HUMAN FACTORS EVALUATION OF SUBMARINE ESCAPE
V. Disconnect Time with Four Combinations of the Schrader Quick-Disconnect Air Fitting

by

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SUMMARY PAGE

THE PROBLEM

To determine for the submarine escape evolution the arrangement of the standard Schrader air fitting which provides the fastest and most reliable disconnect.

FINDINGS

Of the connectors tested, the present arrangement of the Schrader connector was not the fastest and most reliable. An arrangement whereby the female connector is attached at a 90° angle with respect to the charging hose on the Escape and Survival Equipment, Mark 1, Mod 0 (EASE) proved best.

APPLICATION

The results of this research should contribute to improved speed and reliability of egress from a disabled submarine when utilizing the EASE.

ADMINISTRATIVE INFORMATION

This investigation was conducted as part of Bureau of Medicine and Surgery Research Work Unit M4306.03-1020DXC5 - Development of Diver Performance Measurement Methods. It is number 3 on the work unit. The manuscript was submitted for review on 13 June 1973, approved for publication on 12 September and designated as NSMRL Research Report Number 753.

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ABSTRACT

Utilizing a simulated Escape and Survival Equipment, Mark 1, Mod 0 (EASE) escape appliance, four arrangements of the standard Schrader quick-disconnect air fitting and two escape trunk hose positions, fixed and floating, were evaluated with respect to speed and reliability of disconnect in a dry environment. The results indicated that the most desirable arrangement of the Schrader connector is one in which the female part of the connector is attached at a 90° angle with respect to the charging hose of the EASE, while the male connector is attached at a 0° angle with respect to the air hose in the escape trunk. Hose position was not significant for this arrangement. Since the connector is intended to be used in a wet environment, and this research was performed in a dry environment, it is recommended that the study be repeated in a wet environment before final conclusions are drawn.

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INTRODUCTION

In the submarine escape evolution, each escapee must be compressed to ambient water pressure, make an egress from the submarine, and ascend to the surface. During that evolution, a submarine escape appliance, which provides air for breathing and bouyancy for ascent, is worn. To begin egress, the appliance must be charged with air during compression, and then disconnected from the air supply. The United States Navy presently employs a standard Schrader quick-disconnect air fitting (Figure 1) to allow for charging and to provide a means for disconnect.

Physiological hazards, such as decompression sickness and nitrogen narcosis, make it necessary to minimize the time to escape from a disabled submarine. Because of this time constraint it is important that the

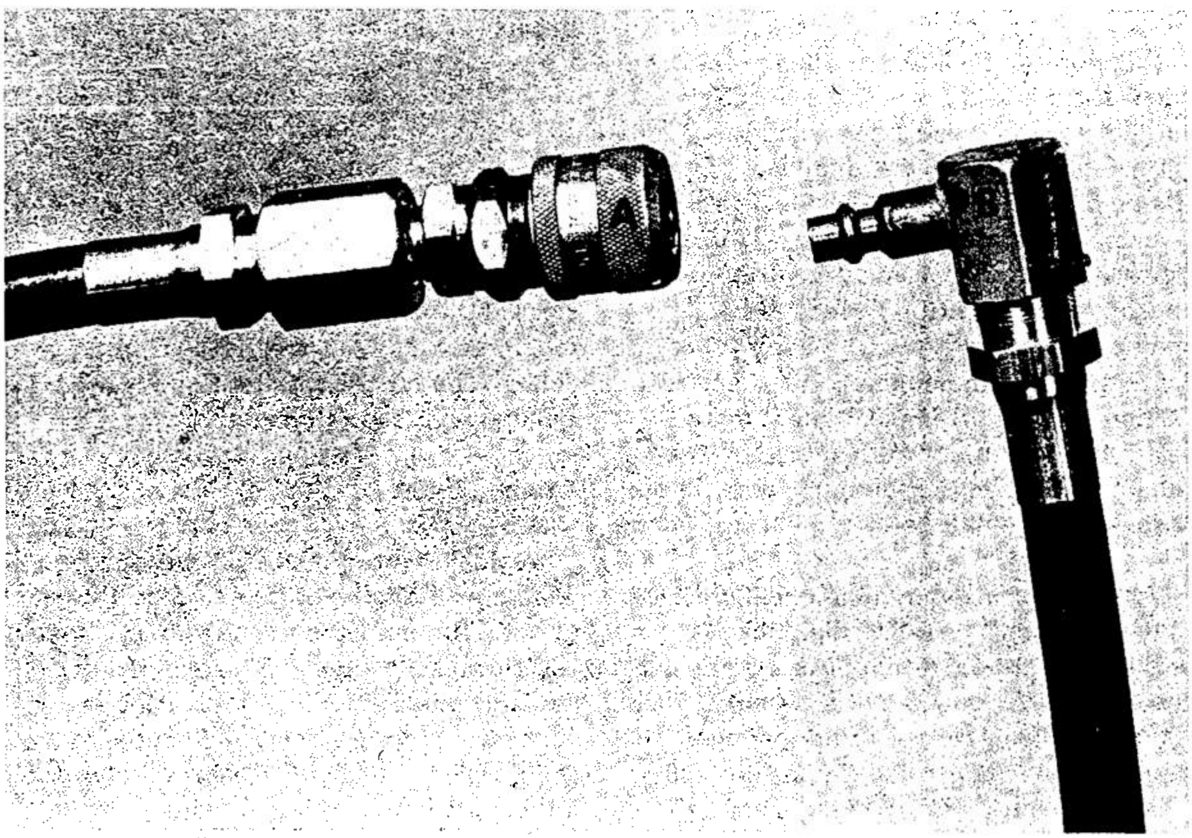

Fig. 1. The standard Schrader connector with attached hoses; the female part (A) is connected to the air supply line in the escape trunk, while the male part (B) is attached to the EASE.

disconnect be made in as rapid and reliable a manner as possible.

