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EXPERIMENTAL TRAINING FOR OPEN-SEA SUBMARINE ESCAPE

by

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Bureau of Medicine and Surgery, Navy Department
Research Work Unit MF12.524.006-9025B.35

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30 March 1970



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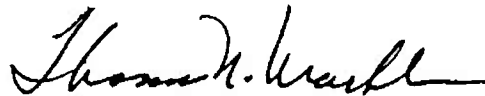
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SUBMARINE MEDICAL RESEARCH LABORATORY
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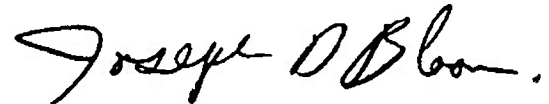
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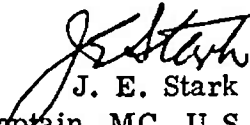
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SUMMARY PAGE

THE PROBLEM

To develop and test a program designed to train non-diver subjects for 100-foot escapes, at sea, from a submerged submarine.

FINDINGS

Five non-diver subjects successfully completed the training sequence which included classroom training and ascents from 50 and 100 feet using the buoyant ascent jacket, the Steinke Hood and the Mark VII Submarine Escape Immersion Equipment. Due to the faster ascent rates involved with the Mark VII Submarine Escape Immersion Equipment, it was determined that trainees should breathe normally during ascent rather than shout "HO-HO-HO", as is standard procedure in escape training at Escape Training Tanks.

APPLICATION

This study provides information applicable to training in use of the Mark VII Submarine Escape Immersion Equipment for actual escapes from a submerged submarine.

ADMINISTRATIVE INFORMATION

This investigation was conducted as part of Bureau of Medicine and Surgery Research Work Unit MF12.524.006-9025B - Assessment of Factors Related to Submarine Habitability, Escape and Rescue. The present report is No. 35 on that Work Unit. The manuscript was approved for publication on 30 March 1970, and designated as Submarine Medical Research Laboratory Report No. 622.

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ABSTRACT

A pilot syllabus was developed for the purpose of training non-diver volunteer subjects for escapes from a submerged submarine at depths down to 100 feet. Five volunteers were put through the training with success. The syllabus included classroom instruction, ladder training, buoyant ascent training, Steinke Hood training and Mark VII Submarine Escape Immersion Equipment (SEIE) training from the 50 and 100-foot levels of the Escape Training Tank. It was concluded that (1) the average, non-diver submariner can be trained for 100-foot escapes; (2) from a medical safety standpoint the training is safe and very similar to routine submarine escape training; (3) instructor attitudes have a great effect on the ability of the trainees to complete successful ascents; (4) the classroom training prior to water work should increase the emphasis given to explanation of air expansion and its effects; (5) it is safe and desirable to have the trainees breathe normally rather than shout "HO-HO-HO" during the ascent, as is done in routine submarine escape training.

EXPERIMENTAL TRAINING FOR OPEN-SEA SUBMARINE ESCAPE

PART I

INTRODUCTION

The Phase II evaluation of the Mark VII Submarine Escape and Immersion Equipment (SEIE) was carried out, for the most part, using Escape Training Tank instructors who are qualified divers. The men are completely "at home" in the water. Their use in the early stages of the evaluation was justified on the basis of safety and their familiarity with the submarine escape problem. However, once evaluation has proceeded to the point where actual at-sea escapes will be demonstrated using the equipment, then it will be necessary to show that the "average" submariner can be safely trained to use the equipment, and that the "average" submariner can, successfully escape from a submerged submarine. A recent report by Goff and Buckbee¹ covered the training implications for deep escape using a suit similar to the Mark VI SEIE (essentially the same as the Mark VII SEIE). Additionally, they presented the equipment and manpower requirements for such training. Their recommendations however were never actually put into practice.

This report, then, presents a submarine escape training syllabus which was developed solely for the purpose of training the "average" submariner. Its use is not intended as a model for future escape training, but as a guide for training subjects to be used in the at-sea escapes which were planned as a

culmination of the Phase II evaluation. In addition to the actual syllabus, this report will present the results obtained when a small group of non-diver volunteers were put through the training.

PROCEDURE

The experimental training syllabus which comprises Part II of this report was followed in total. The only portion of the syllabus not used was the trunk training, Appendix E of Part II. This was not carried out since a submarine is required and the trunk training is designed to be carried out on the submarine from which the actual escapes would be made. It was planned that this phase of the training would be implemented just prior to the at-sea trials utilizing the trunk of the designated submarine. Three methods of escape were employed in the training as outlined in the syllabus. The equipment used for the three methods was: (1) The Buoyant Ascent Jacket, (2) the Steinke Hood; and (3) the Mark VII SEIE. Figure 1 illustrates these appliances. Complete information and data relating to these appliances can be found elsewhere in the series of NSMC reports dealing with submarine escape, e.g., Hall et al², Hall and Summitt³, Parker et al⁴, and Ryack et al^{5,6}.

