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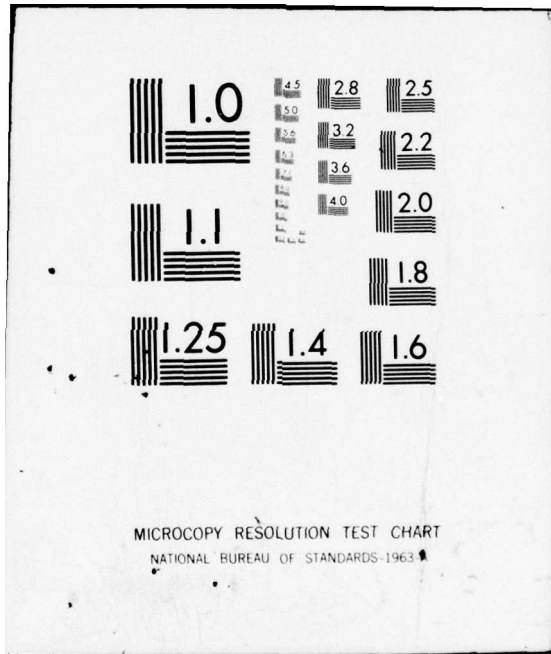
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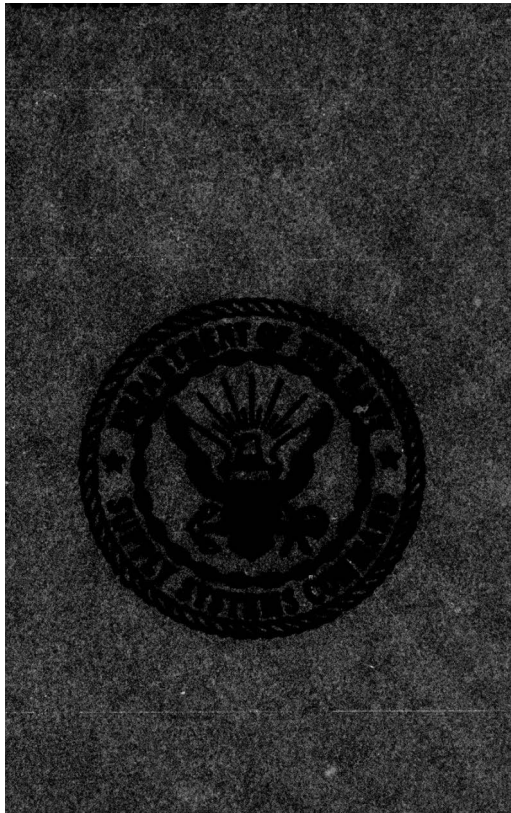


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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Navy Clothing and Textile Research Facility (NCTRF) conducted a 6-month evaluation of a new wash-and-wear coverall aboard 18 surface ships (Operation ALPHA) and 5 submarines, (Operation BRAVO). Each evaluation consisted of three phases. The first phase covered 3 months of normal use, after which the coveralls were returned to NCTRF with individual comments recorded on an NCTRF questionnaire. After being thoroughly examined, the coveralls were returned for an additional 3 months		

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of use, (Phase II). Letter reports (Phase III) were received after the second wearing completion of Phase II. Based on the results of Phases I, II, and III, the coverall was found to be adequate for use by the Engineering Forces in place of the standard blue work jumper and trousers when performing duties which would temporarily soil their clothing. The new coveralls were also found adequate for use as a replacement for the standard submarine utility coverall for all types of duties. A 19-size range, including shorts and longs, shall be specified for issue. (U)

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TABLE OF CONTENTS

	<u>Page</u>
List of Illustrations	iv
Introduction	1
Development of Shipboard Coveralls	3
Investigation of Fabrics	3
Design of Coverall	3
Evaluation Data and Summations	3
Details of the Phase I Evaluation - Operation Alpha	4
Details of the Phase I Evaluation - Operation Bravo	5
Details of the Phase II and Phase III	7
Conclusions	8
Recommendations	9
Appendix A. Questionnaire	A-1
Appendix B. References	B-1

