatoes, cherries and Mateus Rosé. I seemed to get a slight headache after the Rosé; must check again for this effect (amounts are small).

Following our afternoon work of sending up blood etc. and film and receiving recharged SCUBA gear, we had supper. Bob Barth steamed some clams and warmed a can of roast beef and macaroni. After supper, Tiger jumped into his wet suit, got a can of sardines and fed a large striped grouper by hand. We watched through the port. Tiger says the large moray eel has now occupied the after starboard corner of the SL. It's about five feet long, greedy and curious.

In general, things go quite good down here. We still seem somewhat light-headed some of the time. I believe occasionally that I do not write or think very clearly. Medically there is very little change in personnel other than the chronic fatigue and a few migrating aching

joints. This afternoon, for instance, about 1345 the others got into their bunks and were soon fast asleep; I could hardly keep awake myself, but stayed up for the watch.

23 July 1964

A fairly routine day as we seem to be developing our work schedule. We were all up by 0900 and following discussions from topside, we prepared a breakfast of coffee, cereal (from 5-in-1 canned rations) and set about to work. First order of the day was to get the blood samples off. So we did same and had them ready for the SDC by 1000. Bob Barth took the pot outside this time. I went out a little later using the double 90's, took out the garbage, and found the other lost bathythermograph from Argus Island and a couple of lead weights dropped by the divers. I sent the BT, lead weights and few bottom algae balls up on the SDC. Wish they would find some worthwhile mineral or something in these balls. There are millions of them. We sure could collect them by the ton if any use could be made of them. As it is, I think I'll collect enough to send up for anyone who wants one for mementos of our excursions down here. Barth came out on Mk VI. We swam around taking each other's picture. Found a full bottle of Karo syrup, opened it and poured it into the sea. The fish soon smelled it and were crowding around. Groupers, tuna-like fishes and others have become quite accustomed to us down here and we can easily go out and feed by hand many of the large fishes without even going through a period of conditioning them to eat from our hands. Upon return from the dive, I took a nice long hot shower. Boy, does that feel good. One of the aquanauts said under conditions such as these the hot shower is better than sex.

For noon dinner we had sweet potatoes, canned ham and corn. It was fair, but on one except Andy seemed to really eat well. After dinner, we again felt very fatigued, so three of us took a nap.

Our CO₂ scrubber seems ineffective now, so I changed the LiOH canisters for the first time since the July 20th initial filling of the CO₂ hopper. I put in four LiOH cans and one can of activated charcoal. Worked quite well then and took CO₂ down in short order.

1730 - Received a large 33 pound watermelon on the trolley. It came from the cook on the YFNB-12. (Later found out it was purchased by Dr. Marty Kripps). Bread came down also as did heparin blood tubes and mail for all. I received a box from Barbara (my wife) containing my knitted hood which she made for me to keep my ears from getting frozen when I was in North Korea during the Korean Conflict. It still does the job. Also had my pistol belt to use for auxiliary diving belt and a bottle of Vitamin C and bullion cubes.

Swam around for about 35 minutes on the HOOKAH gear and posed for photographers when they came down. Since we do get cold outside when we stay fairly long, the hot shower upon coming in is really good.

Supper tonight cooked by me. It was beans and meat, green beans, bread and butter and the watermelon sent from above. I went to bed about 2100 while Andy and Tiger were playing cribbage. My watch begins at 2400. During the watch I plan to cut a tape with CAPT Mazzone utilizing the Helium speech unscrambler.

24 July 1964

Note that the Krasberg oxygen meter is reading high. Analysis of O₂ by topside meter indicates we are supplied with an adequate amount of O₂, but I believe, since we need to necessarily live in a higher CO₂ here, I prefer to have higher O₂ also. There are other contaminants in the atmosphere that we probably do not note. We have had more headaches (not severe) in the past 24 hours than previously. Walt Mazzone and myself utilizing the He speech unscrambler, cut a tape for the Royal Navy Diving Unit.

Around 0200 had a nice long talk with Cyril Tuckfield using the He unscrambler. Tuck says they have really been kept busy with the bringing of bottles (SCUBA) from the YFNB-12 to the diving stand on Argus Island. One day, because of weather and sea conditions, and the sharp edges around Argus, all three of the rubber boats sank. I guess they have a real job when the weather gets bad.

