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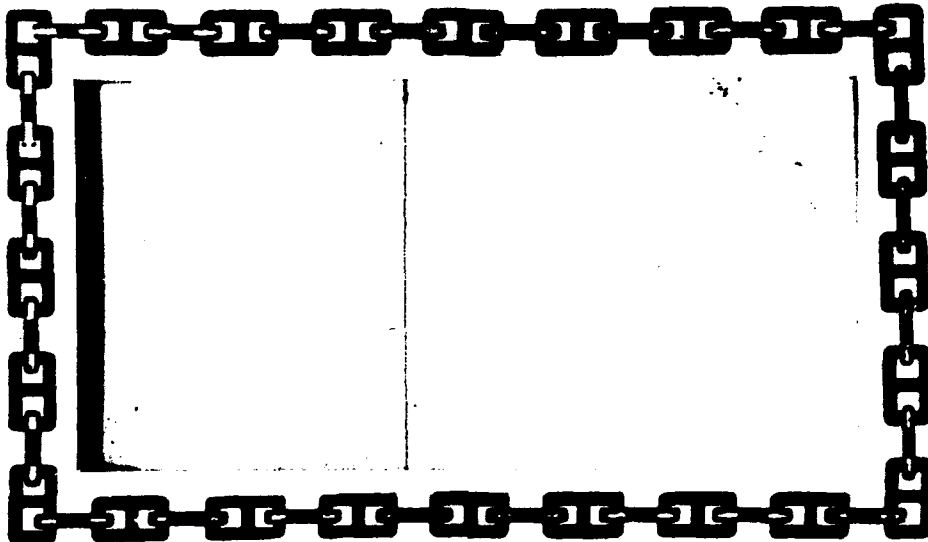
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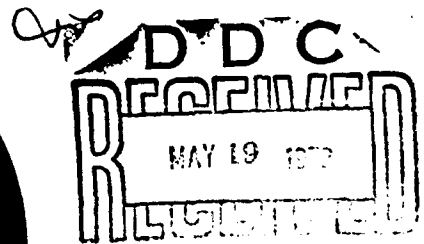


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NAVY EXPERIMENTAL DIVING UNIT
WASHINGTON NAVY YARD
WASHINGTON, D.C. 20390

14
NEDU-

EVALUATION ~~SECRET~~ -17-57

6 SUBJECTIVE EVALUATION OF SCOTT AVIATION CORP'S
CONSTANT FLOW SHALLOW WATER DIVING UNIT

PROJECT NS185-005, ~~SUBTASK 2, TEST 12~~

11 ~~GEORGE HASLIP~~
15 FEB ~~1957~~

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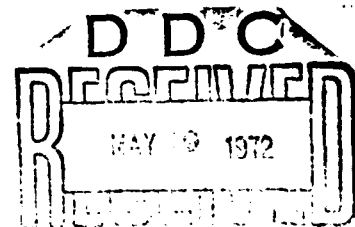
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Wash D.C. 20390

BUREAU INFORMATION TO BE WITHELD

1. It was the general consensus of opinion of all the divers who tested the Scott mask that it was equal to or better than the DESCO (Jack Brown) mask when diving without the dress. The comfort of the mask is a major selling point, particularly for long dives.
2. The only deficiency of note is the location of the non-return valve at the diver's belt (approximately three feet of hose) rather than at his mask. Subsequent to the completion of the project as originally planned, the non-return valve was placed directly adjacent to the control valve and three dives made to determine the effect of this increased off-center weight on the fit of the mask and the manipulation of the control valve. The slight additional off-center weight was not noticed and there was no additional mask leakage.
3. The Scott non-return valve appears to be slightly heavier than the standard non-return (8 ozs vs. 4 oz). It is suggested that if the Scott mask is procured, the standard non-return valve could be used rather than the Scott non-return valve.
4. It is recommended that several Scott constant flow shallow water diving masks be given field evaluation by the forces afloat and that, if satisfactory, the mask be considered as a suitable substitute or competitive item for the Standard U.S. Navy shallow-water mask.

ABSTRACT

This evaluation was made to determine the suitability of the Scott Constant flow shallow water mask as a possible substitute for, or replacement of the U.S. Navy Standard DESCO shallow water mask.

The Scott constant flow shallow water diving mask was evaluated subjectively by pressure tank dives, and the comments are a composite of the subject's opinions. The results are discussed and lead to recommendations concerning modifications required prior to certification as "recommended for naval service".