SUBJECTS

The original group of nine volunteer subjects was obtained from the Pearl



Fig. 1. Subjects wearing the buoyant jacket, the Steinke Hood and the Mark VII Submarine Escape Immersion Equipment

Harbor Submarine Base First Lieutenant's Department. Two chose not to report for training for undetermined reasons. The remaining seven were given complete physical examinations, including 14 x 17 PA chest X-rays, by an NSMC Submarine Medical Officer. One man failed the routine pressure test (112 feet) because he could not

equalize external & middle ear pressures. All subjects were interviewed by the senior author for background information which is briefly summarized in Table I.

As noted in Table I, Subject L was disqualified the first day of training due to his experiencing a severe air

Table I. Subject Profile

Subject	Submarine Qualified	Diving Experience
D	No	None
G	No	Some skin diving
J	Yes	None
K	No	None
L **	No	Some skin diving
P *	No	None
S	No	Qualified civilian SCUBA

* Disqualified, unable to equalize ear pressures

** Disqualified, air embolism

embolism on his first, routine buoyant ascent from the 50-foot lock. This casualty was successfully treated without demonstrable sequelae. Upon questioning, L reported that he remembered holding his breath during the ascent. This subject was medically disqualified from any further participation in this submarine escape training.

The balance of the training sequence was carried out without incident. The remaining trainees conducted themselves well in the water and continued with the program despite the serious casualty which they all witnessed.

RESULTS

At the conclusion of the experimental training course a debriefing session held. This included all personnel involved including trainees, instructors

and project personnel. With respect to the escape appliances, all subjects expressed preference for the Mark VII SEIE as compared with the Steinke Hood or buoyant ascent jacket. It was felt by all present that additional time should be devoted to buoyant ascent training. This is the most critical portion of the training cycle and one in which it is necessary to build up the confidence and ability of the trainees. Additional buoyant ascents which were made from the 50-foot lock were most beneficial and worth the additional time required. It also was agreed that more time should be devoted to the explanation of air expansion in the pre-water work portion of the training. The trainees expressed a desire to know more about this area, no doubt tempered by the casualty which occurred. It was observed that the manner in which the instructors handle the trainees in the

water, e.g., hand signals, attitude, can make the difference between successful and aborted ascents. The instructors in the lock and just outside the lock exit, by their attitude, can do much to build up the confidence of the trainee. It was also determined that the critical time in the ascent was the egress from the lock, especially during the 100-foot ascents. The trainee must be breathing properly (or exhaling in the case of buoyant ascent) and properly oriented if the ascent is to be successful.

Due to the rapid rate of ascent (8-10 feet per second) attained by the Mark VII SEIE, it became apparent during the course of the training that having the trainees use the traditional "HO-HO-HO" during the ascent may be dangerous -- especially from the 100-foot level. The inherent danger was postulated because of insufficient exhalation, and possible obstruction, when saying the syllables intermixed with shallow exhalation. It was felt by all concerned, including the submarine medical officers in attendance, it is far safer for a man to breathe normally during the ascent. Another factor entering into this decision was that the ascent speeds attained made it virtually impossible for the instructors to stop the ascent, especially from the last 30 feet to the surface. Near terminal velocity is probably attained just prior to reaching the surface. Therefore, surface coverage was intensified so as to expedite any emergencies which might arise. Worthy of note on this same point is that the Royal Navy in their submarine escape training at HMS DOLPHIN with the Mark VII do not instruct their trainees to do anything but breathe normally during the

ascent. A final point concerns the rapid ascent rate involved, the man has no time to think of anything -- hence, it is desirable to have him concentrate only on normal breathing. The results of eliminating the "HO-HO-HO" were successful and no subsequent problems arose. All trainees and others who made ascents under the same conditions expressed the feeling they felt much more comfortable during the ascents when not shouting.

CONCLUSIONS

1. The average non-diver, submariner can be trained for 100-foot escapes from a submerged submarine.
2. This training, from a medical safety standpoint, is safe and very similar to routine submarine escape training now being carried out in the submarine force.
3. Instructor attitudes have a great effect on the ability of the trainees to complete successful ascents.
4. The classroom training prior to water work should increase somewhat the emphasis given to explanation of air expansion and its effects.
5. It is safe and desirable to have the trainees breathe normally rather than shout "HO-HO-HO" during the ascent.

