

AD-A111 316

HUMAN ENGINEERING LAB ABERDEEN PROVING GROUND MD

F/8 15/2

A COMPATIBILITY ASSESSMENT AND COMPARISON OF THE FLAME RESISTAN--ETC(U)

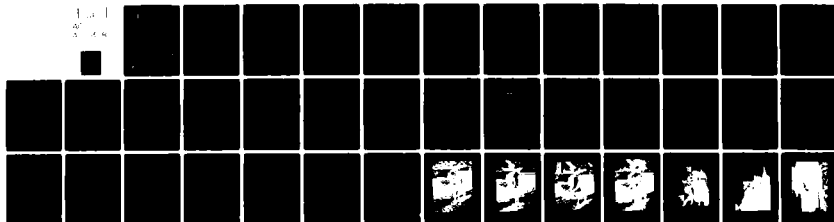
JAN 82 R S BRUNO

UNCLASSIFIED

HEL-TN-1-82

NL

1 1 1
2 2 2
3 3 3



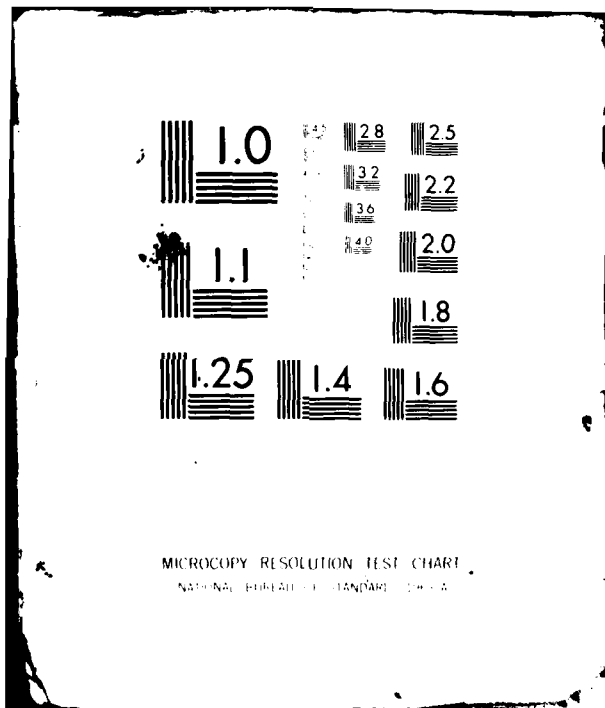
END

DATE

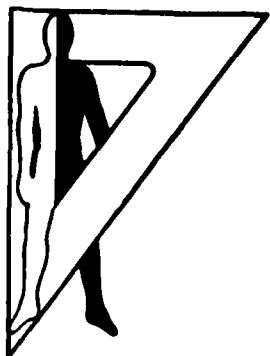
FILED

3 82

DTIC



AD A111318



12

AD

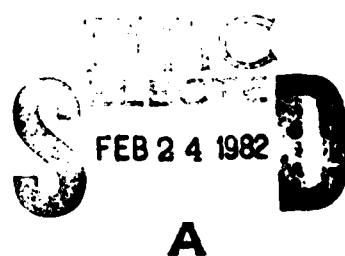
Technical Note 1-82

A COMPATIBILITY ASSESSMENT AND COMPARISON OF THE FLAME RESISTANT
CHEMICAL-BIOLOGICAL (CB) OVERGARMENT WITH THE STANDARD "A" CB OVERGARMENT

Richard S. Bruno

January 1982

Approved for public release;
distribution unlimited.



ENC FILE COPY

U. S. ARMY HUMAN ENGINEERING LABORATORY
Aberdeen Proving Ground, Maryland

8202 24 003

Destroy this report when no longer needed.
Do not return it to the originator.

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Use of trade names in this report does not constitute an official endorsement or approval of the use of such commercial products.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Note 1-82	2. GOVT ACCESSION NO. AD-A111318	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A COMPATIBILITY ASSESSMENT AND COMPARISON OF THE FLAME RESISTANT CHEMICAL-BIOLOGICAL (CB) OVERGARMENT WITH THE STANDARD "A" CB OVERGARMENT		5. TYPE OF REPORT & PERIOD COVERED Final
7. AUTHOR(s) Richard S. Bruno		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Human Engineering Laboratory Aberdeen Proving Ground, Maryland 21005		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE January 1982
		13. NUMBER OF PAGES 41
		15. SECURITY CLASS. (of this report) Unclassified
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Chemical Biological Protection Compatibility Overgarment Combat Vehicle 2; or Clothing System Clothing Flame Resistant Fitting		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report describes an evaluation that compares the Standard "A" Overgarment with the prototype Flame Resistant Overgarment. The Flame Resistant Overgarment was developed to protect the crewmember where flame threat of great intensity exists. The objective and subjective data showed that no differences were found in the Flame Resistant CB Overgarment when compared to the Standard "A" CB Overgarment. The overgarments were virtually identical except for the covering material.		