The existing submarine escape appliance, the Steinke Hood, and the newly developed Escape and Survival Equipment, Mark 1, Mod 0 (EASE) (Figure 2) employ the standard Schrader quick-disconnect air fitting. The Schrader connector has interlocking male and female parts. The female part of the connector has a collar which must be pulled back both to insert and to remove the male part of the connector. The only way to break the connection is to push the parts of the connector together, while pulling the collar back. The parts of the connector then literally fall apart.

Problems in manipulation of the Schrader fitting first came to the authors' attention during a study[1] evaluating egress times for one, two and three man teams with side and top egress escape trunk configurations. The difficulty occurred when an initial attempt to break the connection failed. At this point subjects (Ss) were observed to struggle with the connector for several seconds in an attempt to get it apart. This had the effect of doubling the escape time when the top egress mode of escape was employed.

At present, submarine escape trunks have the female part of the Schrader connector attached to an air hose in the escape trunk, while the male part of the connector is attached to the escape appliance. The prototype escape and survival equipment (EASE), consistent with the foregoing, has a male Schrader connector attached at a 90° angle with respect to a charging hose which extends down the left arm of the suit. There exists no experimental evidence that this arrangement of the Schrader connector is the optimum in terms of speed and reliability of disconnect. In fact, as has been mentioned, problems with this arrangement have been observed in the study of submarine escape. Further, since it is unlikely that the Navy will adopt a new type of connector in the near future, it is desirable to determine if the present arrangement of the Schrader connector is the best one. The present study therefore evaluated several arrangements of the various parts of the Schrader connector in an attempt to determine which configurations could be most profitably employed with EASE in the submarine escape evolution.

METHOD

Subjects

Ss were ten enlisted men waiting to start the Naval Basic Enlisted Submarine Course, at the Naval Submarine School, Naval Submarine Base New London, Groton, Connecticut.

Experimental Design

A three factor repeated measures design was employed to examine the effects of connector arrangement, hose position, and trials. Ss were given seven trials for each combination of connector arrangement and hose position. The order of presentation of the four connector arrangements was randomized; the order of running of the two hose positions was counterbalanced, both within and between Ss.