Up at 0900. Only cocoa for breakfast. We changed batteries and calibrated mike pre-amp. The mercury batteries seem to last only about 12 hours. Following our routine blood-letting, we each wrote a letter to Scott Carpenter, using the electrowriter.

1030 - All transferring to the SDC completed so Bob Barth, Andy and myself hit the water. I collected Algae balls and sent them topside. They really look more like pieces of coral that have been rolled around by the current until they have become round. I believe they should be called coral balls. Also collected a few other specimens and put a white nylon line from SL to the larger coral reef to the north of us. Explored the coral reef which extends for some distance. They are many quite beautiful tropical fish, soft corals and other abundant forms of sea life around it. No evidence of Panularis (spring lobsters) though. The double 90's with 50 per cent He/50 per cent air lasted 27 minutes. There was no real evidence of N₂ narcosis as there is with using plain air. The narcosis effect, I believe, is somewhat more profound after we have become adapted to a Helium atmosphere.

Our meal routine seems broken down today. Because all our food is canned and the fact that each man can choose and heat up food as he desires, it has sort of developed to that system. Only Andy and I sat down together for noon meal of spaghetti, meat balls and pears.

1500 - We sent up all SCUBA gear via the Trolley and at 1540 received a message via CAPT Bond addressed to me and SL subjects from Rear Admiral Leydon (ONR) extending congratulations on our successful descent. He stated we have challenged the imagination of oceanographers throughout the world and is anxious to hear reports from us. I believe Admiral Leydon relieved Admiral Coates at ONR. Around 1700 I skinned out to check a faulty outside TV camera and I mean skinned,--did not wear anything other than mask, weight belt and fins. Did not realize they were filming at that time and later it was mentioned to me that it was not gentlemanly to swim that way. It's a matter of opinion, I guess. We always used to swim naked at the YMCA pool, and even in the College pool in LA before coed swimming started.

Tiger and Andy have a regular cribbage match going on each night now.

Tonight we received from topside the Nordon TV which was flooded out due to faulty packing. We got it fixed by rinsing with fresh H₂O and washing with 190-proof ethyl alcohol. We played a short skit for topside tonight, as they were filming a sound film of our day of entry.

25 July 1964

The morning, or first watch of the new day, 0600, is by Barth. Evidently from the log book he spent much of his time looking out the ports at the fish. We all have, but Bob Barth especially, has become quite attached to the fish around us and he feels somewhat possessive about them. We conveyed to topside our feeling and have requested no one spear fish when they are down here, as we do not injure them in any way ourselves. Our collecting of blood and its transfer to topside went smoother today than any previous day. I hope this is indicative of a trend. I spent 28 minutes on the double 90's this AM and explored much of the coral reef about 100 yards to the north of us. Bob Barth and I found a fish net just as I had requested the day before. This area around Argus Island is pretty good for finding what you want if you look for it. I continued swimming in and out, breathholding for the next 20 minutes and am beginning to find that if I plan these swims, I can explore much of the nearby surroundings in the 1-1/2 minutes out and 1-1/2 minutes back (3 minutes) routine. By each day utilizing some of the lines I previously laid out, I find it easier to go further. I bled down for the first time the 200 cubic foot O₂ bottle. This means, since entering SL, until 1250 when it was

bled dry, we have used only 1840 lbs. from this bottle. Just short of four days for this amount. I then proceeded to recharge the Number 1 O₂ bottle from the large, long bottle under the SL. Wanted to make sure the transfer system worked adequately before bleeding any more O₂ from the inside bottles. It worked very well and now we have recharged the Number 1 200+43 bottle and have also topped off the Number 2 bottle. There were no problems whatsoever.

We have begun to get reports from topside that weather conditions have become adverse and that the YFNB-12 is really rocking and rolling. It is quite serene down here. We do not even feel the pressure waves from the enlarging swells above.

Tonight the photographers plan to make a night dive for photos. This afternoon upon request, two of us went outside to do our routine checking of outside hull integrity in the immediate vicinity, at the time requested, so photographers could dive, take pictures and coordinate their pictures with our work.

At 1735 today, the end of our fifth 24-hour day in SL, we note we have all become quite adapted. Much of our initial fatigue has disappeared and we feel much more active in general. The atmosphere seems quite good today also.