The mechanical workmanship of the Scott constant flow shallow water diving mask is quite good, the design is simple, the maintenance is easy and it has a greater field of vision than the DESCO mask.

The Scott constant flow shallow water mask is not, in its present form, certified as recommended for naval service, although the basic design is very good and in most features equals that of the standard DESCO mask. The most serious deficiency is the location of the non-return valve too far from the mask. It was found that the Scott mask is harder to clear when flooded than the Standard DESCO mask.

It was also found that the Scott mask ejected a fine spray of water on the subject's face, around the control valve area and that there was excess leakage and difficulty in donning the mask when worn over a lightweight diving dress.

SUMMARY

PROBLEM

Can the Scott constant flow shallow water mask be accepted as a substitute for or as a replacement of, the U.S. Navy Standard DESCO shallow water diving mask?

FINDINGS

The mechanical workmanship of the Scott constant flow shallow water mask is quite good. It is simple in design and easy to disassemble for cleaning and maintenance. It provides a comfortable face mask and has a greater visual range than the standard DESCO mask.

The non-return valve however, is located too far away from the mask. The Scott mask is harder to clear when flooded than the Standard DESCO mask. The Scott mask ejects a fine spray of water into the mask from the control valve area. The Scott mask is not compatible with the light weight diving dress due to leakage and difficulty in donning.

CONCLUSION

The Scott constant flow shallow water mask is not suitable as a substitute for, or as a replacement of, the Standard DESCO mask at this time.

ADMINISTRATIVE INFORMATION

- Ref: (a) BuShips ltr S94/1 (588) ser 588-511 of 18 Feb 1956.
(b) EDU Evaluation Report 9-51; Scott Model 8300 Scuba.
(c) EDU Evaluation Report 4-55; Comparison of Demand Scuba.
(d) EDU Research Report 2-57; Surface Supply Conversion
(e) BuShips ltr S94/1 (538) ser 538-771 of 15 Mar 1957.

Reference (a) requested that an evaluation of the Scott constant flow shallow water mask be made by E.D.U.

Reference (b) is an evaluation report by EDU of the Scott model 8300 Scuba.

Reference (c) is an evaluation report by EDU on Comparison of Demand Scuba.

Reference (d) is a research report by EDU on Surface Supply conversion.

On 18 February 1956 by reference (a), the Bureau of Ships directed the Experimental Diving Unit to evaluate the "Scott constant flow shallow water mask" and assigned the project number NS185-005 SubTask 2, Test No. 12.

George Haslip, GM1(DV), USN was designated project engineer.

Work commenced on 11 February 1957 and was initially completed 15 February 1957. Reference (e) subsequently requested that the project be amended to include an investigation of the compatability of the mask with the standard navy non-return valve and the standard lightweight diving dress. This work was completed on 2 April 1957.

The following breakdown indicates the manhours expended for this evaluation:

<u>DESCRIPTION</u>	<u>MANHOURS</u>
Preliminary Setup	4
Subjective Runs	28
Photography	4
Report Preparation	26
Report Typing and Duplication	<u>16</u>
TOTAL	78

This manuscript was submitted for review on 15 February and was originally accepted on 18 February 1957. It was subsequently amended in view of reference (e) and resubmitted and accepted on 2 April.

This report is issued in the evaluation report series, distributed only by the Bureau of Ships. It is the first and final report for the project.

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Figure 1 - Scott Constant Flow Shallow Water Mask.

Figure 2 - Diver Wearing Scott Constant Flow Shallow Water Mask; front view.

Figure 3 - Diver Wearing Scott Constant Flow Shallow Water Mask; right side view.

1. OBJECT

1.1 Introduction

1.1.1 The Scott Aviation Corporation, in order to enter the market of shallow water control valve-type lightweight diving mask, has modified their standard molded face piece as used with the Scott Hydro-Pak scuba, by removing the demand valve and replacing it with a control valve.

An original unit submitted has an intergal non-return valve in the Control Valve portion of the mask, but in an effort to reduce the weight of the mask, the non-return valve has been relocated. It is now on the belt connected to the Scott mask with a length of hose.

1.2 Objective

1.2.1 The objective of this project is to determine the suitability of the Scott constant flow mask as a substitute for, or a replacement of, the Standard DESCO (Jack Brown) shallow water mask.