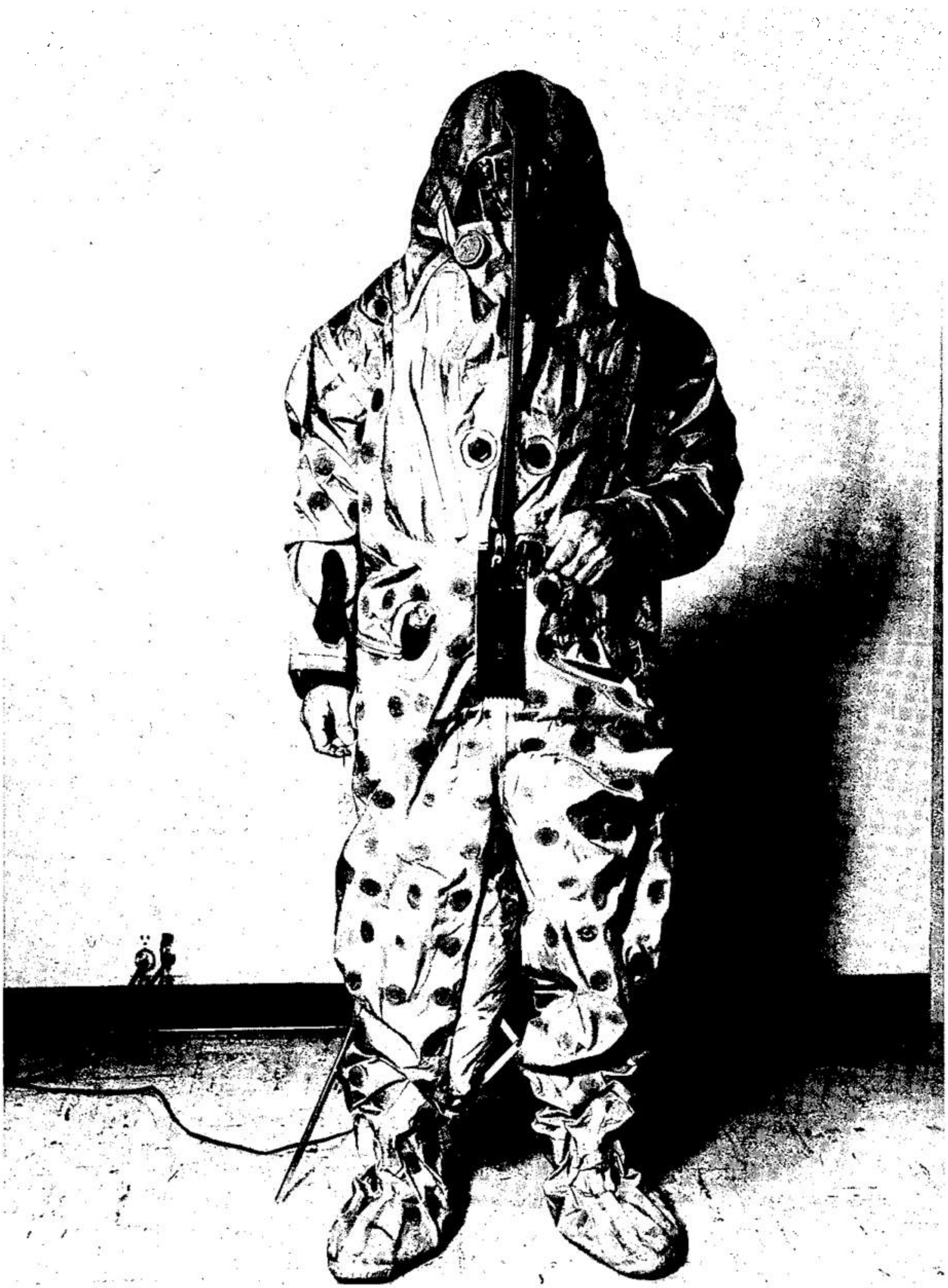

Fig. 2. S wearing the prototype escape and survival equipment EASE.

Apparatus

Figure 3 shows the four arrangements of the Schrader connector which were employed in this study. These connector arrangements will be identified by reference to the part of the connector which is attached to the escape appliance. The complementary part of the fitting is then assumed to be attached to the air hose which is simulating the escape trunk air hose. For example; the connector arrangement numbered 2 in Figure 3, will be referred to as the Male 90, meaning that the male part of a Schrader connector is attached at a ninety degree angle to the escape appliance air hose. The escape trunk air hose for this configuration therefore has the female part of the Schrader connector attached at a zero degree angle.

The simulated submarine escape trunk air hose was either clamped at a fixed height above the deck with the connector tilted at a forty-five degree angle from the vertical (fixed position), or allowed to be free floating in space (floating position).

Coveralls (Figure 4) were used to simulate the EASE escape appliance. Each set of coveralls had an air hose attached to the left arm. Attached to each air hose was one of the components of the Schrader fitting from each of the four connector arrangements which were tested.

Compressed air was supplied to the connector arrangements at 100 psi over ambient air pressure to simulate conditions in actual submarine escape.

A Hunter Decade Interval Timer, Model 111-C, Series D; a Standard Electric Timer, Type S-1; and a control unit were employed in data collection. The Hunter Timer actuated a signal light for several seconds. Offset of the signal light was synchronized with onset of the Standard Timer, which gave readings in hundreds of a second. A six volt battery supplied current through the connector arrangement being tested: breaking the connection interrupted an electric circuit and stopped the Standard Timer.

Procedure

S was given a brief explanation of the purpose of the experiment and a demonstration of the operation of each of the connector arrangements. He was then asked to try them himself to insure that he was able to perform the required tasks.

On any given trial, S connected his escape appliance to the appropriate air hose, which was simulating the escape trunk air hose. The signal light was then turned on for a randomly determined period of from three to seven seconds. At the offset of the signal light S disconnected as fast as possible, using one hand for the fixed hose position or two hands for the floating hose position. Disconnect time, defined as the time from offset of the signal light until the circuit was broken, was recorded. Each S had fourteen trials with each connector arrangement, seven trials in the fixed position and seven trials in the floating position.