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LIST OF ILLUSTRATIONS

Figure Page

1. The New Shipboard Coveralls for Engineering Personnel 2

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

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Experimental Shipboard Coveralls for Engineering Personnel

INTRODUCTION

The Navy Clothing and Textile Research Facility (NCTRF) has developed a new wash-and-wear shipboard coverall for use by the Engineering Force in fire and engine rooms and in other warm shipboard areas (Figure 1). The coveralls were designed to be worn when the type of duty would result in soiling the sailor's standard work uniform. The development work consisted of producing a new coverall that would be easy to care for, be trim in appearance even after numerous washings, and be light and comfortable to wear in warm environments.

The work on the new coverall was approved by Chief of Naval Operations (CNO) (1 & 2). This approval was based on recommendations made by Chief of Naval Personnel (CHNAVPERS) (3), which were based on proposals made by Commander of Naval Supply Systems Command (COMNAVSUP) (4). COMNAVSUP directed NCTRF to proceed with the development of coveralls for use in surface ships (5) as organizational clothing to supplement the Navy standard work clothing for use primarily, but not exclusively, in ships' engine rooms and machinist spaces, or other warm environments.

The new coveralls were made from a 65/35 polyester-cotton two-up, one-down twill fabric weighing 5.6 ounces per square yard. The fabric chosen for the new coverall fulfilled the basic material requirements, which were that the garment be lightweight, have a wrinkle-free appearance after laundering, be resistant to color fading and have good durability with a crisp feel, or hand. Field evaluations confirmed that the new coveralls had a smart military appearance, were easy to care for, and had a good durability even after 6 months' wear and over 30 launderings. The coveralls were sized to be worn directly over underwear.