1.3 Scope

1.3.1 The scope of this project is to evaluate the Scott constant flow mask and non-return valve combination towards as assessment of its acceptability for use as a shallow water diving mask in competition with, or as a substitution for, the DESCO Standard U.S. Navy mask. Work shall be aimed at making a specific statement as to whether or not the Scott mask has advantages or disadvantages as compared to the standard mask. All evaluation shall be subjective.

2. DESCRIPTION

2.1 General

2.1.1 The Scott constant flow shallow water diving mask is a standard Scott Hydro-Pak mask, converted to a constant flow mask by the use of an air control valve, which replaces the demand type regulator.

It consists of a molded rubber face piece and six adjusting straps. An air control valve is located at the right side of the mask, and an exhaust valve is located on the left side. A length of rubber hose connects the air control valve to the non-return valve, the latter being secured at the diver's belt.

2.1.2 The Scott constant flow shallow water mask is shown in figure (1) and is composed of the following parts.

- (1) Molded rubber facepiece
- (2) Circular face port
- (3) Adjusting harness
- (4) Leader hose
- (5) Non-return valve
- (6) Air-control valve
- (7) Exhaust valve

Figures 2 and 3 show the Scott mask being worn by a diver.

3. PROCEDURE

3.1 The depth tests were made subjectively in a pressurized, water filled tank, using ten experienced deep sea divers as subjects. Ten dives were made to random depths, the deepest to 150 feet, using the Scott constant flow mask and then a Standard DESCO shallow water mask for comparison. After each dive the subjects answered a prepared questionnaire, the purpose of which was to enable a constructive criticism.

3.2 Back pressure tests were applied to the Scott non-return valve with pressures ranging from a minimum of 1/2 P.S.I. to a maximum of 100 P.S.I. in increments of 25 P.S.I.

3.3 After all subjective dives were completed, the control valve and non-return valve were dismantled and evaluated for ease of maintenance, and especially desirable or undesirable features in comparison with the Standard DESCO mask.

3.4 Three dives were made using the Scott mask on a diver dressed in the Standard Lightweight Diving Dress ("Zoot Suit") and with a standard non-return valve in lieu of the Scott non-return valve. Depth of dives was 150, 100 and 50 ft. The operation (manipulation and leakage) of the valve was carefully observed and the subjects made detail and general comments concerning the compatibility of the mask with the suit.

3.5 A comparison of the visual field and distortion characteristics of the two masks has been accomplished under Experimental Diving Unit Evaluation Report 4-57, "Visual Field Perimeters and Distortion in Diving Masks". Reference has been made to this report in the overall comparison of the two masks.

4. RESULTS

4.1 Pressure Tank Tests

4.1.1 Ten subjects were used to evaluate the Scott constant-flow shallow water mask. Subjects performed all dives in a pressure tank wearing swim trunks, weight belt and mask only. Each subject was required to fill out a prepared questionnaire. The following answers are a composite of the individual answers.

4.1.2 Q. Comment on the general fit and comfort of the mask.

A. The general fit of the mask was considered very good and much more comfortable than the DESCO mask when worn for long periods of time.

4.1.3 Q. Did you have to adjust straps more frequently than you normally would expect with a DESCO mask?

A. The straps do not have to be adjusted more frequently than the DESCO mask. When the Scott mask is properly adjusted on the surface, it remains adjusted throughout the remainder of the dive.

4.1.4 Q. The DESCO mask has five adjusting straps; the Scott six; does this make any difference to you? Have you a preference?

A. Most subjects preferred the six Scott adjusting straps; because of the better adjustment obtained over the five DESCO adjusting straps. The Scott straps were much more comfortable in the area around the subject's ears.

4.1.5 Q. Comment on the ease of reaching and manipulating the control valve as compared to the DESCO.

A. The ease of reaching and manipulating the control valve was the same on each mask.

4.1.6 Q. Comment on the relative number of turns necessary to get and adjust air as compared with the DESCO mask. How many turns to full open?

A. To receive enough air with the Scott mask, it requires more turns as compared to the DESCO Mask. However, this is not considered a disadvantage. A Scott mask requires 5-1/2 turns to full open, compared to 3-1/2 turns with a DESCO.

4.1.7 Is there any peculiar noise condition in the Scott mask as compared to the DESCO?

A. There was no peculiar noise condition noted.

4.1.8 Q. The rubber in the Scott mask seems to be more flexible than the DESCO. When you manipulate the control valve does the mask distort?