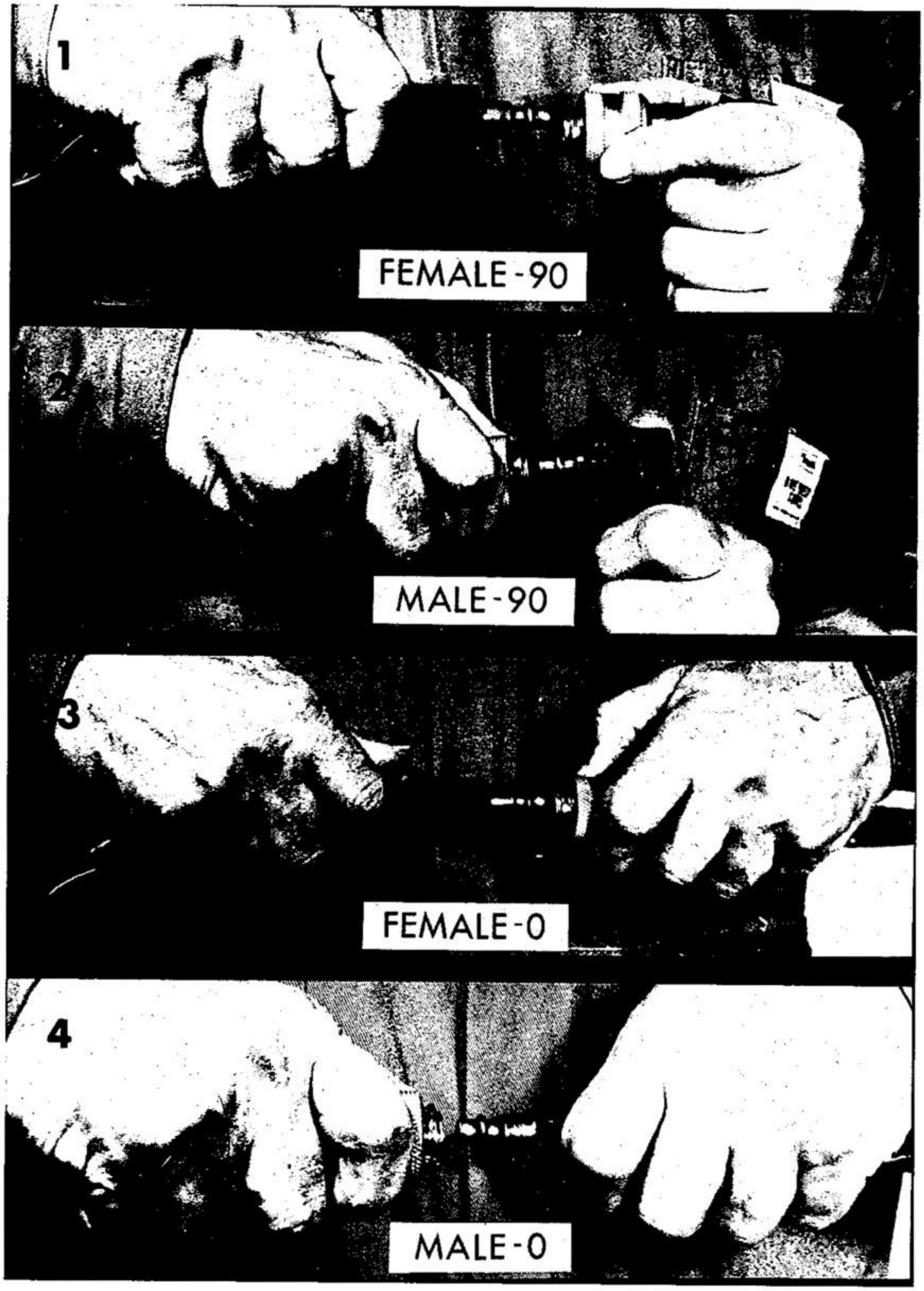

Fig. 3. The four arrangements of the Schrader fitting which were tested.

Fig. 4. S wearing the simulated escape appliance, EASE.

RESULTS

The means and standard deviations of the disconnect times are given in Table 1. Figure 5 is a graph of the means by hose position and connector arrangement. The raw data appear in the Appendix. Analysis of variance, Table 2, resulted in statistically significant effects for connector arrangement ($p < .001$), hose position ($p < .05$), and for the interaction between connector arrangement and hose position ($p < .005$). _t_ tests of the differences between the means by hose position for each connector arrangement resulted in a significant difference only for the Female 0 connector arrangement ($t = 4.76$, $p < .001$), i.e., the fixed Female 0 arrangement took significantly longer to disconnect than the floating Female 0 connector arrangement. Because of the significant interaction, additional simple analyses of variance were performed for each hose position. The main effect for connector arrangement in each hose position was significant ($p < .05$). Duncan multiple range tests of the differences between the means of the four connector arrangements for each hose position were performed. For the floating position, disconnect time with the Female 90 connector arrangement was significantly shorter than with the Female 0 connector arrangement ($p < .01$) or with the Male 0 connector arrangement ($p < .05$). When the fixed position was employed, disconnect time with the Female 0 connector arrangement was significantly longer than with any other connector arrangement ($p < .01$). There were no other significant differences.

Table 1. Disconnect Times (seconds) by Hose Position and Connector Arrangement

Hose Position	Arrangement	$\overline{X}$		P_{99}
Fixed	Male 0	0.770	0.625	2.226
	Male 90	0.985	0.956	3.212
	Female 0	2.225	4.291	12.223
	Female 90	0.469	0.140	0.795
Floating	Male 0	0.953	1.611	4.707
	Male 90	0.736	0.827	2.663
	Female 0	1.055	0.909	3.173
	Female 90	0.520	0.242	1.084

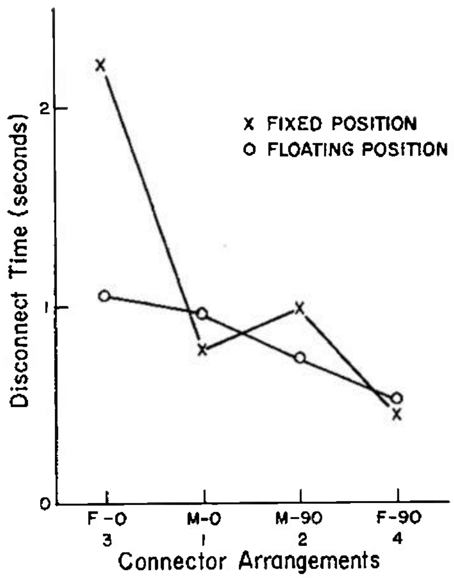

Fig. 5. Mean disconnect times by hose position and connector arrangement.

DISCUSSION

Statistically significant main effects for connector arrangement and hose position, as well as a significant interaction between the two were obtained. Comparisons of each of the connector arrangements across hose position revealed that only with the Female 0 connector arrangement was there a significant difference between the hose positions, indicating that the main effect for hose position was due solely to this arrangement. Evaluation of differences across connector arrangements revealed that, for the fixed position only, the Female 0 connector arrangement was significantly different from the other arrangements. In the floating position both the Female 0 and the Male 0 connector arrangements took significantly longer than the Female 90 connector arrangement to disconnect.