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6. Ryack, B. L., Rodensky, R. L. and Walters, G. B. Human factors evaluation of submarine escape: 1B - Escape depth capability of the British submarine escape immersion suit and the Steinke Hood under conditions of side and tube egress. NSMC Report No. 625(c), 17 April 1970.

PART II
EXPERIMENTAL TRAINING SYLLABUS
FOR
100-FOOT AT SEA ESCAPES

EXPERIMENTAL TRAINING SYLLABUS FOR 100-FOOT AT SEA ESCAPES

INTRODUCTION

This pilot training syllabus is designed to train a number of non-diver, submariner subjects in the methods of egress and ascent required to make actual escapes from a submarine at depths down to 100 feet keel depth. The majority of the work accomplished to date in the Phase II evaluation of the British Mark VII Submarine Escape and Immersion Equipment (SEIE) has been done using Escape Training Tank instructors as subjects. In order to evaluate the system more realistically, it was decided that a certain number of non-diver submariners should also make escapes. This should instill additional confidence in the minds of submarine personnel in the Mark VII SEIE and, additionally, will increase the value of the Phase II evaluation since it will have used submarine personnel -- who have had no specialized training in submarine escape. It has been the experience of the Royal Navy that using volunteer submarine personnel accomplishes this end.

Before proceeding, it must be pointed out that this experimental training syllabus is designed for one use only --- that of developing a training program which will be used only to train volunteer subjects for 100-foot at-sea escapes to be done as the final part

of the Phase II evaluation of the Mark VII SEIE. The results of the experimental training and modifications resulting will be used for the final training of volunteer subjects who will make escapes from the still to be designated submarine. If the system is accepted for submarine force-wide usage, the training to be instituted at the Escape Training Tanks at Pearl Harbor and New London will not necessarily follow this outline. Further study will be required before force-wide training is begun.

This experimental training syllabus was developed at a conference attended by representatives of the Naval Submarine Medical Center, the Director of Escape Training Tank, Fleet Submarine Training Facility, Pearl Harbor, and the Officer in Charge of the Escape Training Tank, Naval Submarine School, New London. The detailed lesson plans which are appended to this syllabus are a direct input from the two Escape Training Departments. It was felt by all the attendees at the conference that it was necessary to go through the actual training sequence with the same type of subjects as would be used in the final training for at-sea escapes. This would enable the training personnel to go through the training without the pressure of time lines imposed by impending at-sea trials. It also would enable certain changes to be

made in the training as a result of the experience gained. The specific egress techniques to be used, the stationing of instructors and the content of the lecture material are some of the areas in which changes might be made.

The subjects to be used in the experimental training sequence will be volunteer, submarine personnel. It is desirable, but not necessary, that they have completed other types of submarine escape training. They must have been pressure tested to a minimum of 50 psi (112 feet equivalent). Before being accepted as volunteers for this training, they must have been completely briefed on the training and exactly what is expected of them. At the completion of the training, appropriate health record entries will be made. The basic premise behind this entire training sequence is that no non-diver personnel will make training or demonstration escapes from depths greater than that for which they have been trained in the Escape Training Tank. This training is designed to prepare them for any casualty situation and the appropriate action to be taken. With the exception of the rate of compression the simulation of the at-sea situation will be as realistic as is possible.

SEQUENCE OF TRAINING

The sequence to be followed in this training is as follows:

1. Classroom. The initial classroom training will consist of a lecture which will present the overall situation to the trainee. It will include some historical background and the progression in escape appliances. The philosophy of escape and why at-sea escapes are being planned will be explained. The various appliances to be used in the training will be described and demonstrated, including the buoyant ascent jacket (Steinke Hood jacket with hood unzipped and thrown back), the Steinke Hood and the British Mark VII SEIE. A brief description of the various types of escape trunks found on USN submarines will be given. The final portion of this initial classroom training will be a thorough description of the basic physiological principles involved including the causes and effects of expansion and compression of air volume in the lung with decreasing and increasing pressures.
2. Buoyant Ascent Training. This phase will commence with a short descriptive classroom session followed by ladder (controlled subsurface) training in the water to insure that the trainee is familiar with the required method of exhalation. Buoyant ascents will be made from 50 and 100 feet. The appliance used will be the Steinke Hood jacket with the hood unzipped and thrown back out of the way.
3. Steinke Hood Training. This will proceed much the same as buoyant ascent training with the exception of ladder training. The trainees will be instructed in saying "HO HO HO" during the ascent. Ascents will be made from 50 and 100 feet.
4. Mark VII SEIE Training. After basic classroom training, the trainees will make at least two 100-foot ascents using top egress as found on SS-563 class submarines.