1755 - More adverse weather reports. Roy Lanphear sounds quite foreboding and wishes to prepare for possible severance of the umbilical line. In preparation for this, there is an auxiliary 440V 3-phase power line to be put down from Argus Island. We will bring it into the Air Space and have it ready for hookup in the event we lose power from the YFNB-12.

Although the above was accomplished, it was not an easy job for Bob Barth. At first, there was not enough slack in the cable, and, along with other problems (including a slight narcosis I believe he may have experienced from the long time in the Air Space), this job took several dives outside before completion. We then all settled down for a restful night and set the watch.

2100-2400, Tiger; 2400-0300, Andy; 0300-0600, Bob Barth; 0600-0900, Bob Thompson.

26 July 1964 (Sunday)

0630 - I am awakened by someone shaking my left foot. It is Bob Barth awakening me for my watch, one half-hour late. I stagger up, wipe my eyes and he hands me a cup of hot cocoa which just hits the spot. The place is filled with soft blue light. This is the first

Sunday I have ever been awakened to find myself inhabiting an underwater house 192 feet below the surface of the ocean. It was almost six days ago that Lester Anderson, Sanders Manning, Bob Barth, and myself descended from the surface to man the U.S. Navy's SEALAB I. We entered at 1735 on the 20th of July. Although we could have easily descended to this depth utilizing our SCUBA gear, we did not. We used our Submersible Decompression Chamber, something like an underwater elevator, and under our own control descended to 165 feet and lowered over the SL. We had no diving equipment other than masks, fins and weight belts. We waited a minute or so for photographers to get into place, and then Anderson took a breath and a piece of white line and skinned to the SL resting 192 feet below on the plateau called Plantagenet Bank, 26 miles SW of Bermuda, BWI. Andy tied the line to the shark cage at the entrance of our home to-be and I followed within the minute; Manning followed the next minute and Barth, following a check of the SDC and returning control of it to topside, skinned down also and entered SEALAB.

As I sit now on this our first Sunday morning, I find now I must take measurements for entering in our log and make adjustments that may be necessary to insure adequate atmosphere and comfortable environment in the SL.

0700 - Outside temperature is 21°C. (almost lost a thermometer that time as a large hungry Grouper snapped at it as I lowered it to the bottom from the access trunk in our Helium Space).

Current-meter - 2.5 microamperes or about one-half knot current.

Visability - 85 feet.

Fish population - Too numerous to count. Many small fish, jacks, small groupers, and a dozen or so large groupers hanging on close by to the SL. The large pelagic fish were here only two to three hours ago but now as the sun rises, they seem to fade away perhaps to hide in the coral reefs away from us or to plunge into the deeper depths not far away from this extinct volcano which we are resting upon. The depth on the edge drops suddenly to over 3000 fathoms.

Inside temperature - 84°F. Comfortable, but slightly less than we maintain during the day. In a helium atmosphere, the conduction of heat is several magnitudes greater than in an air atmosphere, so we must maintain higher ambient temperatures in order to remain comfortable and wear light clothing.

Carbon Dioxide CO₂ - 2 per cent (2/10 of 1 per cent). CO₂ builds up gradually, but we find there is nowhere near the problem of CO₂ in

this undersea laboratory open to the water as there was during chamber runs in preparation for this experiment. Evidently the open water in the entrance way to our habitat absorbs CO₂ readily (the absorption coefficient of CO₂ is quite high) and even though this is the sixth day below, we are only on our second charge of Lithium Hydroxide Canisters.

Oxygen - 4.03 per cent. More than adequate even though the per cent of oxygen we all breathe at atmospheric pressure is 20.95 per cent. The SL occupants are living at a pressure of 6.4 atmospheres and therefore actually need only 1/6.4 as much oxygen per cent wise. There are still the same number of molecules of oxygen present for each breath of atmosphere and that is all our bodies desire.

Nitrogen - 21.3 per cent. A little high for today but within range of acceptable readings. We had originally thought of using only a helium-oxygen atmosphere, but with the convenience of the heat-saving phenomena in utilizing N₂ and with the marked increased intelligibility of our speech over a pure helium-oxygen atmosphere, it was decided to keep the nitrogen in our atmosphere, even though it was usually less than 20 per cent.

Water level in the trunk - three feet-eleven inches below the top of trunk. This is now just at the level of our bilge drain. The water level fluctuates with the tide or the hydrostatic pressure above us. Actually during the night with the 35-knot winds on the surface, large swells and high tide were more than 200 feet below the surface.