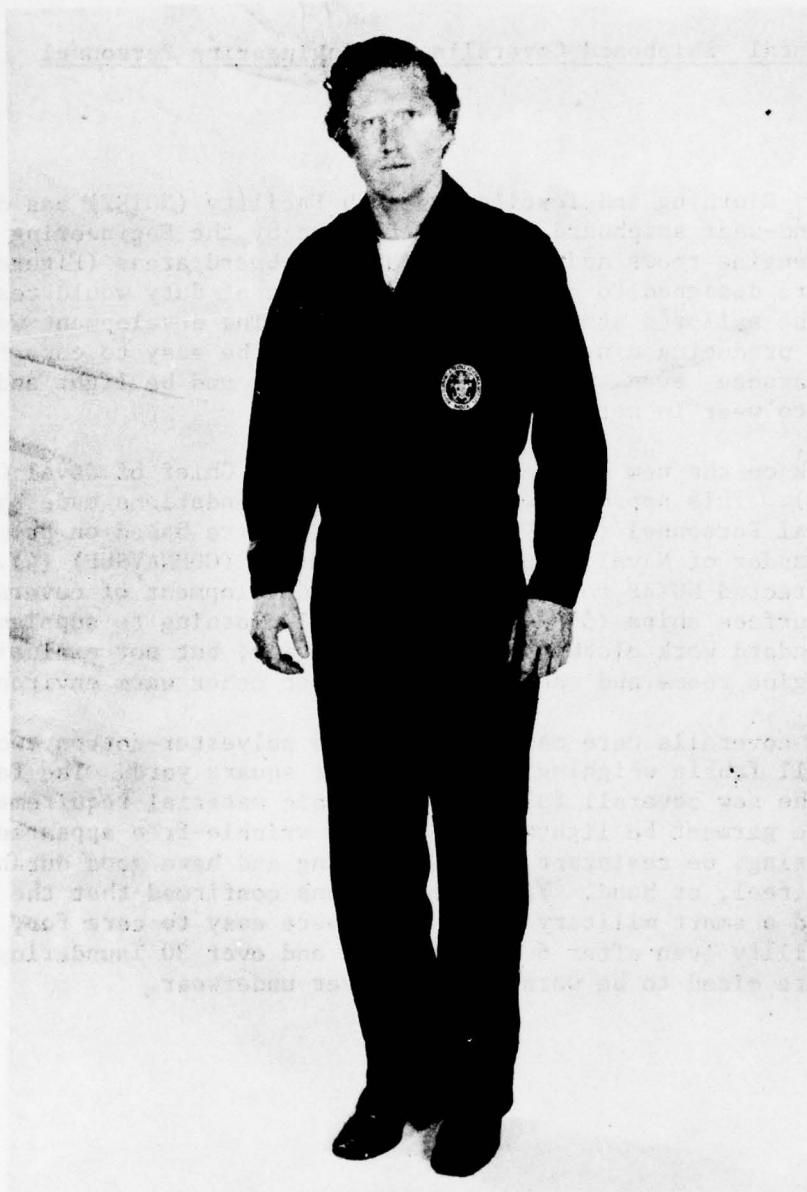


Figure 1. The New Shipboard Coveralls for Engineering Personnel.

DEVELOPMENT OF SHIPBOARD COVERALLS

Investigation of Fabrics

Many fabrics were investigated which would be easy to care for, have a good appearance even after numerous washings and be comfortable to wear even in warm environments. Seven candidate blend fabrics were selected after an exhaustive investigation of 40 possible candidate fabrics. Two candidate fabrics were initially chosen for the new coveralls after laboratory testing of the seven candidate fabrics indicated their superiority. Both fabrics were 65% polyester, 35% cotton-blend materials. One fabric was a 2/1 twill weighing 5.6 ounces/square yard and the other fabric was a plain weave weighing 6.1 ounces/square yard. Both fabrics were considered suitable for the intended purpose. The twill fabric was ultimately chosen because, although lighter in weight, it was more tear resistant than the plain weave. Also, its predominantly warp face made it more wear resistant.

Design of Coverall

Because of many unsolicited comments from the fleet, several design modifications were included in the development of the new coverall. These consisted of sleeves designed to be worn rolled up over the elbows and pant legs made wide enough to be put over work shoes. Belt loops were provided to properly position the trouser portion at the waist. The addition of double sliders on the slide fastener eliminated the need to always undress in the bathroom. The top of the coveralls was designed with a deep V-opening so that it could be worn open or closed with a button at the top. Two buttons were sewn on each cuff to yield a loose or snug fit. Six patch pockets were supplied, one on each breast with sewn-down flaps covering the top of the pocket to prevent such items as wallets, cigarettes or change from falling out, one on each trouser front with the top of the pocket caught in the waistband. One hip pocket on each back was positioned just below the waistband.

For convenience, a pencil slot opening was included in the left breast pocket flap. The left hip pocket had a sewn-down flap covering its top. A gripper-type snap was positioned just above the top of the slide fastener so that with the snap closed, the slide fastener could be zipped open for ventilation.

EVALUATION DATA AND SUMMATIONS

Two separate evaluations were conducted. One evaluation designated as Operation Alpha consisted of wear testing the garment on 18 surface ships, the other evaluation designated as Operation Bravo included testing on five submarines. Each evaluation included three phases. The first phase covered 3 months of normal use, after which the coveralls were returned to NCTRF with individual comments recorded on an NCTRF questionnaire. The coveralls were examined by NCTRF technical personnel for rips and tears as well as for general appearance and were returned for an additional 3 months of normal use (Phase II). After the completion of Phase II, letter reports (Phase III) were requested.

The surface ships in Operation Alpha were: USS BROOKE (DEG-1); USS EDSON (DD-946); USS FANNING (DE-1076); USS ORLECK (DD-886); USS PARSONS (DDG-3); USS PREBLE (DLG-15); USS BENJAMIN STODDERT (DDG-22); and the COMCRUDESPAC Boiler Inspectors in the Pacific and the USS BIDDLE (DLG-34); USS BRUMBY (DE-1044); USS R.A. OWENS (DD-827); USS SANSFIELD (DD-837); USS FOREST SHERMAN (DD-931); USS TALBOT (DEG-4); USS TATTNALL (DDG-19); USS VESOLE (DD-878); and the COMCRUDESLANT Boiler Inspectors in the Atlantic.