5. Trunk Training. This portion of the training is designed to familiarize the trainee with the basic operation of escape trunks, including hatches, blow, vent and drain valves, as well as the methods of egress to be used in getting out of the various configurations with the various appliances.

actually performing "dry" runs in the escape trunk. Trainees will become familiar with all controls and valves in the trunk. It is not considered that this portion is essential in this experimental training sequence to develop the final training protocol.

6. On-Board Submarine Trunk Training. This will be a part of the training for actual at-sea escapes and will involve going aboard the submarine designated for the at-sea trials and

The outlines or lesson plans for this training are appended to the experimental training syllabus as Appendices A through E. The complete training schedule is presented as Table I.

TABLE I. TRAINING SCHEDULE

1. Muster trainees in classroom for initial training presentation.
2. Trainees remain in classroom for Buoyant Ascent lectures. Trainees issued Buoyant Ascent jackets.
3. Trainees move to Tank top for ladder training.
4. Trainees complete two successful ascents from 50-foot lock using buoyant ascent procedures.
5. Trainees complete one successful ascent from 100-foot lock using buoyant ascent procedures.
6. Trainees return to classroom for Steinke Hood lecture.
7. Trainees complete two successful ascents from 50-foot lock using free breathing ascent procedures (HO HO HO).
8. Trainees complete one successful ascent from 100-foot lock using free breathing ascent procedures (HO HO HO).
9. Trainees return to classroom for Mark VII SEIE lecture.
10. Trainees complete a minimum of two (or more) successful ascents from 100-foot lock wearing Mark VII SEIE and using free breathing ascent procedures (HO HO HO).
11. Trainees return to classroom for trunk training lecture. Trainees move to 18-foot lock for trunk training.
12. Trainees muster on board designated submarine for escape trunk operators course (may not be a part of experimental training course).

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Pearl Harbor, Hawaii

LCDR M. A. Paul, USN
Director, Submarine Escape Training Department
Naval Submarine School
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Groton, Connecticut

TABLE I

TRAINING SCHEDULE

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3. Trainees move to Tank top for ladder training.
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APPENDIX A

OUTLINE FOR INITIAL TRAINING PRESENTATION

OUTLINE FOR INITIAL TRAINING PRESENTATION

A. OBJECTIVE:

1. To acquaint the trainee with the background of submarine escape procedures and the necessity for the present individual escape training, using different appliances.

B. MATERIALS:

1. Steinke Hood, Mark VII SEIE suit, Hold-down Belt.
2. Slide showing various trunk configurations.
3. Chart showing relation of air volume and pressure.

C. PRESENTATION:

1. Introduce self and assistant, if any.
2. Introduce subject of lecture:
 - a. To present background of individual submarine escape and the reason for this special training.
3. Background of submarine escape:
 - a. Progression of methods -- Davis rig, Momsen Lung, free ascent, buoyant ascent, Steinke Hood free breathing ascent, British system using Mark VII SEIE.
 - b. Depth limitations and training required for various methods; hazards involved.
4. Why this specialized training is being done:
 - a. Phase II evaluation to culminate in actual at-sea escapes from an SS-563 class submarine using top hatch egress.
 - b. Value to evaluation of having escapes to 100 feet made by non-diver, submariners.
 - c. No one to make escapes at sea deeper than the depth trained for in the Escape Training Tank.
5. Appliances to be used:
 - a. Buoyant Ascent: Steinke Hood with hood portion unzipped and thrown back.
 - b. Free-Breathing Ascent: Steinke Hood with hood portion intact.

c. Mark VII SEIE Suit:

- (1) Mention thermal properties; the rest to be presented in lecture on Mark VII.

d. Hold-Down Belt:

- (1) To control path of ascent and to enable instructors to have better control of trainee.
- (2) Not used at sea.

6. Escape Trunk configurations:

- a. Side egress found in Fleet and Guppy type submarines.
- b. Torpedo loading tube egress found on nuclear attack and FBM submarines.
- c. Top egress trunks found on 563-class and certain new nuclear attack submarines (SSN-671).
- d. Royal Navy Single Escape Tower (SET):
 - (1) Designed for use with Mark VII SEIE.
- e. Trainees to be given trunk training later in course.

7. Basic Physiology:

- a. Bends or decompression sickness.
 - (1) Depends on depth and time on bottom.
 - (2) Deep escapes "out-run" bends by fast compression and speed of ascent.
- b. Nitrogen Narcosis.
 - (1) Depends on breathing gas mixtures, depth and time.
 - (2) Deep escapes "out-run" narcosis again by fast compression and speed of ascent.
- c. Air Embolism.
 - (1) Caused by expansion of air in lungs rupturing tissue and air bubbles entering pulmonary vessels thence proceeding to other areas such as the brain.