Oops, I smell something burning. Busy with my measurements, I forgot the pot of hot cocoa on the stove. Even though the burner was on low, everything here gets much hotter on the stove due to the increased pressure, like living inside a pressure cooker.

If all agree, we will hold a brief "Church Service" this morning.

1030 - Church Service, very simple, very brief. I noted our feelings of thankfulness for our safe descent and good care while we have been here. I tried to play "Onward Christian Soldiers" on my harmonica but seemed to choke up a bit today. CAPT Bond read a SL prayer over the loudspeaker.

1200 - Barth and I complete an outside inspection of the tower legs nearest to us. I note no welding deficit. The salt is building up around the electrical leads on the current meter, so I removed most of it.

The fish, especially the groupers, now expect to be fed every time we go out. So when I went out this time with no food, they almost interfered with what I was trying to do by nibbling on the tips of my fingers hoping for some food. One large grouper almost bit off the end of our 200 C. mercury thermometer trying to get something, when I dipped it down the Helium trunk to get our routine water temperature measurements.

The atmosphere this afternoon does not seem as good. Andy and Bob Barth are complaining that they do not seem to be able to get an adequate breath. Our CO₂ meter registers 0.4 per cent, topside says .5 per cent, and we have recently run the CO₂ scrubber. Therefore the LiOH canisters must be dead now. After replacing the LiOH canisters, the CO₂ soon dropped to 0.1 per cent (by 1700) in short order and I added 300 more liters of O₂ and all seems well with our underwater world now.

1945 - I went out to the NE leg of the tower to pick up a communications lead, swam all around the leg and did not find it (used no SCUBA this time, only breathholding). I found the end of the lead on the second time out and brought it inside where Andy hooked up two of the leads to the divers' transceiver speaker. We now have established communications with the Argus Island diving phones. Perhaps the diving operations can go a little smoother now.

Andy noted in the log that the current is from the west at this time. 1800 - We had not noted current of any significance from the west before.

27 July 1964

I have the 0300-0600 watch. There seems to be a slight discrepancy between our O₂ reading and that of topside. It is quite likely our chemical sensor meter is in error. Perhaps today the meters brought by Ed Wardwell of Link's project will be sent down and we can give them a try.

Tiger has not gone out to dive for the past two days now. He has not given any particular reason. Tiger says he feels better today or this AM than he has felt for the past couple of days. Perhaps it took him longer to adapt or else something else was bothering him. Anyway, he rolled into action this AM and took most of the blood himself. We had most of our morning routine completed by 1000.

This afternoon the STAR I, a midget submarine from the Electric Boat Division of General Dynamics Corporation, made a simulated seat on a bottomed submarine. First they dropped the false seat from Argus.

Bob Barth and I put it into place and the sub descended onto the seat. The plan was to make six runs up and down while we covered with cameras along with the topside photo boys. After the first run, I decided to duck back into one of the trunks for a while to conserve gas. Tiger was just ahead of me and apparently ducked into the He space, so I ducked into the air space trunk. While getting comfortable, I got a yell from Andy over in the He space to come over. I ditched my gear and noted upon ducking over that Tiger was being held up out of the water by Andy. Tiger was unconscious. We took off Tiger's Mk gear and weight belt and while Andy pulled, I pushed and we soon had Tiger up in the He space and on the deck. He began to stir and come around. His face was quite pale and blanched (not blue). Eyes were markedly bloodshot and his respiration was rapid and shallow. In short order after we loosened his clothing, he was quite lucid and seemed aware of the situation. He stated he felt "funny" outside and decided to head for the SL, but only remembers coming to the shark cage, does not remember entering it.

This was a narrow call. Had Tiger failed to head for SL and one of us not seen him sooner because he was on the other side, or had Andy not heard him outside the trunk as soon as he did, we may have well lost him. Lucky for all he made it.

Tiger's physical signs were soon back to normal, with the exception of the conjunctiva of his eyes. He rested for a while as I advised, but soon was up and playing cribbage with Andy.

For supper we had delicious steaks sent from above, with baked potatoes. We warmed them up and sat down to a fine meal. Tiger's appetite was not affected by his casualty. This was a good ending for the completion of one entire week on the bottom. Tiger retired again a little after 2000 and stated he wanted to be sure and be called for his 0300 watch.