To break the Female 0 connector arrangement in the fixed position (Figure 6), an S using only one hand must push the female part of the connector down and simultaneously pull the collar of this part of the connector back; Ss reported that this was a very difficult maneuver. Taking into consideration S's reports and the very long mean disconnect time obtained with this connector arrangement, it would seem reasonable to conclude that this arrangement should not be employed in the submarine escape evolution.

To evaluate the remaining connector arrangements it is necessary to keep two things in mind: (1) since we are considering an emergency system, reliability is essential; and (2) the physiological hazards previously named place a significant limitation on available escape time. Table 3 shows the severity of the time constraint. These values were obtained by subtracting an assumed compression time of 20 seconds from the values given by Ryack and Walters[2] for no decompression limits as a function of depth. Thus, we need to determine which arrangement of the Schrader connector is fastest and most reliable.

The last column in Table 1 presents data which takes both factors into account.

Table 2. Analysis of Variance for Trials, Connector Arrangement, and Position

Source	df	MS	F
Subject (S)	22	8.2566	
Trials (T)	6	3.9457	1.6056
Connector Arrangement (C)	3	74.9738	10.0889 ***
Position (P)	1	28.2692	5.4554 *
TXS	132	2.4573	
CXS	66	7.4312	
PXS	22	5.1817	
TXC	18	3.0565	1.3999
TXP	6	1.6823	0.7200
CXP	3	29.9535	5.0859 **
TXCXS	396	2.1832	
TXPXS	132	2.3365	
CXPXS	66	5.8894	
TXCXP	18	2.6134	1.0174
TXCXPXS	396	2.5687	

* Significant at beyond the .05 level.
** Significant at beyond the .005 level.
*** Significant at beyond the .001 level.

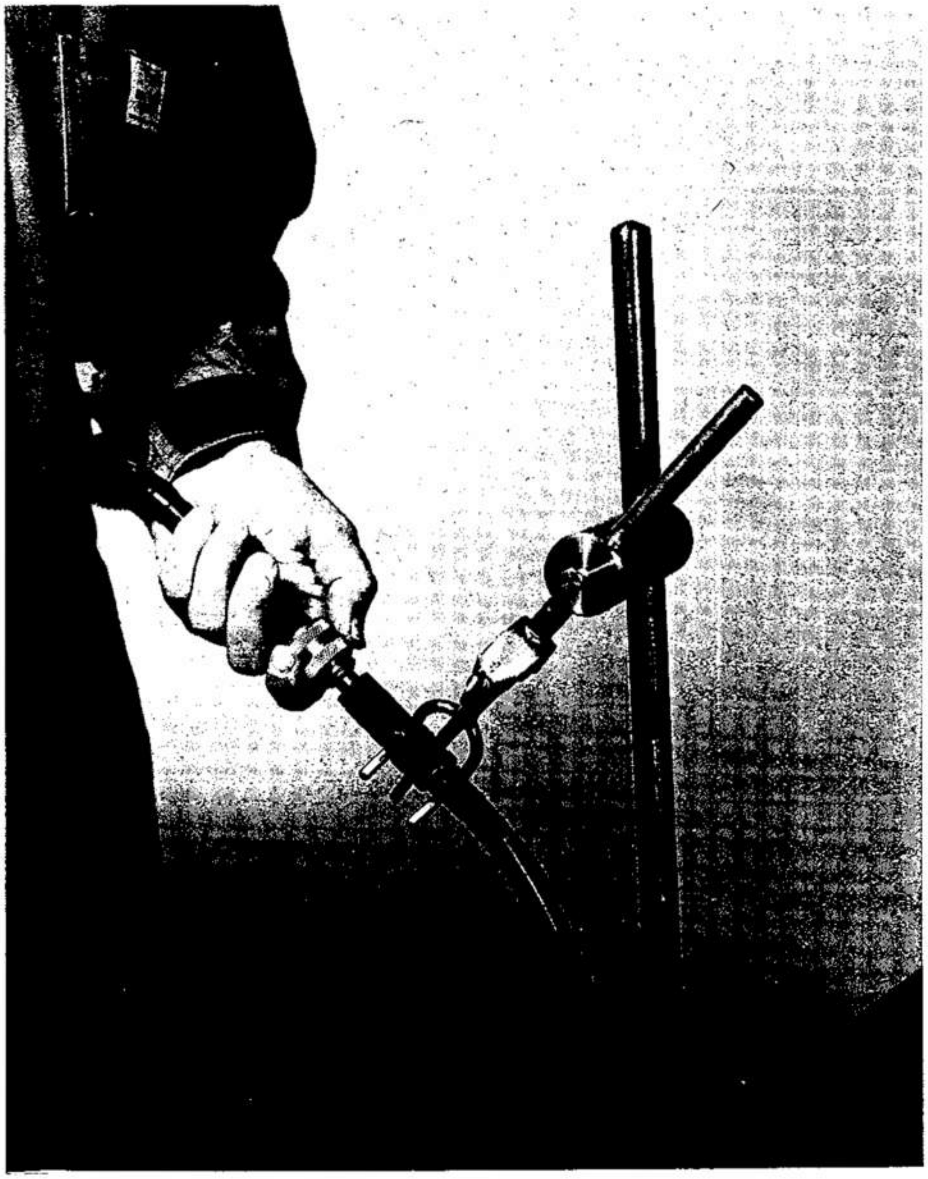

Fig. 6. The Female 0 connector arrangement in the fixed position.