- (2) Show air expansion chart - expansion in going from 100 feet (4 atm abs) to surface (1 atm abs).
- (3) Necessity of free breathing to allow expanding air to escape from the lungs; or continuous exhalation if not in free-breathing situation.
- (4) Treatment by immediate recompression.
- (5) Saying "HO-HO-HO" while ascending enables instructors to insure that trainee is breathing properly.

8. Announce that next lecture on Buoyant Ascent Training will follow immediately.

APPENDIX B

OUTLINE FOR BUOYANT ASCENT TRAINING LECTURE

OUTLINE FOR BUOYANT ASCENT TRAINING LECTURE

A. GO INTO LOCKER ROOM:

1. Take off clothes.
2. Stow in lockers.
3. Valuable box (no change).

B. INTRODUCTION:

1. Introduce yourself and assistant.
2. Why you are here.
 - a. To learn the proper method of individual escape from your submarine.
3. What you will do here today at the Tank.
 - a. Method of leaving locks.
 - b. Go through mock-up.
 - c. Ladder training.
 - d. Number of ascents to qualify.

C. PRESENTATION (USE JACKET):

1. Life Jacket:
 - a. Submarine Escape Appliance.
 - b. Stripped.
 - c. How to inflate.
 - d. Low pressure relief valves.
 - (1) Set at two pounds.
 - (2) Do not tamper with jackets, they are pre-set.
 - e. Has 35 pounds of positive buoyancy when fully inflated.
 - (1) Brings you to the surface at rate of 300 - 400 FPM.
 - f. Charge life jacket until relief valves void off air.
 - (1) Make sure valves are working properly.

(2) Roll head when charging to make "V" in the jacket.

2. Lock Procedure:

a. Flood down then pressurize lock.

- (1) Breathe normal.
- (2) Pop ears to keep ahead of the pressure.
- (3) Ear trouble, raise hand.
- (4) No talking in the locks.
- (5) Will vent lock after it is pressurized.

3. Leaving Lock:

- a. Leave lock in numerical order.
- b. Instructor will inflate jacket.
- c. Start deep breathing.
- d. Right foot out of lock on platform.
- e. Right hand on top of combing.
- f. Do not leave lock until instructor tells you to do so.
- g. When told, take a deep breath, hold it and duck it.
- h. Face the lock.
- i. Look up.
- j. Hold yourself down.
- k. Exhale through pursed lips.
- l. Let go and exhale all the way to the surface.

4. Explain why you will not run out of air.

5. Reaching surface:

- a. Fold arms across jacket.
- b. Do not kick or swim.
- c. Will be assisted out of the Tank.

6. Stopped during ascent:

- a. Failure to see exhalation.
 - (1) Bury head in jacket.
- b. Stop exhalation for a second.
- c. Placed in an air space.
 - (1) Will not continue to the surface.

(2) Placed in roving bell after run.

7. Assistant instructor don belt and jacket and demonstrate equipment.

8. Assistant instructor demonstrate going through the mock-up.

a. Bring out position and exhalation twice.

9. Issue life jackets and put trainees through the mock-up.

APPENDIX C

OUTLINE FOR STEINKE HOOD LECTURE

OUTLINE FOR STEINKE HOOD LECTURE

TITLE: INDIVIDUAL SUBMARINE ESCAPE

A. OBJECTIVE:

1. To acquaint the trainee with the proper techniques for making a safe individual escape from a disabled submarine on the bottom, using the Steinke Hood.

B. MATERIALS:

1. References.

a. NWIP 37 (A) Chapter Four (4).

2. Training Aids:

- a. Training film (MN 9485) Steinke Hood plus RN films.
- b. Mock-up of the door and platform in the 50-foot lock.
- c. Assistant classroom instructor.
- d. Steinke Hood.

C. INTRODUCTION:

1. Establish contact.

a. Introduce self and assistant.

b. Introduce subject.

(1) You are here today to learn the proper techniques for making an individual escape from a disabled submarine on the bottom, using the Steinke Hood.

2. Create Interest:

a. The knowledge you acquire here today may enable you to save your life at some future date.

b. This method of escape is much easier and safer than any previous method.

(1) Even an unconscious man can make safe ascents using this method from depths up to 450 feet or greater.

c. Check condition of trainees:

- (1) Check for head or chest colds in the past week.
- (2) Make sure that all trainees had a pressure test.
- (3) Check for contact lens and false teeth. Remove before training.

D. PRESENTATION:

1. What you will do here today:

a. First you will see a movie showing the Steinke Hood and Training Tank procedures.