I am now on the 2400-0300 watch. After finishing the routine instrument readings and writing a letter home, I turned out the lights inside and watched the activity outside. The large pelagic tuna-type fish are again down near the bottom around us. The largest must be about five feet long. The entire bottom is teeming with smaller fishes darting from cover to cover. On the Argus Island side, they hide along the large cross-members of the tower. Many invertebrates not seen in the daytime also swim around us. The Nudibranchia come lumbering by, swimming with their large wing-like lateral ridges. One, about 14 inches long, just passed the port. On the side not lighted by the diving lights, you can still see some distance. Sort of like looking out on a blue scrubby desert with a moon glow coming over the mountains behind you. For all intents and purposes, the Hollywood people could

easily film out of this port for a science fiction story of living or landing on another planet.

28 July 1964

I now have the 2100-2400 watch. During the morning hours nothing out of the ordinary occurred. I re-examined Tiger's eyes, and find some spreading of the hemorrhages in the right and the left conjunctival areas. No fresh hemorrhaging though.

We used plastic syringes this AM for the blood drawing and noted for the first time there was no hemolysis using these syringes.

This afternoon while setting up for underwater photography from above, we had some delay and reduction in visibility, due to a reported squall above. Except for the change in visibility, we noticed nothing here in SL. At 1815 we received two pressure pots from above, containing syringes, sample bottles and a remote radio transceiver. The radio was soon hooked up to the lead brought inside the other night, and a radio check with TUDOR HILL (ONR Bermuda) came in loud and clear. With the help of the topside Argus radio operator, Bill Dean, we worked three Ham radio stations.

- (1) WA4EJA, Savannah, Georgia, an entomologist named Norman.
- (2) K77BB, and NBC radio announcer from McLean, Virginia, but operating this time from Charleston, South Carolina.
- (3) W8DJG, St. Clairsville, Ohio, close to Wheeling, West Virginia.

The shark-attracting sound gear sent down on the trolley. Some of it was imploded but the sound transducer is in good condition and it was placed outside SL. Some sound experiments done tonight.

I have not felt too perky today and am running a temperature around 100.3°F. Andy feels the same way.

The introduction, though, of the communications from the outside world sparked up the activity of the team. Tomorrow we hope to hook-up with a telephone patch via the Pentagon. Our phone bill will then be D.C. to Groton or elsewhere called. We all hope to call our wives.

The ham operators were elated. I think this may be the first time a habitat on the sea bottom has communicated in this manner, although it is not uncommon for this or even more exotic communications to be managed on some submarine systems.

29 July 1964

Following our morning cocoa and information that today we would speak with some officials in Washington, D.C., I went outside using the He/air mixture in the double 90's and set up the Electronic Shark-Attractor, tripod and colored lights so we may proceed with some of our planned biological studies involving sharks and other fishes' responses to sound and light. Articles of clothing were also set out.

1140 - On radio-phone to Washington, D.C. with Rear Admiral Leydon, Office of Naval Research. I spoke with him briefly and turned the mike over to each individual team member for a few words.

At 1200 we all spoke with Cal and Bob Workman in the Experimental Diving Unit, Washington, D.C.

At 1229, Assistant Secretary of the Navy for R&D, Dr. Morris, was on the radio-phone. We all had several social-type chats with him in addition to giving him a status report. Dr. Morris invited us all out some evening with him when we have a chance to be in Washington, D.C.

1254 - After Tiger and myself had unsuccessful attempts to call home, Andy got his wife on the phone in Uncasville, Connecticut. The connection was somewhat poor.

At 1315 we received word from CAPT Bond that there are storm warnings down south and a possible hurricane is heading up this way. We are therefore planning to proceed with pre-lift-off procedures.

We began to clear gear in and around SL, bleed in O₂ to increase our ppm O₂ so as to begin the preparation for removal of inert gases from our body tissues. Plan to get O₂ up to about 64 per cent effective gradually.

1738 - Hook from crane on the way down for removal of the first of four ballast anchors from our ballast bins. Andy's out for this job.

2013 - Fourth anchor on the way up. We plan to ascend at 3 foot per hour after we complete the ckeck-off.

All of us out at different times to complete outside rigging and clearing.