A. There was no apparent distortion.

4.1.9 Q. Does any leakage occur in the Scott mask?

A. A slight leak occurs in the Scott mask in the area of the control valve. This leak caused a fine spray of water to be ejected against the subject's right cheek.

4.1.10Q. Does the control valve flop around, due to its weight, when swimming or working?

A. The control valve does not flop around when swimming or working.

4.1.11Q. Do you notice any lopsidedness in weight as compared with the DESCO?

A. There is no apparent lopsidedness in weight as compared with the DESCO.

4.1.12Q. Comment on the ease of clearing the Scott mask of water as compared to the same operation of a DESCO.

A. The Scott mask definitely is harder to clear of water than the DESCO. This is probably due to the flexibility of the molded rubber facepiece.

4.1.13Q. Describe any malfunctioning of the control valve during your dive.

- A. The control valve worked very well, and there were no deficiencies noted.

4.1.14Q. Comment on the directional flow of inlet air as it may affect a pressure on the side of the face or any excess noise in the right ear as compared to DESCO.

- A. The directional flow of inlet air, and all noises that are involved with the Scott, are exactly the same as the DESCO.

4.1.15Q. Is there any relative difference between the two masks as regards the washing action of the air in clearing fog from the faceplate?

- A. There is no relative difference between the Scott mask and the DESCO mask as regards the washing action of the mask in clearing fog from the faceplate.

4.1.16Q. Do you notice any affect from the difference in volume of the two masks?

- A. There is no apparent difference in volume between the Scott mask and the DESCO.

4.1.17Q. Do you notice any affect from the difference in flexibility of the mask's rubber sides as regards the mask collapsing against the face on inhalation?

- A. The Scott mask does not collapse against the face on inhalation, providing the proper amount of air is being used.

4.1.18Q. Do you have a preference between the Scott mask with control valve and the standard DESCO shallow water mask?

- A. Most subjects preferred the Scott mask because of the comfort obtained on long dives, the good fit of the Scott mask, and the fact that the Scott is more securely held to the face. Although the subjects like these features of the Scott mask, they feel that the straps on the DESCO are much stronger; the DESCO is much easier to clear of water; and it does not leak as much as the Scott mask. The subjects also prefer a non-return valve located on the mask, as on the DESCO, instead of a non-return valve located on the belt, as in the Scott.

4.2 Non-Return Valve Test

4.2.1 Back pressure tests were applied to the Scott non-return valve with pressures ranging from a minimum of 1/2 P.S.I. to a maximum of 100 P.S.I. in increments of 25 P.S.I. There was no leakage of air at any point.

4.3 Compatibility Tests

4.3.1 Three subjects were dressed in the "zoot-suit" and performed dives to 150, 100 and 50 feet wearing the Scott constant-flow shallow water mask. The diver on the 150 foot dive experienced a minor suit "squeeze" which was attributed to the depth of dive (this is not uncommon in the "zoot-suit") and not to the Scott mask.

4.3.2 The general feeling of the three subjects was that the Scott mask was inferior to the DESCO mask when used in conjunction with the lightweight diving dress. Specific comments follow:

- (1) The Scott mask leaked considerably more around the edges in way of wrinkles or folds in the dress face gasket.
- (2) The leakage in the Scott mask presents a problem of causing a constant mist stirred up inside the mask by the injection of supply air. The Scott mask fits the chin and lower face very closely, providing no reservoir for water other than at the lower lip. The DESCO mask, being held away from the lower face and chin by the stiffness of the rubber presents a reservoir lower down and apparently out of the jet of supply air. The subjects objected both to the mist and to the reservoir of water at the mouth in the Scott mask.
- (3) It was noticed that the Scott mask was slightly harder to don prior to the dive, there being some obstruction from the top of the dress in pulling the straps over the head and also in distending the dress face gasket to obtain a good facepiece seal. This problems was magnified underwater and one diver reported near inability to redon the mask. Particular trouble underwater was inability to get the strap clear to pull over the heads, the lower two straps fouling in the mask and over the head.

4.3.3 The Scott non-return valve was replaced by a Navy standard non-return valve. The exchange is not possible at the supply end of the leader hose (manufacturer's position for the Scott valve). At this location the Navy valve leaked. It was determined upon investigation that the male end of the Scott valve and the female coupling of the leader hose were beveled to provide a seat. The Navy valve not being beveled did not seat adequately.

4.3.4 The Navy standard non-return valve was placed directly adjacent to the control valve (this is in conformance with the comments of article 4.1.18 above), eliminating the leader hose. No leakage occurred in this location and the operation of the valve was in all respects satisfactory. The additional weight at the mask presented no problem.