- (1) Point out the differences in our method of training and the method shown in the movie.
 - (a) We keep waist belts snug around the body (no two hands in between).
 - (b) Last man entering the lock closes and dogs the water tight door.
 - (c) We pressure the 50-foot lock to 20 feet before we start to flood.
 - (d) The signal for you to go will be the lock instructor telling you to take a deep one and go.
 - (e) You will not receive any signal from the instructors on the platform.
 - (f) You will say (HO HO HO) in groups of three with a short shallow breath in between each group, all the way to the surface. Make the (HO HO HO's) loud and clear.

b. You will be issued hold-down belts and escape appliances and each of you will go thru the mock-up.

c. After the classroom lecture you will be taken to the top of the Tank.

d. Each of you will make two (2) ascents from the 50-foot lock plus one (1) from the 100-foot lock.

e. To complete your training you will receive a short lecture on open sea ascents.

2. Show the movie.

3. After the movie.

a. Please hold your questions until after the presentation is finished. I am sure most of your questions will be cleared up as we go along.

4. Lock Procedures:

a. Have assistant don hold-down belt and escape appliance. Explain each move as he goes along.

b. Put assistant thru the mock-up and explain the procedure in detail.

- (1) This mock-up resembles the door in the 50-foot lock and the platform on the outside of the 50-foot lock where you will be making your ascents from.
- (2) Have assistant don the appliance in the ready position, making sure that the hood is all the way down to his shoulders.
- (3) Inflate the appliance.
- (4) Tell the assistant to step up and put right foot out and his right hand on the combing.
- (5) Always stop charging the appliance (momentarily) while talking to the trainee.
- (6) Tell assistant to take a deep one and go.
- (7) Have assistant remove his appliance and hold-down belt after he has completed his (HO HO HO's) with a short shallow breath in between each group.
- (8) There will be two (2) instructors outside the 50-foot lock on the platform to hold you down until you do everything right.
- (9) If you do not do everything right, the two (2) instructors outside the lock will load you back into the lock and you will have your mistakes pointed out to you and you will be allowed to try again.

5. Method:

a. You will enter the lock in numerical order.

b. The last man to enter the lock will close and dog the outer door.

c. If you have any trouble equalizing the pressure in your ears, raise your hand and get the attention of the lock operator and he will stop pressuring and vent off the pressure until you equalize your ears with pressure in the lock. Do not hurt your ears!!!!

d. While the lock is being pressured or vented off, breathe normal.

e. Once the lock is flooded and pressured and the escape door is open, the lock operator will vent the lock for at least ten (10) seconds.

f. When we are ready to start training, the lock operator will tell the first man to step up and put his appliance on.

g. At this time the first trainee will dump the water out of his hood and put on his appliance, making sure that the hood is all the way down on his shoulders.

h. As soon as your hood is on, he will inflate your appliance with air.

i. The lock operator will then tell you to step up to the hatch, put your right foot out and your right hand on the combing.

j. When the lock operator tells you to "take and deep one and go", I want you to:

- (1) Take a deep breath (all you can possibly hold) and hold it.
- (2) Push yourself to a sitting position on the inside of the hatch so that you can get your head out first. Come thru the hatch sideways, putting you head out first. Do not back out the hatch!!!!
- (3) Get out on the platform and face the door, holding yourself well down with both hands and the door combing.
- (4) Exhale one half ($\frac{1}{2}$) of your breath.
- (5) With the other half ($\frac{1}{2}$) start saying HO HO HO (loud and clear). At the same time release your grip, bring your hands up over your head and interlock your thumbs. Do not kick your feet or jump off the platform.
- (6) Take a short shallow breath and continue your HO HO HO's with a short shallow breath in between each group of three, all the way to the surface.

(7) Illustrate the rhythm we desire (keeping them loud and clear) HO HO HO, Short Shallow Breath, HO HO HO, Short Shallow Breath, and repeat if necessary.

6. Do not break your hands apart until you reach the surface unless you want to be stopped.

a. Explain in detail about the hands:

(1) Breaking your hands apart at any time during your ascent is the signal that you want to be stopped.

(2) You will be stopped even if you break your hands apart accidentally.

7. When you reach the surface, relax!

a. Fold your arms across your appliance.

b. Climb out of the water quickly when told to do so.

c. Deflate your appliance and assume your position on the white line.

d. There will be no unnecessary talking topside or in the lock.

e. We have a head topside for your use.

f. If you do not feel well at any time, inform any instructor immediately.

8. Miscellaneous:

a. The water temperature in the Tank is maintained at 92 degrees.

b. You will be split up into two (2) groups. Stay in your assigned group unless otherwise instructed.

c. On the first ascent, low numbers will leave the lock first, working up.

d. On the second ascent, high numbers will leave the lock first, working down to the lowest numbers.

e. Should your hood rupture or slip off your head, exhale continuously thru pursed lips all the way to the surface or until you are standing up in an air space.

f. When you are ascending thru the water, one of the instructors will ride you from the 18-foot level to the surface.