2325 - Anderson in, reports crane hookup ready to go. 2330 - All aquanauts exit SL to SDC for lift off of SEALAB.

Lift-off successful. One quad 21 cable caught on thin nylon line under cage.

2400 - I re-enter SL after cutting the line from the cage to the 21 quad cable, followed by Manning, Barth and Anderson. All checks out OK. We are about 10 feet from the bottom.

We set the watch. Others to bed for rest, as is necessary during decompression and we continue our way up at 3 feet/hour using 1 foot/20 minutes schedule.

30 July 1964

Lift-off and ascent procedures have gone very smoothly, in spite of reported possible increase in adverse weather conditions this evening. We continued observing through the ports on the way up and took many pictures of Argus Tower legs and cross-members and fish.

Except for placing slings on the axial ballast by Andy and Bob Barth, we had sort of a lazy day.

By 1600 the weather picture was much improved and we became able to relax from the idea we may occupy the SDC tonight. Apparently the storm is moving east of us, speed of advance is 17 knots and 30 knot winds.

A significant event in Andy's day was being able to take a smoke in the air space when we were about 112 feet. Bob Barth did the same.

At 1730, another good report. The crane lifting us now, with 10 foot waves, is getting a maximum strain of only \dagger 3 tons. No sweat until it gets in the \dagger 15 ton range.

Because of pressure fluctuations, the Dwyer CO₂ instrument cannot be used for CO₂ readings so we will run the CO₂ scrubbers one-half out of every 1-1/2 hours. That should easily take care of CO₂.

I ducked out at 100 feet to check the distance to Argus Tower-- 10 to 15 feet. The water was very refreshing. Relieved of watch by Tiger.

We continued our decompression ascent until the 81 foot stop where maximum allowable strain on the crane occurred.

31 July 1964

By 0700 we decided to leave SL. At 0735 we entered the SDC and

remained at this 81 foot level for a brief period, then continued ascent and decompression in the SDC while SL was brought to about 50 feet and four large mine buoys attached to keep her positively buoyant. The hook on the SL was removed and we in the SDC were then placed in the crane hook. We were then at the 67-foot stop. The SL drifted away being pulled by the stand off anchor line. We shut the lower door on the SDC and were brought up about 10 feet. The door appeared secure. We undogged it and prepared to be brought all the way to the surface and on the Argus Tower. Andy not really mentioning much at any time before, of fear while performing during operations in and around SL, said he really did not like this lift high up in the air about 70 feet above the water to be set down on the deck. He would not even look out the port. The view was fine and we were gently set down on the deck. Then came the re-establishing of air systems and pressure gauges. Following this period, the SDC was then tipped from the vertical to the horizontal, its normal position, and we began our long sit. Decompression continued roughly at 3 foot/hour. We received food and drink and passed out waste via the medical lock. During the evening we were shown a movie, to view through the ports.

1 August 1964

0817 - Decompression completed.

Upon entering the fresh air, we were greeted by numerous cameras and reporters. I immediately went to CAPT Bond and thanked him for getting us up safely. We had a few minutes to ourselves and then went to the dining room on Argus for what might be called a press conference. Soon thereafter we all entered the helicopter and were whisked away to the Kindley AFB hospital for more medical follow-ups.

By noon we were finished and returned to the Navy Base by bus. We were all quite fatigued. I had a slight headache but soon felt quite well after a long hot shower, and a cool beer soon thereafter. Really slept well that night though; I did not awaken until 1000 on 2 August.

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13. ABSTRACT <p>The author was the medical officer participant in the group of four men who spent ten days in the underwater habitation designated SEALAB I in July-August 1964. This is a day by day account of the experiences and problems encountered by the author during the preparation for the experiment, beginning on 28 April, and during the actual time underwater and during the ascent to the surface and the period of decompression, terminating on the first of August. This particular submarine-qualified medical officer was chosen for this assignment in the SEALAB I project because of his previous training in the fields of marine biology and diving medicine. This personal account is published at this time as a part of the record of the SEALAB series of projects, which are part of the larger Man-in-the-Sea Program.</p> <p>He describes what they ate, how they slept, details of their sorties into the ocean around them; problems due to contamination of their atmosphere; the fish and marine life observed through their portholes or encountered in their excursions outside the SEALAB; as well as their psychological states, their relationships with each other, and their communications with both the support personnel topside and their families at home.</p>			

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