4.4 Mechanical Evaluation

4.4.1 After all dives had been completed, the Scott air-control valve and the Scott non-return valve were disassembled to evaluate the ease of disassembling and maintenance. They were found to be equal to the standard valves.

4.4.2 A comparison of the weight of the Scott vs. DESCO masks is as follows:

(1) Scott Mask and control valve	21lbs 6oz.
Leader hose	9oz.
Non-return valve	8oz.
	31lbs.7oz.
(2) DESCO	
Mask and control valve	21lbs.14oz.
Non-return valve	4oz.
	31lbs. 2oz.

4.5 Visual Characteristics

4.5.1 Referring to the Visual Field Perimeter project, Experimental Diving Unit Evaluation Report 4-57, a visual perimeter comparison was made between the Scott mask and the standard DESCO mask. It was determined that the DESCO mask had a visual perimeter of 40° on a horizontal scope, 40° at the upper scope, and 50° at the lower scope. The Scott mask had a visual perimeter of 49° at all angles, indicating that the Scott mask has a slightly greater range of vision at most angles, in comparison with the DESCO mask. The distortion characteristics of the two masks are essentially the same.

5. DISCUSSION

5.1 General

5.1.1 The general design, mechanical workmanship, and finish of the Scott constant flow shallow-water mask are quite satisfactory, all subjects agreed that when not wearing a dress, the comfort of the Scott mask and the six strap method of securing the mask to the subject's face were superior to the standard DESCO mask. However, most subjects felt that the straps on the Scott were not strong enough to withstand hard use; a fine spray of water enters the mask in the area of the control valve; the Scott does not clear as easily as the DESCO when flooded; and the non-return valve would not be of any use in the event a rupture of the hose should occur between the mask and the non-return valve, which is located at some distance from the mask.

5.1.2 The Scott mask was considered inferior to the DESCO mask as regards compatibility with the Navy standard lightweight diving dress ("zoot suit") primarily because of the increased tendency to leak and the difficulty in redonning the mask underwater.

5.1.3 The Scott mask is compatible with the Navy standard non-return valve if the valve is located directly on the control valve. This position is preferred in any case and so the non-compatibility of the Navy non-return valve with the Scott leader hose presents no difficulty.

5.1.4 The Scott non-return valve and air-control valve were found to be mechanically equal to those on the standard DESCO mask; a greater range of visibility is obtained at most angles from the Scott mask as compared with the standard DESCO mask.

5.1.5 The DESCO mask is 5 oz. lighter than the Scott mask (including leader hose). If the Scott non-return valve were attached to the mask, the Scott unit, (excluding hose) would then be 4 oz. less than the DESCO. Using a Navy non-return valve attached to the Scott control valve, the entire unit is 8 oz. less in weight than the DESCO. This latter is a distinct advantage.

5.2 Specific comments

5.2.1 The most serious objection to the Scott mask which was voiced by the subjects was the location of the non-return valve at the end of a leader hose. In the event of a rupture in the leader hose, there would be no non-return protection. This objection is eliminated if either the Scott or Navy non-return valve is located at the control valve. Since there is no mechanical preference between the two, the Navy non-return valve is preferred because of its lighter weight.

5.2.2 The subjects seemed to feel that the securing straps on the Scott mask were not strong enough to stand long and rough treatment. This may be an erroneous observation stemming from a psychological reaction to the lighter material used. The difficulty in donning the mask, particularly over the "zoot suit" is, however, a serious objection. A possible improvement could be effected by lengthening the two lower straps at least two inches and the center two straps one inch. Additional subjective evaluation would be in order.

5.2.3 The spray of water or mist in the mask is a disadvantage. A redesign of the air baffle might improve the misting but the high reservoir of water is a feature of the Scott mask stemming from the close fit at the chin and lower face. The close fit is in itself an advantage. This deficiency would best be attacked by eliminating leakage into the mask and/or improving the clearing features.

5.2.4 The fact that the Scott mask does not clear quite as easily as the DESCO mask is a minor deficiency and is probably due to the close fit of the mask to the chin and lower face and to the more flexible edges of the mask.