The submarines included in Operation Bravo consisted of the USS JAMES MONROE (SSBN22) in the Pacific and the USS BERGALL (SSN667); USS BILLFISH (SSN676); USS HAMMERHEAD (SSN663); and USS RAY (SSN653) in the Atlantic.

Details of the Phase I Evaluation - - Operation Alpha

Operation Alpha had a return of 136 questionnaires. This was a response of 76 percent of the 180 questionnaires furnished.

A tabulation of the questionnaires returned and an analysis of the test subject comments revealed the following:

Fit

74% indicated that the coveralls fit satisfactorily.
26% indicated discomfort across shoulders, under arms and in crotch or seat.

The majority of these comments were received by men wearing coveralls too large or too small for them. The most common complaint was the location of the belt loops. They could not be used as an adjustment to hold up the pants.

Appearance

93% indicated shipmates liked the appearance.
5% indicated they did not.
2% had no comment.

The test subjects complained about the lack of a side slash to adjust underwear; some thought the garment was too baggy in the seat and too wide in the legs. Some preferred the jump suit design which uses stretch inserts around waist and shoulders.

Comfort

74% indicated that the coveralls were comfortable.
26% indicated that they were not comfortable.

Most of the complaints were the result of incorrect sizings. (Although this garment has a range of 19 sizes, only five sizes (38 short and 38, 40, 42, and 44 regular) were issued for this test.) A typical example was 200-pound

six-foot sailor wearing a 40 regular when he should have been wearing a 42 long. Naturally, he complained about tightness in the shoulders and crotch, and could not stretch or bend.

Durability

88% found the coveralls durable.
12% did not.

Many rips and tears were found in the coveralls after the initial 90-day wear tests (Phase I) aboard ships. It was noted that most of the damaged garments were worn by fire room personnel who had crawled around boilers. Sharp or heavy tools carried in pockets caused some of the rips. It was observed that the stitching on the seat seam was fraying and breaking while the fabric was not too abraded or worn. A different stitch and seam construction would correct this.

Style

88% liked the style.
12% did not.

Many of the test subjects indicated a preference for the all-cotton chambray shirt, dungaree outfit.

Mobility

80% indicated freedom of movement.
20% indicated that some restrictions were experienced.

Here again improper sizing was prevalent among the negative comments.

Summation

Eighty-six percent of the 136 sailors from 18 ships who wore the new coveralls reported they preferred the new coveralls, made from polyester/cotton fabrics, over their standard blue jumper and trouser work uniform, made from nylon/cotton fabrics.

After 90 days' evaluation aboard ship many of the test coveralls were extremely soiled and had rips and tears. Complaints regarding fit were usually the result of the test subjects being issued only coveralls with regular lengths. Short and long lengths will be available when the garment is procured in volume.

Details of Phase I Evaluation - - Operation Bravo

Operation Bravo involved 157 completed questionnaires. This was a response of 78% of the 202 questionnaires furnished.

A tabulation of the returned questionnaires and an analysis of the test subjects' comments revealed the following:

Fit

44% indicated that the coveralls fit satisfactorily.

56% indicated discomfort across shoulders, under arms and in crotch or seat.

The most common complaints concerned the location of belt loops being too high or too low and the absence of stretch panels in the fabric. The wearing of incorrect sizes was also a major problem.

Appearance

73% indicated shipmates liked the appearance.

27% indicated they did not.

Most adverse comments were concerned with the belt loops. Some complained about baggy seats and too wide legs. Many commented on the smart appearance, the ease of washing and wearing and the fabric color's not fading.

Comfort

44% indicated that the coveralls were comfortable.

56% indicated that they were not.

Most complaints indicated that the test subjects preferred the knitted stretch panels under the arms. Many complained of being irritated under the arms and that the fabric was too harsh on their skin. Some commented that the fabric was too heavy, probably because the standard submarine utility coverall has a very lightweight polyester/rayon blend fabric in the upper torso portion of the garment.

Durability

82% found the coveralls durable.