A COMPATIBILITY ASSESSMENT AND COMPARISON OF THE FLAME RESISTANT
CHEMICAL-BIOLOGICAL (CB) OVERGARMENT WITH THE STANDARD "A" CB OVERGARMENT

Richard S. Bruno

January 1982

APPROVED:

John D. Weisz
JOHN D. WEISZ

Director

US Army Human Engineering Laboratory

Accession For

NTIS GRA&I

DTIC TAB

Unannounced

Justification

US ARMY HUMAN ENGINEERING LABORATORY
Aberdeen Proving Ground, Maryland 21005

Approved for public release;
distribution unlimited.

CONTENTS

INTRODUCTION	3
OBJECTIVE	3
METHOD AND PROCEDURE	3
FITTING AND COMPATIBILITY ASSESSMENT (FR AND STANDARD "A" OVERGARMENT) .	7
SUBJECTIVE MEASURES	12
RESULTS AND DISCUSSIONS	15
CONCLUSIONS	20

APPENDIXES

A. Suit, Chemical Protective, Flame Resistant Overgarment Fact Sheet	21
B. Semantic Differential Rating Scale (S.D.) Questionnaire . . .	25
C. Data Forms--Tasks Assessments	29
D. Flame Resistant CB Overgarment--Illustrated Views	33

FIGURES

1. Format for Semantic Differential Scales	13
2. Counterbalancing S.D. Adjective Pairs for Polarity	13
3. Assignment of Numerical Values to S.D. Scale Positions	14
4. Flame Resistant CB Overgarment Compared to Standard "A" CB Overgarment Reference to Material	17
5. Flame Resistant CB Overgarment Compared to Standard "A" CB Overgarment Reference to Fit-Static	18
6. Flame Resistant CB Overgarment Compared to Reference to Working in the CB Overgarment-Dynamics	19

TABLES

1. Basic Anthropometry	3
2. Flame Resistant CB Overgarment Test Design	4
3. Vehicle Fluids Check Scenario	5
4. Track Adjustment Scenario	5
5. Ammunition Reload Scenario	6
6. Tactical Mine Sweep Scenario	6
7. CB Suit Size Prediction Chart	8
8. Static Exercises for Uniform Fitting Check	9
9. Summary of CB Overgarment Fitting Assessment - N=8, 60°F . . .	10
10. Summary of Crew Station Interface Tasks - N=8, 60°F	11
11. Summary of External Tasks - N=8, 60°F	12
12. Flame Resistant CB Overgarment Evaluation Semantic Differential Rating Questionnaire	16

A COMPATIBILITY ASSESSMENT AND COMPARISON OF THE FLAME RESISTANT
CHEMICAL-BIOLOGICAL (CB) OVERGARMENT WITH THE STANDARD "A" CB OVERGARMENT

INTRODUCTION

In December 1978, the US Army Training and Doctrine Command (TRADOC) recommended that the Standard "A" Chemical-Biological (CB) Overgarment be issued to all personnel. However, the overgarment was not flame resistant where high intensity flame threat existed, and was not resistant to chemical agents.

A Product Improvement Program (PIP) was initiated in April 1979 to modify the Standard "A" overgarment for use by aircrew and combat vehicle crewmembers.

The US Army Human Engineering Laboratory was tasked by the US Army Natick Research and Development Laboratories (NLABS) to compare the Standard "A" overgarment with the prototype flame resistant overgarment.

OBJECTIVE

The objective of this evaluation was to compare the Flame Resistant (FR) CB Overgarment with the Standard "A" CB Overgarment. The overgarments were evaluated for general compatibility in the operational environment.

METHOD AND PROCEDURE

Test Participants

Eight tankers, MOS 19E, from the Soldier Operator Maintainer Test Evaluation (SOMTE), Material Test Directorate, Aberdeen Proving Ground, MD, served as test participants (TPs) during this evaluation. Basic anthropometry of these subjects is given in Table 1.