5.2.5 The comment that the Scott mask leaks more than the DESCO, should not be considered with alarm. The leakage is not severe and would not be objectionable to a diver in the habit of wearing the mask. The leakage in the Scott mask when worn over a dress is a distinct disadvantage, especially so in view of the difficulty in clearing. An initial comparison of the two masks would seem to lead to the expectation of less leakage, rather than more, with the Scott mask in view of its form fitting shape. The softness of the rubber in the Scott mask, however, allows the mask to stretch when pulled-up by the straps whereas in the DESCO the straps pull the entire mask back into the face (rather than around it), gaining a better seal all around.

The stiffness of the frame in the DESCO mask is also probably the reason that it forms a better seal on the dress by pushing harder against any creases in the facepiece gasket and squeezing the gasket into a self-seal. The better clearing characteristics of the DESCO mask are also probably due to the stiffness of the frame and consequently a larger clearing area when the mask is pulled out from the face.

6. CONCLUSIONS

6.1 Findings

6.1.1 The Scott constant flow shallow water diving mask is found to be a comfortable, well built diving mask, which adequately fulfills its purpose as a shallow water mask. However, before it can successfully replace the standard DESCO mask, the deficiencies (Section 5.2) should be corrected.

6.2 Conclusions

6.2.1 It is concluded that the Scott constant flow shallow water diving mask, in its present form, is not suitable for recommendation as a substitute, or a replacement for the Standard DESCO mask, primarily because of the non-return valve, which is located so far from the mask, the difficulty in clearing and the difficulty in donning over a lightweight diving dress.

6.3 Recommendations

6.3.1 It is recommended that the following deficiencies be corrected:

- (1) Relocate the non-return valve to a position on the mask (use of the standard non-return valve is preferred).
- (2) Eliminate the fine spray of water which enters the mask from the control valve area.
- (3) Reinforce the securing straps and the sections of the mask which contain the securing strap buckles and lengthen four lower straps.
- (4) Make the mask easier to clear when flooded.

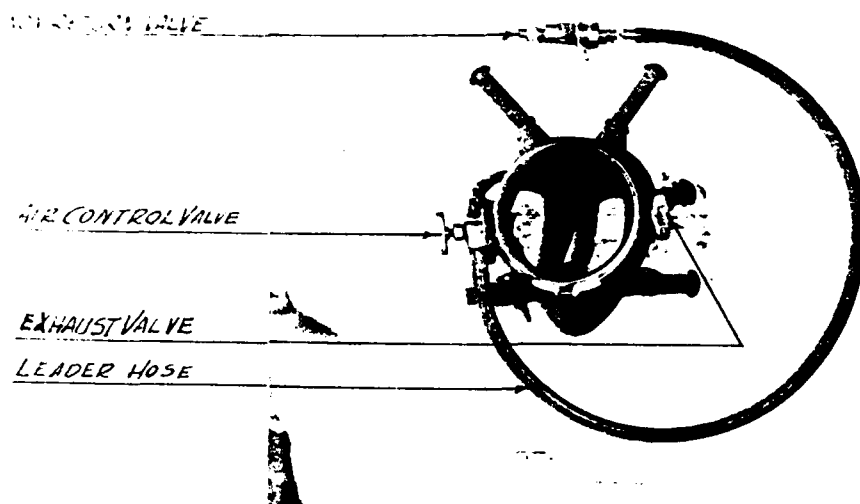


FIG. 1



FIG. 2



FIG. 3

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13. ABSTRACT

This evaluation was made to determine the suitability of the
Scott Constant flow shallow water mask as a possible substitute for,
or replacement of the U.S. Navy Standard DESCOS shallow water mask.

The

The Scott constant flow shallow water diving mask was evaluated
subjectively by pressure tank dives, and the comments are a composite
of the subject's opinions. The results are discussed and lead to
recommendations concerning modifications required prior to certifica-
tion as "recommended for naval service".

The mechanical workmanship of the Scott, constant flow shallow
water diving mask is quite good, the design is simple, the maintenance
is easy and it has a greater field of vision than the DESCOS mask.

The Scott constant flow shallow water mask is not, in its present
form, certified as recommended for naval service, although the basic
design is very good and in most features equals that of the standard
DESCOS mask. The most serious deficiency is the location of the non-
return valve too far from the mask. It was found that the Scott mask
is harder to clear when flooded than the Standard DESCOS mask.

3.1.1.1 Classification

Abstract

water

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Equipment, Diving Evaluation						

Abstract Con't

It was also found that the Scott mask ejected a fine spray of water on the subject's face, around the control valve area and that there was excess leakage and difficulty in donning the mask when worn over a lightweight diving dress.