18% did not.

Few rips or tears were found in the coveralls after the initial 90-day wear tests (Phase I). Complaints included pocket seams opening, sleeve buttons falling off, or stitching, in general, breaking and fraying.

Style

63% liked the style

37% did not.

The main objection to the style was the lack of a drop seat. Many also indicated the dislike of the location of the belt loops and lack of a hanger loop on the coveralls. A substantial minority who expressed a preference for many of the style features, such as sewn-down pocket flaps, a number of pockets, two-button cuffs and a snap closure at the top of the V-neck opening, wanted the coverall to be made into a two-piece outfit.

Mobility

53% had no problems.
47% indicated severe restrictions.

Most adverse comments indicated the inability of the wearer to bend or reach. Much of this was due to improper sizing. Most of the test subjects were wearing a regular size when they should have been wearing longs or extra longs. A 19-size-range schedule has been developed for procurement. The location of the belt loops also was reported as restricting the wearer.

Summation

Sixty percent of the 157 sailors who wore the new shipboard coveralls reported that they preferred them to the standard utility coveralls.

Many test subjects complained that the new coveralls were too hot and did not have any "give". Thus, the test subjects felt very restricted in them. Many disliked the coveralls because of the lack of a drop seat and requested a two-piece outfit based on the new coverall's design features such as flap-covered pockets, V-neck snap closures, pencil slots in the left breast pockets, and two-button sleeve cuffs. They also indicated that the new polyester-cotton blend fabric would not be too objectionable in a two-piece outfit.

Most of the returned coveralls were in good condition after 90 days' wear. Rips and tears were at a minimum and the appearance of the fabric was excellent.

Details of Phase II and Phase III

Phase II, an additional 90-day evaluation, was conducted aboard the submarines and the surface ships. In Phase III the letter report response from the submarines was favorable. Four of five submarines responded and made the following comments:

- a. Liked the improved styling.
- b. Liked the more comfortable material.
- c. Liked the availability of a 19-garment size range.
- d. Liked the potentially reduced cost versus the price of the standard utility coverall.
- e. Liked the use of zipper versus Velcro fasteners in the standard.
- f. Liked the use of pocket flaps versus Velcro fasteners in the standard.
- g. Subject coveralls were found to be superior in appearance to the standard submarine utility Polaris coveralls, even after only a few washings.

The letter report response from the surface ships was very favorable. Six of nine ships reported from the Atlantic Fleet and four of nine ships reported from the Pacific Fleet. This was a total response of 55 percent or 10 of 18 ships from both fleets.

All of the responding ships and submarines reported that the coveralls were useable after 6 months' wear. Nine of the commands indicated that the garments were comfortable, had an excellent design and construction and were ideal for use in the Engineering Division work areas. One command reported rips and tears and could see no advantages in the coveralls over the dungaree work uniform.

CONCLUSIONS

The new coveralls were developed for use by the Engineering Forces in place of the sailor's standard blue work jumper and trouser uniform when the type of work the men were performing would result in temporarily soiling their work uniforms. The new coveralls were not to be used when the work would result in permanently soiling them.

Examination of the coveralls returned after Phase I indicated that the test subjects of the Alpha evaluation had worn them for very dirty work duty. The coveralls were extremely soiled with lagging paste and heavy grease. It was later reported, however, these stains were washed out, leaving them in a presentable condition though slightly faded.

Examination of test garments returned by the Bravo evaluation group showed no heavy soiling. In fact, the coveralls were in nearly perfect condition.

Many personal likes and dislikes of the test subjects were recorded on the Phase I questionnaires. The Alpha group, because of their familiarity with the all-cotton dungaree uniform of a lightweight chambray shirt and heavy denim trousers, frequently referred to their preference for them. This was also true of the Bravo group wherein a minority definitely preferred the stretch inserts found in the standard utility submarine coveralls. In spite of all complaints, 86 percent of the Alpha group and 60 percent of the Bravo group reported on their questionnaires that they preferred the new coverall over their standard work uniforms.