(1) The man is a safety man because we have no air space between the 18-foot lock and the surface.

(2) Just continue with your normal ascent when you feel him on you.

g. In the event of any emergency requiring the immediate evacuation of the Tank, the trainees will follow the instructions of their immediate instructors. All trainees will use the ladder to come from the Tank top.

9. Issue hold-down belts and appliances.

10. Cotton Balls (Alcohol).

a. Each one of you clean the mouth piece on the escape appliance issued to you and discard the cotton in the container provided.

11. Put the trainees thru the mock-up:

a. HO HO HO's must be loud and clear with a short shallow breath in between each group.

b. Keep hands together with thumbs interlocked.

12. Make sure all instructors are topside before bringing the trainees topside.

13. Take trainees topside.

APPENDIX D

OUTLINE FOR BRITISH MARK VII SEIE LECTURE

- a. Greet class.
 - (1) State name and rate.
 - (2) Form 2 groups (10-men each).
 - (3) Introduce second instructor and write name and rate on board.
 - b. Secure class cooperation.
 - (1) State need for:
 - (a) Paying close attention.
 - (b) Asking questions.
2. Scope of lesson:
- a. State objectives:
 - (1) Submarine Escape Immersion Suit method of individual submarine escape.
 - b. Method provides safe procedure to follow in order to escape from a depth in excess of 400 feet.
 - c. Rate of ascent is 540 feet/minute.
3. Outline of instruction.
- a. Approximately four (4) parts.
 - (1) Classroom.
 - (2) Demonstration by second instructor.
 - (3) One (1) or more ascents from 100 feet.
 - (4) Instructor coverage.
4. Create personal interest.
- a. Relate own personal experience.
 - b. Establish simplicity of escape method.
 - c. Explain surface survival capabilities.
5. Establish trainees learning goals.
- a. Equipment required to make a successful SEIE escape, its parts, names and how the equipment operates.
 - b. How to prepare for and make an escape.

D. PRESENTATION:

1. Show slides.

2. Exhibit SEIS.

a. British Standard appliance for individual submarine escape.

b. Explain exposure part of suit, 2 layer etc. and how attached to buoyancy part of suit.

3. Demonstrate SEIS.

a. Proper method of putting on SEIS.

(1) Second instructor put on SEIS.

b. Parts nomenclature.

(1) Explain use of diaper.

(2) Goggles.

(3) Nose clip.

(4) Whistle.

(5) Relief valves.

(a) Down-open (1/2 psi over bottom pressure).

(b) Out-locked closed.

c. Inflation umbilical cord.

(1) Explain charging connection and use. Can be used to deflate stole (Mae West).

(2) Inflate partially to demonstrate oral method.

(3) Finish inflating using HIS.

(4) Deflate by depressing umbilical valve fitting.

d. Inflation and deflation of Exposure Suit Portion.

(1) Explain double material with neoprene type staple to make pockets for insulation, double-layered suit, waffled.

(2) CO₂ cartridge (Danger - during escape - OPERATE ONLY ON SURFACE.

(3) Oral inflation tube also can be used to deflate suit.

- e. Salt water battery and light.
 - (1) Show battery and explain it works only in salt water and that light is white.
 - f. Exposure Gloves.
 - (1) Used only on the surface.
 - (2) Demonstrate method of blowing up orally.
 - g. Water Proof Zipper.
 - (1) Demonstrate proper method of operation (hold top of hood or bottom of hood so as not to rip material).
 - h. Hood.
 - (1) Clear plastic to see through.
 - (2) Rip tab in case zipper sticks.
 - i. Safety Belt.
 - (1) Used only in Tank.
 - (2) Explain purpose (stop trainee for observation).
 - (3) Traveling Lanyard (1. Have instructor wire shaft lanyard. 2. Provide safe route to surface.).
4. Lock Flooding Procedures (for 50 feet and 100 feet):
- a. Lock entry five (5) men and instructors (2).
 - b. Flood lock to 4" over lower lip of hatch.
 - c. Trainee climb up to top of trunk and plug in to HIS.
 - d. Three (3) taps --- ready to flood.
 - e. Commence pressurizing as fast as possible.
 - (1) Water should go up trunk with vent open simulating single escape tower.
 - (2) As soon as pressure equalizes with Tank depth upper hatch will open, trainee will rise to approximately knee level in hatch. Outside instructors will talk to trainee and change lanyard. Trainee then will travel to surface at approximately 540 feet/minute.
5. Lock Draining Procedure:
- a. Tank Instructor closes upper hatch.
 - (1) 110 foot lock instructor opens vent wide. As pressure drops to atmospheric, water in trunk will drain down.