TABLE 1
Basic Anthropometry

Mean	SD	Maximum	Minimum
Weight 76.0kg (69%)	12.4kg	96.9kg (97%)	60.3kg (10%)
Stature 172.26cm (40%)	7.14cm	181.4cm (85%)	159.3cm (1%)
Chest Cir 94.75cm (60%)	7.49cm	110.4cm (99%)	84.3cm (5%)
Waist Cir 81.82cm (65%)	3.80cm	105.1cm (99%)	71.4cm (10%)

Uniform

The Standard "A" CB Overgarments were worn for comparison with the Flame Resistant CB Overgarment. They were worn over the Combat Vehicle Crewmember Clothing System (CVCCS) coveralls as the basic uniform.

Equipment

Helmet, DH-132, CVC, Std "A"
Goggles, Improved, CVC
M60A1 Tank (2)

Description of the Flame Resistant Overgarment

The FR is identical in design to the Standard "A" CB Overgarment. The outer shell material is made of 95% Nomex and 5% Kevlar, plain weave, 4.3 oz/square yard. The inner-shell material is made of cloth, laminated, nylon, tricot knit, polyurethane foam charcoal impregnated and tested for flame resistance. (Throughout the evaluation, a neck covering was worn as required by the Surgeon General while wearing the Flame Resistant Overgarment to prevent possible skin irritation.) A detailed description can be found in the Fact Sheet, Appendix A.

Procedure

The basic design for this evaluation illustrated in Table 2 is a repeated measures type, with all TPs exposed to all conditions and crew stations. Test runs were randomly assigned and counterbalanced for time of day and exposure sequence. Comparisons were made between the two CB overgarments.

TABLE 2
Flame Resistant CB Overgarment Test Design

Run AM	Days					
	1	2	3	4	5	6
1	S.O.	F.R.O.	S.O.	F.R.O.	S.O.	F.R.O.
2	F.R.O.	S.O.	F.R.O.	S.O.	F.R.O.	S.O.
3	F.R.O.	S.O.	F.R.O.	S.O.	F.R.O.	S.O.
4	S.O.	F.R.O.	S.O.	F.R.O.	S.O.	F.R.O.
			Semantic and Debriefing		Semantic and Debriefing	

F.R.O. = Flame Resistant CB Overgarment
S.O. = Std "A" CB Overgarment

In each test cell the TPs were required to perform MOS related scenarios and to maneuver the tank on a dirt tank trail approximately 6km in length. The four scenarios were vehicle fluids check, track adjustment, ammunition reload and tactical mine sweep, illustrated in Tables 3, 4, 5, and 6. The tactical mine sweep scenario was conducted on the tank trail.

TABLE 3

Vehicle Fluids Check Scenario

-
1. Loader exited his crew station and proceeded to rear deck of tank.
 2. Loader opened the grille doors 1, 2, and 3. Fluid level check of oil and transmission was conducted. Fluids were added if necessary at that time. After the checks were made, the grilles were secured.
 3. Loader returned to his crew station to continue the mission.
-

TABLE 4

Track Adjustment Scenario

-
1. Driver allowed tank to roll to a stop without using brake.
 2. Loader dismounted tank to conduct an inspection of suspension system and track.
 3. Driver also dismounted tank and proceeded to sponson box.
 4. Driver opened sponson box and removed track adjustment bar and wrench. Necessary adjustments were made to track. Driver returned wrench and adjusting bar to sponson box.
 5. After inspection and adjustments were made, the loader and driver remounted vehicle.
-

TABLE 5

Ammunition Reload Scenario

-
1. Driver stopped tank and exited crew station.
 2. Driver positioned himself for ammunition reload from ground onto tank.
 3. Gunner exited hatch and proceeded to side of turret to accept rounds from driver.
 4. Loader positioned himself to accept and place round in ammunition storage area.
 5. Commander supervised reload operation.
 6. Reload completed, crew mounted tank and continued mission.
-

TABLE 6

Tactical Mine Sweep Scenario

-
1. Commander alerted the crew to possible mines.
 2. Driver stopped tank and allowed loader and gunner to dismount.
 3. Commander scanned surrounding area from high vantage point.
 4. Loader and gunner visually and physically review area for potential mines. Located mines were marked and tank rerouted.
 5. After mine fields were bypassed, the mission was continued.
-

The vehicles averaged 15 miles per hour with a maximum speed of 30.