The Phase III letter reports indicated that the commands, with the exception of one ship in the Mediterranean, were unanimous in their selection of the new coveralls over the standard Navy work uniform and the standard submarine utility coverall.

RECOMMENDATIONS

As a result of Phases I, II and III of the Alpha and Bravo evaluations the following recommendations are made:

1. The new coveralls should be classified as a good candidate for the replacement of the standard blue work jumper and trousers uniform when the type of duty the men are performing would result in soiling their uniforms.

2. The new coveralls should also be classified as a candidate for the replacement of the standard submarine utility coverall for all types of duties.

3. Modifications, such as the relocation of the belt loops to improve mobility and the redesign of the armholes to reduce irritation, shall be incorporated in the coveralls before standardization of the items. (NOTE: This has already been accomplished.)

4. A 19-size range including shorts and longs shall be specified, thus eliminating the incorrect fitting problems that were reported.

The experimental coveralls that you are evaluating were developed by this facility in response to a request made by the Chief Technician's Submarine Study Group. The coveralls were developed by the Chief Technician's Submarine Study Group.

APPENDIX A. QUESTIONNAIRE

This appendix contains a copy of the questionnaire

that both the submarine and the surface ship personnel

filled in after completion of Phase I. A copy of

the Information Sheet is also included.

1. Shirts have been designed to be worn rolled up over the elbows.
2. Pant legs have been made wide enough to be put on over work shoes.
3. Belt loops have been provided to properly position the trousers at the waist.
4. Double sliders on the slide fastener eliminate the need to address in the bathroom for coat hangers.
5. Top of the coveralls may be worn down (deep V-neck) or closed.
6. Two buttons have been supplied on the cuffs for a loose or snug fit.
7. Snap fastener at the top of the slide fastener allows the wearer, when conditions permit, to secure the top while leaving the slide fastener half open for ventilation.
8. Six pockets have also been supplied. Three of the pockets have sew-down flaps to prevent items such as wallets, cigarettes and change from falling out.

The objective of this evaluation is to determine acceptability of style, comfort, appearance, durability and mobility of the experimental coveralls. Your personal opinions, and opinions of other witnesses who see you wearing the coveralls, are most important.

PLEASE READ THE QUESTIONNAIRE WHEN THE COVERALL IS ISSUED TO YOU SO THAT YOU WILL HAVE A FAMILIARITY WITH THE TYPE OF INFORMATION DESIRED.

Remember, you are part of a group of sailors who have been selected to determine whether or not this coverall will do the job as a working uniform for our environments such as engine rooms and machinery spaces. Your candid responses to the attached questionnaire are very important. DO NOT USE THIS COVERALL FOR HEAVY DUTY WORKING.

INFORMATION SHEET FOR SHIPBOARD COVERALL FOR ENGINEERING PERSONNEL

The experimental coveralls that you are evaluating were developed by this Facility in response to a request made by the Boiler Technician's Retention Study Group for a lightweight coverall for use by fireroom personnel.

The coverall, designed for use in ships' engine rooms and machinery spaces, is made from a lightweight, wash-and-wear, polyester-cotton-blend fabric, and is sized to be worn directly over underwear. Nineteen sizes which run from a 36 short to a 48 long have been scheduled for this garment. (This evaluation, however, covers only sizes 38 short, and 38 regular to 44 regular.) Because of many unsolicited comments from the Fleet concerning the standard coverall, we have included the following modifications in this experimental item:

1. Sleeves have been designed to be worn rolled up over the elbows.
2. Pant legs have been made wide enough to be put on over work shoes.
3. Belt loops have been provided to properly position the trousers at the waist.
4. Double sliders on the slide fastener eliminate the need to undress in the bathroom for most visits.
5. Top of the coverall may be worn open (deep V-neck) or closed.
6. Two buttons have been supplied on the cuffs for a loose or snug fit.
7. Snap fastener at the top of the slide fastener allows the wearer, when conditions permit, to secure the top while leaving the slide fastener half open for ventilation.
8. Six pockets have also been supplied. Three of the pockets have sewn-down flaps to prevent items such as wallets, cigarettes and change from falling out.