APPENDIX E

OUTLINE FOR TRUNK TRAINING COURSE

OUTLINE FOR TRUNK TRAINING COURSE

Ref: NWIP 23-6(a)

A. INTRODUCTION:

1. Introduce self to class. Put class at ease.
2. Check for pressure test, x-ray, bad colds, etc.

B. OBJECTIVE:

1. To teach the proper method of making an individual escape with the STEINKE HOOD and the MARK VII SEIE from an escape trunk on a bottomed submarine.

C. TRAINING TO BE GIVEN:

1. Lecture on escape procedures including:

- a. Advance preparations. (General)
- b. Escape trunk procedures.
- c. Surface procedures.

2. Actual flooding and pressurization of 18 foot lock under escape conditions. (Note: Care must be taken not to rupture ear drums during training but it must be emphasized that rapid pressurization, especially at deep depths is essential during actual escapes.)

D. PRESENTATION:

1. Lecture. Following points to be covered:

a. Advance preparation. Most important part of escape. Study individual escape bills in own submarine. Insure that all hands know what to do before proceeding with escape. Issue and check hood for leaks. Get rid of as much CO₂ as possible. Establish communications with other end of boat. Remove pyrotechnics to other room or torpedo tube. Rig and check escape trunk in accordance with escape bill. Check communications, lights, escape door or hatch undogged, latch secured open, other doors or hatches dogged closed. Vent trunk for at least 10 seconds to clear line of dirt, oil, etc. Remove ladder and other obstructions. Form men in escape teams of 3 or 4 men with escape captain. Brief escape captains and have them brief their teams. (Note: Fleet type trunks have 3 man escape teams. Other trunks have 4 man escape teams.)

b. Escape Trunk Procedure: Team captain brief men of duties. Assign one man to operate air to appliances, another to keep pressure on

escape door. Enter trunk with Steinke Hood over head breathing through snorkel or the British Mark VII SEIE with the hood unzipped. Snap on charging connections to the Steinke Hood or zip off the Hood on the Mark VII SEIE and charge with the HIS Controller. Make quick check of trunk to insure escape door or hatch is undogged and latch secured open. Check air to appliance charging manifold. Main stop valve closed, individual hose valves open. Vent compartment for at least 10 seconds. Close lower hatch, open vent and flood trunk to water mark. Inflate appliances on signal from escape captain. On signal from captain, close snorkel and remove from mouth, take a deep breath and breathe normally as he pressures lock as rapidly as possible. Do not worry about ears. Ruptured drum not painful or serious. DO BREATHE NORMALLY. When door opens, secure air to trunk. First man take a deep breath, step outside holding self down well. Exhale about one half breath, release hold, bring hands overhead and breathe normally all the way to surface. Use hands to guide yourself clear of obstructions in the water or on the surface. DO NOT FORGET ----- BREATHE NORMALLY. When making escape, try to stay within the allowable time limits posted in the trunk. If you exceed this time, make your escape anyhow. It is just as dangerous to go back in the boat. Bends is not always serious and in many cases requires no treatment. Last man out should insure air is secured to facilitate draining trunk for next group.

c. Surface Procedure: With the Steinke Hood, open snorkel and breathe through snorkel. If you desire, you may remove hood by unzipping. With the British Mark VII Suit unzip the hood or tear away the hood strip. Form groups and remain together. If an unconscious man has been sent up in hood, one man who proceeded him should be designated to unzip his hood and care for him on the surface. Use oral inflation tube to keep stole inflated.

d. Review: Remember, advance preparation is the most important factor in successful escape. Review instructions before attempting escape. Time under pressure should be kept to an absolute minimum at deep depths. Try to remain within maximum allowed time limits posted in trunk but make your escape regardless of the time element. BREATHE NORMALLY all the way to the surface. Try to relax and think of what you have to do. This appliance will save your life from depths in excess of 400 feet if you obey a few simple rules. RELAX, THINK, FAST PRESSURIZATION OF TRUNK, BREATHE NORMALLY DURING ASCENT.

2. Actual Flooding and Pressurization.

a. Trainees will be taken to 18 foot lock which will be rigged to look as much as possible like the escape trunk on a submarine. Instructor will go through entire procedure with trainees on dry runs including advance preparations; rigging of trunk; venting; flooding; and pressurization. Instructor will then act as team captain and actually flood and pressure lock. Trainees and instructors will use only Steinke

Hoods during this run. Each man will then repeat the entire procedure acting as team captain. Instructor will act as safety observer.

3. Post Training Question and Answer Period: Ask trainees if they have any questions. Clear up any misunderstandings. If requested, go to trainees ship and explain difference in tank lock and ship lock.

4. The above training will be repeated in escape trunks of designated submarine at appropriate time before at-sea escapes.