The 99th centile (P_{99}) was computed by adjusting the means for their variance ($\bar{X} + 2.33\sigma$). These adjusted values may be expected to be exceeded in only one percent of disconnects. Therefore, the connector arrangement(s) which has the smallest adjusted value is the fastest and the most reliable arrangement of the Schrader connector.

An examination of these adjusted values reveals that the Female 90 connector arrangement in the fixed position has the smallest adjusted disconnect time associated with it. In second place is the Female 90 in the floating position. All of the remaining values are at least twice that of the second place connector arrangement.

Table 3. Maximum Allowable Egress Times at Various Depths

Depth (feet)	Time
50	99 minutes, 40 seconds
100	24 minutes, 40 seconds
150	6 minutes, 40 seconds
200	3 minutes, 40 seconds
300	1 minute, 40 seconds
400	55 seconds
450	40 seconds
500	25 seconds
600	10 seconds

From these data, we are led to conclude that the Female 90 connector arrangement in either the fixed or floating position should be employed in the submarine escape evolution.

One final matter needs to be considered. The difficulty in disconnecting which was described in the introduction was not observed in this study. This may have been a function of the dry, safe environment in which the study was performed. Thus a study should be performed evaluating several of these connectors in the simulated wet submarine escape environment in which the difficulty was first encountered. A study of this sort would provide more conclusive evidence from which to make a determination of the best arrangement of the Schrader connector.

REFERENCES

1. Ryack, B. L. and Walters, G. B. Human factors evaluation of submarine escape: IV. Evaluation of Submarine Escape and Survival Equipment, Mark 1, Mod 0 for side and top egress with two disconnect systems. NAVSUBMEDRSCHLAB Report 752, September 1973.

2. Ryack, B. L. and Walters, G. B. Human factors evaluation of submarine escape: II-A Top-egress with the British Submarine Escape Immersion Suit and the Steinke Hood. NAVSUBMEDRSCHLAB Report No. 644, October 1970.

APPENDIX

Table 1. Raw Data: Table of Obtained Disconnect Times[1]

Subject	Hose Position	Connector Arrangement	Trials 1	2	3	4	5	6	7
1	Floating	1	.628	.383	.455	.896	.746	.940	.355
		2	.610	.338	.338	.630	.530	.725	.628
		3	.388	.700	.525	.540	1.100	.477	.545
		4	.342	.295	.335	.315	1.172	.350	.295
	Fixed	1	.458	.511	.520	.765	.510	.640	.545
		2	.482	.450	.484	.440	.448	2.670	.505
		3	2.800	.468	.720	.435	.640	.615	.648
		4	.625	.424	.538	.342	.342	.676	.325
2	Floating	1	.670	.780	.650	.650	.578	.585	.670
		2	1.860	.982	.975	.670	.723	.738	.900
		3	.525	.470	.570	.570	.640	.870	2.950
		4	1.700	1.235	.407	.818	.470	.988	.687
	Fixed	1	.440	.490	.600	.999	.720	.444	.460
		2	1.530	1.300	2.050	.720	1.580	1.300	1.610
		3	5.260	.830	.725	.540	1.116	1.200	2.925
		4	.528	.558	.793	.408	.798	.512	.785
3	Floating	1	.365	.330	.347	.380	.302	1.720	.290
		2	.330	.232	.295	.350	.240	.240	.440
		3	1.720	.455	5.570	.480	.390	.760	.470
		4	.330	.400	.360	.365	.555	.340	.355
	Fixed	1	.570	.524	.500	1.570	.812	.560	.435
		2	.495	.510	1.910	.553	.510	.498	.530
		3	.320	2.380	.400	.420	.350	.432	.390
		4	.398	.532	.420	.448	.405	.405	.420
4	Floating	1	.686	.610	.640	.605	.800	1.485	1.000
		2	1.500	.724	.826	.744	.778	.610	.580
		3	.640	.708	.700	.950	1.010	.760	.780
		4	1.165	.785	.690	.680	.617	1.182	.820
	Fixed	1	.745	.720	.565	.450	.680	.680	.690
		2	.898	.670	.710	.745	.695	.757	.776
		3	3.066	.740	.730	.780	2.370	6.280	2.070
		4	.730	.578	.690	.720	.660	.650	.580

[1] All times are in seconds.

Table 1 (cont.)

