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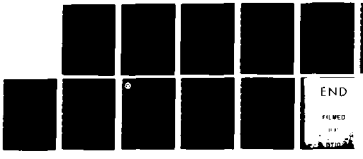

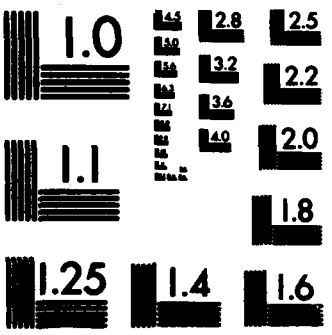

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WOOL/NYLON MELTON MATERIAL FOR USE IN NAVY PEACOATS

NAVY CLOTHING AND TEXTILE RESEARCH FACILITY
NATICK, MASSACHUSETTS

TECHNICAL REPORT NO. 149

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NCTRF - REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: TR-149	2. GOVT ACCESSION NO.: AD-A134 103
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): A WOOL/NYLON MELTON MATERIAL FOR USE IN NAVY PEACOATS	5. TYPE OF REPORT & PERIOD COVERED: Final Report; October 1979-September 1981
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Maurice W. Roy and Sumner H. Bernstein	8. CONTRACT OR GRANT NUMBER(s):
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Navy Clothing & Textile Research Facility, 21 Strathmore Road, Natick, MA 01760	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 29-001-66
11. CONTROLLING OFFICE NAME AND ADDRESS: Same as 9.	12. REPORT DATE: July 1983
	13. NUMBER OF PAGES: 14
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office):	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Same as 16.

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Wool/Nylon Melton Material; Navy Peacoats; Blend Fabrics; Materials Tests; Military Clothing

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Navy Clothing and Textile Research Facility (NCTRF) has developed and evaluated two experimental 85/15 wool/nylon, 22-ounce per linear yard, melton materials for possible replacement of the current Cloth, Melton, Wool, MIL-C-16290. One of the experimental materials was constructed identically to the standard material, while the other was constructed with a 10% reduction in warp and filling yarns. Those materials were subjected to laboratory tests of 18 material characteristics, including weight, shrinkage, break strength,

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acidity, colorfastness, abrasion resistance, and permeability. Test results indicated that both constructions are suitable as a replacement for the standard. As a result, the modified construction with the 10% reduction in warp and filling yarns is being recommended for adoption as a replacement for the standard 100% wool melton. (U)

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A WOOL/NYLON MELTON MATERIAL FOR USE IN NAVY PEACOATS

INTRODUCTION

The Navy Clothing and Textile Research Facility (NCTRF) developed two experimental 85/15 wool/nylon, 22-ounce per linear yard melton materials for possible replacement of the current Cloth, Melton, Wool, MIL-C-16290. The objective was to develop a material which would provide the same general physical and performance characteristics of the standard melton but would be both easier and less expensive to manufacture. Two manufacturers produced each of two types of constructions for our evaluation. One construction was identical to that used in the standard melton, while the other was modified with a 10% reduction in warp and filling yarns. Both manufacturers' materials were laboratory evaluated and one manufacturer's material was subsequently selected to be made into peacoats for wear testing. Results of the wear test indicated that either construction would be suitable for use as a replacement for the current standard. Because the modified construction is lower in cost, this material is being recommended for adoption. This report discusses both the laboratory test results and the garment evaluation findings.

BACKGROUND

The high cost, increased demand, and short supply of fine wool has greatly stimulated interest in the production of quality wool-like fabrics, utilizing blends of wool and nylon. Discussions with wool melton manufacturers indicated that the addition of 15% nylon would result in a smoother, stronger yarn, that is easier to spin and, subsequently, easier to weave than the present material. This survey also revealed that a similar fabric with a 10% reduction in warp and filling yarns should have little effect on performance (e.g., warmth and durability) and would realize an estimated total savings per yard of 75 cents to 1 dollar. Consequently, both types of materials recommended in the survey were manufactured for evaluation. To obtain a more realistic idea of what actual production of the materials would yield in terms of performance, NCTRF let contracts to two manufacturers. The two manufacturers were J.P. Stevens and Co., Inc., and Dornan Mills.

LABORATORY EVALUATION

The materials were evaluated against MIL-C-16290 requirements with additional tests being conducted to provide a more thorough analysis. The test procedures used to evaluate these materials are provided in Table I, and the laboratory results are provided in Table II. The materials identified as Fabric I-S and Fabric II-S were manufactured by J.P. Stevens, whereas Fabric I-D and Fabric II-D were made by Dorman Mills.

Table I. Material Test Procedures

Characteristics	Fed. Test Method No.*
Yarns/Inch	5050
Weight	5041
Shrinkage	5590
Break Strength	5100
Acidity	2811
Colorfastness to Light	5660
Colorfastness to Crocking	5651
Colorfastness to Laundering	5614
Colorfastness to Wet-Dry Cleaning	5622
Colorfastness to Perspiration	5680
Abrasion Resistance	5300
Fiber Content	2101
Air Permeability	5450
Mothproofing Content	2015
Clo Value	ASTM D 1518

*Federal Standard for Textile Test Methods, No. 191.