The objective of this evaluation is to determine acceptability of style, comfort, appearance, durability and mobility of the experimental coverall. Your personal opinions, and opinions of other shipmates who see you wearing the coverall, are most important.

PLEASE READ THE QUESTIONNAIRE WHEN THE COVERALL IS ISSUED TO YOU SO THAT YOU WILL HAVE A FAMILIARITY WITH THE TYPE OF INFORMATION DESIRED.

Remember, you are part of a group of sailors who have been selected to determine whether or not this coverall will do the job as a working uniform for hot environments such as engine rooms and machinery spaces. Your candid responses to the attached questionnaire are very important. DO NOT USE THIS COVERALL FOR HEAVY DUTY CLEANING.

QUESTIONNAIRE

SHIPBOARD COVERALL FOR ENGINEERING PERSONNEL

Name/Rate _____

Ship _____

Length of Service _____ Age _____

Height _____ Weight _____

Work Jumper Size Worn _____

Work Trouser Size Worn _____

Standard Coverall Size Worn _____

Experimental Coverall Size _____ Length _____

Identification Number Issued _____

Evaluation Date: Start _____ Finish _____

Average Temperature When Coverall Was Worn _____

Number of Times the Coverall Was Washed _____

Number of Days the Coverall Was Worn _____

1. DID YOU LIKE THE STYLE? YES _____ NO _____

If NO, please explain below. Style includes features such as the type of pockets, double slider, belt loops, adjustable sleeve cuffs.

2. WAS THE COVERALL COMFORTABLE? YES _____ NO _____ If NO, please indicate if the discomfort was caused by the fit:

Across the Shoulders _____
Under the Arms _____
In the Crotch _____
In the Seat _____
Around the Waist _____
Other (EXPLAIN) _____

3. WAS THE APPEARANCE ACCEPTABLE? YES _____ NO _____

If NO, please indicate if after repeated washings the coverall became unacceptable because:

The color faded _____
The garments became baggy _____
or shapeless _____
The collar became creased _____
or wrinkled _____
Other (EXPLAIN) _____

4. WAS THE COVERALL DURABLE? YES _____ NO _____

If NO, please indicate if after extended wear:

The snap did not work _____
The pockets ripped _____
The seams opened _____
The fabric tore _____
The zipper broke _____
The buttons fell off _____

Please give cause of the defect _____

5. DID THE COVERALL PROVIDE MOBILITY? YES _____ NO _____

If NO, please indicate why you found the coverall difficult to work in:

You could not climb _____
You could not reach _____
You could not bend down _____
Other (EXPLAIN) _____

6. DID YOUR SHIPMATES LIKE THE APPEARANCE OF THE COVERALL? YES _____ NO _____

If NO, please indicate below what comments your shipmates made. These comments can include any comparisons between the test garment and the standard work uniforms.

7. PLEASE GIVE US ANY ADDITIONAL COMMENTS THAT MIGHT HELP IN EVALUATING THE EXPERIMENTAL COVERALL.

8. In conclusion, would you prefer to wear the Experimental Coveralls you have evaluated instead of the Standard Work Uniforms?

YES _____ NO _____

9. The completed QUESTIONNAIRE should be returned to:

Officer in Charge
Navy Clothing and Textile Research Facility
21 Strathmore Road
Natick, MA 01760

Attention: Mr. J. Silvia

Signed _____
Name of Test Subject

Date _____

APPENDIX B. REFERENCES

1. Chief, Naval Personnel, Memo to ADM Kidd and VADM Bagley OP-09C6-887-71 Serial 1361 P09C of 19 April 1972.
2. Chief, Naval Material, Action Sheet 140-72 of 26 April 1972 to COMNAVSUP.
3. Chief, Naval Personnel, Memo to CNO via VCNO Pers-Pd-9s of 18 Mar 1972.
4. Commander, Naval Supply Systems Command of 17 February 1972 to CHNAVPERS.
5. Commander, Naval Supply Systems Command of 10 April 1972 to Officer in Charge, NCTRF.