Subject	Hose Position	Connector Arrangement	Trials 1	2	3	4	5	6	7
5	Floating	1	.518	.530	.540	.480	.570	.950	1.100
		2	.518	.706	.520	4.600	.720	3.190	.510
		3	2.920	.630	1.420	4.840	1.585	3.050	4.140
		4	.695	.405	.600	.535	.720	1.660	.705
	Fixed	1	1.450	.795	.795	.740	.820	.825	.810
		2	1.564	.390	.608	5.230	5.880	1.918	4.684
		3	2.090	1.710	1.000	2.740	7.580	2.970	3.560
		4	.405	.401	.462	.700	.470	1.000	.686
6	Floating	1	.888	.740	.720	.700	.730	.650	.688
		2	.635	.630	.670	.492	.560	.530	.635
		3	2.900	4.820	3.780	.860	.950	2.640	.855
		4	.610	.490	.560	.540	.510	.520	.480
	Fixed	1	2.640	1.150	1.030	1.130	.990	.915	.830
		2	.746	1.310	.585	.616	.600	.528	.520
		3	1.410	2.640	3.730	.868	1.880	.957	2.450
		4	.520	.450	.455	.406	.478	.420	.395
7	Floating	1	.680	.495	.635	.542	.612	.498	.585
		2	.510	.540	.575	.660	.490	.425	.712
		3	.690	.818	1.610	1.660	.805	1.730	.710
		4	.650	.533	.485	.468	1.290	.460	.443
	Fixed	1	.540	.510	.420	.490	.455	.470	.508
		2	.690	.630	.520	.460	.490	.420	1.108
		3	1.880	2.230	1.220	1.620	2.820	2.300	2.120
		4	.518	.500	.530	.510	.458	.390	.370
8	Floating	1	.540	.788	.942	.640	.572	.598	.360
		2	1.050	2.230	.512	1.038	.810	.652	.688
		3	1.080	1.275	1.400	1.870	.980	.795	2.030
		4	.560	.639	.462	1.240	.532	.546	.502
	Fixed	1	2.120	1.060	1.020	.870	.750	.760	.680
		2	1.235	1.310	.822	.820	.790	1.835	1.020
		3	5.930	1.930	1.330	1.190	1.050	1.090	1.900
		4	.700	.600	.440	.520	.478	.315	.894

Table 1 (cont.)

Subject	Hose Position	Connector Arrangement	Trials 1	2	3	4	5	6	7
9	Floating	1	.842	.655	2.150	.830	.557	.380	.420
		2	.880	.530	7.630	.282	.501	.462	.530
		3	.562	1.108	.880	.502	.400	.610	.580
		4	.380	.310	.398	.280	.480	.440	.268
	Fixed	1	.490	.498	.600	2.620	1.190	.833	.658
		2	2.510	1.160	1.237	1.870	1.006	1.108	.878
		3	.560	.410	1.925	1.250	1.150	.720	.490
		4	.520	.404	.490	.410	.455	.420	.348
10	Floating	1	.562	.425	.455	.410	.406	.364	.427
		2	.494	.463	.410	.420	.448	.448	.475
		3	.442	.387	1.325	.410	.470	.515	.448
		4	.285	.276	.310	.308	.310	.328	.372
	Fixed	1	.410	.352	.352	.328	.318	.378	.362
		2	.343	.320	.988	.322	.368	.340	.482
		3	.455	2.420	.480	.552	.512	.540	.574
		4	.388	.280	.270	.300	.252	.240	.260
11	Floating	1	.425	.442	.490	.474	.492	.445	.380
		2	.440	.445	.482	.430	.375	.520	.390
		3	.490	.420	1.447	.464	.478	.528	1.210
		4	.780	.355	.350	.285	.340	.355	.370
	Fixed	1	.425	.400	.458	.415	.587	.396	.420
		2	.532	.447	.398	.315	.400	1.318	.390
		3	1.410	.488	.535	.520	1.946	1.815	1.872
		4	.312	.342	.300	.378	.295	.320	.288
12	Floating	1	.922	.678	.606	7.500	13.330	12.230	3.480
		2	.378	.370	.371	.432	.380	.375	.360
		3	.870	.552	.450	.315	.513	.518	1.925
		4	.350	.353	.370	.430	.350	.360	.396
	Fixed	1	2.170	1.160	.905	.850	.952	.652	.606
		2	.590	.640	1.130	1.700	.900	1.750	1.740
		3	1.270	1.305	.490	1.250	.722	1.128	1.000
		4	.355	.366	.405	.374	.455	.480	.447

Table 1 (cont.)

Subject	Hose Position	Connector Arrangement	Trials 1	2	3	4	5	6	7
13	Floating	1	.932	.407	.618	.610	1.210	.442	3.850
		2	1.070	.540	.595	.520	1.050	.590	.780
		3	.660	.544	1.420	.440	.718	.590	1.030
		4	.630	.750	.720	.800	.488	.490	.410
	Fixed	1	1.010	.600	1.100	.780	.648	.610	.535
		2	2.060	6.130	4.190	.900	1.690	4.290	2.830
		3	1.780	.750	1.300	1.380	1.630	.690	.692
		4	.432	.350	.320	.390	.382	.420	.400
14	Floating	1	.300	.970	.409	.400	.420	1.390	.443
		2	.360	.575	.650	.470	.478	.490	1.530
		3	.650	1.190	1.090	.630	.625	1.730	.800
		4	.501	.380	.474	.520	.580	.680	.438
	Fixed	1	.754	.470	.670	.780	.595	.306	.492
		2	.515	.465	.598	.710	.470	.480	.580
		3	.298	.318	3.380	1.500	4.680	3.540	1.530
		4	.505	.372	.462	.362	.417	.380	.405
15	Floating	1	.830	.948	.710	.850	.724	.775	.542
		2	.520	.520	.735	.910	.538	.594	.540
		3	.603	.660	.441	.587	.790	.708	.640
		4	.388	.340	.924	.420	.390	.478	.430
	Fixed	1	.845	.600	.830	.496	.580	.602	.830
		2	.760	1.000	.845	1.020	.845	.835	.785
		3	2.290	1.150	2.970	1.210	3.570	1.210	1.110
		4	.590	.420	.445	.380	.412	.410	.440
16	Floating	1	.522	.490	.586	.518	1.100	.528	.590
		2	.590	.464	.509	1.080	.980	.710	.570
		3	.530	.430	.440	.476	.552	1.310	.450
		4	.509	.372	.404	.382	.394	.362	.412
	Fixed	1	.454	.420	.451	.440	.685	.501	.430
		2	.610	.580	.510	.530	.480	.460	.450
		3	.510	1.380	1.490	.490	2.530	.556	1.425
		4	.452	.443	.460	.455	.508	.412	.468

Table 1 (cont.)