DISCUSSION OF RESULTS

As can be seen in Table II, deficiencies from the specification requirements were found in weight (Fabrics I-S and II-S), acidity (Fabrics I-D and II-D), colorfastness to light (Fabrics I-S and II-S) and colorfastness to laundering (Fabrics I-D, II-D, and II-S). None of these deficiencies, however, is considered serious, and we feel that all can be easily remedied.

The deficiencies in weight encountered with the I-S and II-S materials could be rectified either by using a slightly heavier yarn or by varying the finishing technique. The acidity of the Dornan Mills materials was found to be significantly greater than that of the Stevens materials. This high acidity could possibly be attributed to the high mothproofing agent content of the Dornan Mills materials. The colorfastness of both manufacturers' materials was deficient because neither manufacturer used chrome dyestuffs, but instead used combinations of acid and premetalized acid dyes. We believe that all colorfastness requirements could be met with a better selection of dyestuffs.

A comparison of physical characteristics of the full versus the modified construction (I-S vs II-S and I-D vs II-D) revealed fewer specification deficiencies in the full construction materials. Laboratory results, however, would seem to indicate that, although the modified constructions weigh less, other properties (e.g., strength and resistance to abrasion) are well within acceptable limits. The reduced construction also resulted in an increase in air permeability. Consequently, to learn whether either of the new constructions would provide less warmth than the standard material, we obtained the clo values of the standard and the experimental materials.

The J.P. Stevens materials were selected for measurement, because they were lighter than the Dornan Mills materials, thus presenting the "worst case." Results show that the I-S material had a slightly, but not significantly, higher clo value than the standard (approximately 6%). One should, therefore, expect the thermal protection of the I-S material to be quite similar to that of the standard, but the II-S material may not provide sufficient warmth since its clo value is 17.6% lower than the standard. When these outershell materials are combined with a fleece lining, the clo value for each system more than doubles. In this case, the system with the II-S shell fabric has an insulation value approximately 8% lower than the standard shell fabric with the fleece lining.

The Dornan Mills materials were found to possess a harsher "hand" than either the J.P. Stevens materials or the standard material, which also resulted in their appearance being adversely affected. This harshness can be attributed to improper finishing, which is considered to be remedial. As a result of the harshness of the Dornan materials, the J.P. Stevens materials (I-S and II-S) were selected for manufacture into peacoats for service evaluation. In all other aspects, the materials were judged to be equal.

Table II. Laboratory Analysis

Characteristic	MIL-C-16290	J. P. Stevens		Dorman Mills	
		I-S	II-S	I-D	II-D
Weave	3/1 crowfoot	3/1 crowfoot	3/1 crowfoot	3/1 crowfoot	3/1 crowfoot
Yarns/Inch (Warp & Filling)	55 x 45 (min)	54 x 43	49 x 47	56 x 45	45 x 38
Width (in)	56 (min)	57 1/16	57 7/16	58 1/16	58 5/16
Weight (oz./lin. yd)	22.0 (min)	21.8	21.0	25.2	22.9
Shrinkage (Warp & Filling)	4.5 x 2.0 (min)	3.7 x (-.5)	3.4 x 0.9	3.7 x 1.1	3.5 x 0.9
Break Strength (lbs. Warp & Filling)	80 x 60	109 x 81	95 x 83	126 x 109	121 x 97
Acidity (min/max)	4.0 to 8.0	5.6	8.3	3.4	3.4
Colorfastness to Light	good	fair	fair	good	good
Colorfastness to Crocking	good	good	good	good	fair
Colorfastness to Laundering	good	good	fair	poor	poor
Colorfastness to Wet-Dry-Cleaning	good	good	good	good	good

Table II. Laboratory Analysis (Cont.)

Characteristic	MIL-C-16290	J. P. Stevens I-S	J. P. Stevens II-S	Borman Mills I-D	Borman Mills II-D
Colorfastness to Perspiration	good	excellent	excellent	good	good
Abrasion Resistance (Warp & Filling) (Flex Fold) (# of cycles to destruction	191 x 212	400 x 740	550 x 900	820 x 1480	1290 x 1340
Fiber Content:					
Wool (%)	95 (min)	—	—	—	—
Wool/Nylon (%)	—	82/16	82/16	81/13	80/14
Air Permeability ($ft^3/min/ft^2$)	24	22	30	16	22
Mothproofing Content (%)	0.26 to 0.60	0.3	0.4	2.2	2.6
Clo Value*					
Base Fabric	0.34	0.36	0.28		
Base Fabric & Fleece Lining	0.72	0.74	0.66		

* Not a MIL-C-16290 requirement.

GARMENT EVALUATION

Sixty-five peacoats constructed from the I-S and II-S materials were distributed as follows:

Garments	Duty Station
29	USS CONSTITUTION, Charlestown, MA
21	NAS Brunswick, ME
15	Northeastern Navy Band, NETC Newport, RI

Each activity was issued a nearly equal number of garments constructed from each material.