Subject	Hose Position	Connector Arrangement	1	2	3	4	5	6	7
17	Floating	1	.580	.488	.503	.470	.708	1.140	.500
		2	.386	.300	.720	.704	.460	.513	.312
		3	.672	1.380	.570	.490	.420	.420	1.510
		4	.430	.436	.410	.352	.840	.280	.410
	Fixed	1	.544	.548	1.460	.650	.644	.683	.484
		2	.595	1.420	.865	.542	.660	.972	1.220
		3	.582	.510	2.420	1.750	1.790	1.680	.602
		4	.440	.340	.350	.272	.902	.375	.970
18	Floating	1	.392	.530	.470	.480	.544	.440	.488
		2	.480	.520	5.070	3.540	.578	.523	.493
		3	1.630	.605	.620	.679	.532	.637	.998
		4	.508	.554	.498	.482	.422	.405	.486
	Fixed	1	.680	1.040	.664	.664	.690	.500	.617
		2	.760	.740	.890	.790	.692	.843	.900
		3	.660	.720	.564	1.880	1.180	1.640	.695
		4	.460	.490	.515	.512	.420	.510	.432
19	Floating	1	.450	.430	1.360	.470	.500	.535	.478
		2	.514	.629	.640	.532	.470	.598	.524
		3	1.450	.520	1.660	.552	.426	3.280	.490
		4	.623	1.000	.458	.548	.492	.430	.600
	Fixed	1	.490	.489	.480	.410	.418	.436	.413
		2	.500	.762	2.900	.536	.736	.500	.675
		3	.556	1.130	.593	.450	.428	.490	.582
		4	.390	1.000	.385	.580	.460	.398	.462
20	Floating	1	.893	.552	.519	.583	1.580	.550	.472
		2	.580	.540	.620	1.560	.630	.428	.492
		3	.617	2.150	.694	.575	2.720	.550	3.450
		4	.318	.437	.330	.280	.945	.423	.388
	Fixed	1	.520	.432	.510	.405	.497	.398	.400
		2	.533	.507	.450	.590	.468	.450	.533
		3	10.830	4.300	46.590	4.390	2.810	1.730	4.300
		4	.478	.430	.420	.400	.372	.380	.352

Table 1 (cont.)

Subject	Hose Position	Connector Arrangement	Trials 1	2	3	4	5	6	7
21	Floating	1	.423	.440	7.920	.625	2.625	1.170	.900
		2	.420	.528	.455	.410	.815	.520	.454
		3	.380	1.030	.600	.519	.850	1.800	1.740
		4	.258	.418	.422	.631	.416	.448	.420
	Fixed	1	.518	.465	.460	.445	.400	.430	.422
		2	.675	.560	.472	.539	.475	.442	.472
		3	.578	8.330	17.000	3.640	.740	1.130	.575
		4	.457	.474	.437	.471	.468	.419	.405
22	Floating	1	.790	1.080	1.180	.708	.600	.980	.614
		2	.483	.800	.605	.440	.489	.390	.514
		3	.528	.565	1.630	.625	1.140	.668	2.200
		4	.460	.430	.518	.415	.448	.378	.350
	Fixed	1	2.690	.735	.936	.642	.670	.756	1.350
		2	.570	.580	.500	.580	.617	.465	.400
		3	.710	.490	.400	1.810	.730	1.040	.578
		4	.460	.430	.370	.365	.340	.380	.458
23	Floating	1	1.280	.827	.828	.810	.800	.568	1.380
		2	.577	.610	.630	.573	.574	.836	.960
		3	.924	1.600	.640	.800	.570	1.360	.680
		4	.488	.690	.450	.480	.574	.547	.570
	Fixed	1	.878	.952	1.850	5.900	2.280	3.420	1.140
		2	.730	.764	.947	.725	.652	.692	.740
		3	8.160	4.630	3.810	1.000	10.660	2.340	17.010
		4	.670	.630	.648	.525	.570	.584	.578

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V. Disconnect Time with Four Combinations of the Schrader Quick Disconnect Air Fitting

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13. ABSTRACT

Utilizing a simulated escape and survival equipment appliance, four arrangements of the standard Schrader quick-disconnect air fitting and two escape trunk hose positions, fixed and floating, were evaluated with respect to speed and reliability of disconnect in a dry environment. The results indicated that the most desirable arrangement of the Schrader connector is one in which the female part of the connector is attached at a 90° angle with respect to the charging hose of the EASE, while the male connector is attached at a 0° angle with respect to the air hose in the escape trunk. Hose position was not significant for this arrangement. Since the connector is intended to be used in a wet environment, and this research was performed in a dry environment, it is recommended that the study be repeated in a wet environment before final conclusions are drawn.

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Human Factors in Submarine Escape						
Submarine Escape						
Submarine Escape Suits						
Simulation of Submarine Escape						
Submarine Escape Appliances						
Charging Connectors for Submarine Escape Appliances						
Steinke Hood						
Escape and Survival Equipment, Mark I, Mod 0 (EASE)						
British Submarine Escape Immersion Suit, Mark VII(SEIS)						