Of a total of 65 peacoat evaluators, 35 (about 60%) returned their completed questionnaires. Questionnaire results of the evaluation are summarized in Table III and a sample questionnaire has been provided as Appendix A. The opinions and ratings of the experimental garments on the questionnaires by the test subjects and the NCTRF observations keynote lack of warmth and pilling as the predominant problem areas. Overall, the questionnaire ratings for both experimental materials were quite similar.

There was, however, a noticeable difference in two areas, comparison to the standard, and comparison in warmth to the standard. With regard to comparison to the standard, 43% of the subjects wearing the I-S material responded negatively (worse than), while only 18% of those wearing the II-S melton gave a negative response. Responses on warmth confirmed laboratory thermal insulation data on these two materials, which showed the I-S material as superior to the II-S material.

NCTRF observation of the test garments indicated that pilling of both the I-S and II-S material occurred early in the wear trial, but attenuated as the test approached its end. The pilling, which had been expected, can be attributed to the 15% nylon content. Since the problem disappears within a short period of time, pilling should not be considered a serious detriment.

Regarding warmth, the test subjects indicated that the experimental coats were generally not warm enough, particularly when the wearer was exposed to subfreezing temperatures and high winds. Recent feedback from the Fleet has shown that the standard peacoat also is lacking in warmth. As a result, a fleece lining is being added to the standard peacoat to provide more warmth. The increased clo values obtained with the addition of the fleece lining are provided in Table II. As can be seen, the lining doubles the insulation value of the garment, making insignificant the insulation differences between the lighter weight construction garment (II-S) and the standard.

Table III. Summary of Garment Evaluation Responses

Sample Size	19	16
Question	**I-S**	**II-S**
Appearance		
Good	68%	81%
Fair	32%	19%
Poor	0%	0%
Comparison to Standard		
Better	50%	38%
Same	7%	44%
Worse	43%	18%
Temperature when worn		
Less than 32°F	44%	53%
32-40°F	56%	47%
No. of days worn	38	28
Comfort and Fit vs Standard		
Better	36%	23%
Same	50%	69%
Worse	14%	8%
Warmth vs Standard		
Better	39%	0%
Same	33%	63%
Worse	28%	37%
Retain Standard		
Yes	44%	57%
No	66%	43%

CONCLUSIONS AND RECOMMENDATIONS

Although the II-S material is lighter and has a higher air permeability than the I-S material, the questionnaire data indicate that it was judged equal to or better than the standard in more categories than the I-S material.

Based on the similarities in data obtained from both the laboratory and the service evaluation of the two materials, and since any questions related to warmth have been resolved by introducing a nylon fleece lining to the peacoat, NCTRF recommends that a modified construction (10% reduction in warp and filling yarns) be adopted as a replacement for the standard 100% wool melton because of its lower cost.

APPENDIX A. QUESTIONNAIRE

DEPARTMENT OF THE NAVY
NAVY CLOTHING AND TEXTILE RESEARCH FACILITY
21 STRATHMORE ROAD
NATICK, MASSACHUSETTS 01760

IN REPLY REFER TO:
31:WP:pd
29-001-54

NAVY WEAR TEST PROGRAM
INFORMATION SHEET

The overcoat (peacoat) that you are evaluating was constructed the same as your standard issued overcoat but fabricated with an experimental wool/nylon blend outer material.

The objective of this evaluation is to determine its durability and overall performance.

Wear the overcoat as often as possible during the winter months. At the end of the wear test period, 30 March 1981, you will be requested to fill out the questionnaire with your personal comments. Your candid responses are most important.

Please return your completed questionnaire to your test monitor.

Your cooperation in assisting the Navy in this project is greatly appreciated.

NAME/RATE_____

ACTIVITY ADDRESS_____

LENGTH OF SERVICE_____

HEIGHT_____ WEIGHT_____

SIZE ISSUED_____

LABEL IDENTIFICATION (PLEASE CIRCLE) "A" OR "B"

EVALUATION PERIOD: START_____ COMPLETED_____

1. How was the overall dress appearance of the experimental overcoat (peacoat)?
   Good_____ Fair_____ Poor_____
   If poor, please explain._____

2. Indicate how you liked the experimental overcoat (peacoat) as compared to your standard issued overcoat (peacoat) now in use.
   Better_____ Same as_____ Worse_____
   If worse, please explain._____

3. Circle appropriate average temperature range(s) when overcoat (peacoat) was worn.
   Below Freezing 32^{o}-40^{o}F 40^{o}-50^{o}F Above 50^{o}F

4. Approximate total number of days the overcoat (peacoat) was worn._____

5. In comparing the comfort and fit of the experimental overcoat (peacoat) to your standard issued overcoat (peacoat) now in use, the experimental overcoat is:
   Better_____ Same as_____ Worse_____
   If worse, please explain._____

6. In comparing the experimental overcoat (peacoat) to your standard issued overcoat (peacoat) relative to warmth, the experimental overcoat is:
   Better_____ Same as_____ Worse_____
   If worse, please explain._____

7. Would you prefer the standard issued overcoat (peacoat) to be retained in the system? Yes_____ No_____
   If yes, please explain._____

8. Comments._____

_____

_____

_____

_____

Signed_____
(Name of test subject)

Date_____

END

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