The purpose of the tank trail runs was to familiarize the TPs with the clothing ensembles while performing MOS-related tasks. TPs and uniforms were subjected to such environmental elements as water, mud, ice, and cold temperatures.

After familiarization with the clothing ensembles, the TPs were able to make subjective evaluations and discuss body/clothing and vehicle interactions. A Semantic Differential Rating Scale (SDRS), illustrated in Appendix B, was used to assess differences between uniforms. The assessment included donning, doffing, static exercise performance, fit, and general compatibility of the overgarments. Results are described in the Fitting and Compatibility Assessment section of this report.

Essential Characteristics Assessed

The following essential characteristics were assessed:

1. Fit (static and dynamic).
2. General compatibility of all equipment.
3. Donning and doffing.
4. General features.
5. Overall effectiveness.

Data Collection Methods

The following data collection methods were used:

1. Observation.
2. Semantic Differential Rating Scale (SDRS).
3. Debriefing.
4. Sizing and fitting.
5. Photographic coverage (motion picture and still).

FITTING AND COMPATIBILITY ASSESSMENT (FR AND STANDARD "A" OVERGARMENT)

Method and Procedure

Uniform and equipment combinations were worn in accordance with TM 10-275¹ and FM 21-40². Fitting and sizing guidelines for the overgarments were provided by NLABS and are given in Table 7.

¹Department of the Army. Cold weather clothing and sleeping equipment (TM 10-275). Washington, DC. July 1975.

²Department of the Army. Nuclear, biological and chemical defense (FM 21-40). Washington, DC. July 1975.

TABLE 7
CB Suit Size Prediction Chart

Waist Size	Over Underwear and Summer	Over Coat and Trousers Hot Weather	Over Coat and Trousers Man's Field Wear	Over Parka and Trousers Man's Arctic Wear
27	XS	XS	S	M
31	XS	S	M	L
35	S	M	L	XL
39	M	L	XL	XXL
43	L	XL	XXL	XXL

The areas considered were ease of doffing and donning, compatibility with prescribed clothing and field equipment combinations, and allowance for extremes of body size and configuration.

An exercise routine, Table 8, was followed to determine the adequacy of fit and to aid in assessing clothing and equipment compatibility. Any fitting problems encountered (which ranged from changes in basic garment size, garment tightness, excess material, joint fold characteristics or restrictions in range of motion) were verbally reported by the TPs and visually assessed for severity by the USAHEL test personnel.

TABLE 8

Static Exercises for Uniform Fitting Check

The TP performs each of the exercised listed below one or more times, starting from and returning to a basic position. In the basic position, the TP stands erect with feet together and both arms hanging relaxed at the sides.

1. From the basic position TP extends arms horizontally from the sides of the torso with palms of the hands facing the floor. Arms are extended so as to lie in a straight line from right to left fingertips.
2. From the basic position TP raises both arms forward and horizontal, then crosses them maximally in front of the body.
3. From the basic position TP raises both arms horizontally to the side. Keeping arms straight, TP swings them horizontally backward to the limit of movement. The arms should be swung forcefully as though in an attempt to bring the hands together behind the back.
4. From the basic position TP raises both arms laterally and upwards until the palms of the hands are in contact facing each other directly overhead.
5. From the basic position TP raises arms horizontally as in exercise 1, then bends forward from the hip joint as far as possible. Knees are kept locked straight, and trunk is kept straight.
6. From the basic position TP raises arms horizontally as in exercise 1, then bends backward from the hip joint as far as possible. Knees are kept locked straight, and trunk is kept straight.
7. From the basic position TP raises arms horizontally as in exercise 1, then rotates the trunk (about the vertical body axis) from the hips as far as possible to the right and to the left. Knees are kept locked straight.
8. From the basic position TP places hands on the waist laterally and executes a deep knee bend to full squat position.

As TP takes each of the exercise positions, TP is asked to report any binding or restriction of movement caused by the test clothing ensemble. Observer records all such comments, identifying exact site of problem as well as possible.

The TPs performed the exercises and verbally reported any binding or restriction of movement that they felt resulted from the clothing ensembles. Their comments were recorded in brief with emphasis on both body area and aspect of the ensemble involved in the reported interaction.

Specific, relevant tasks were assessed with all of the subjects in all clothing and equipment combinations. The tasks were general in nature, involved external and internal crew station uniform interfaces plus transfer from crew station-to-crew station as listed in Appendix C.

RESULTS AND DISCUSSION

Static Fit and Exercise Routine

There were no major fitting problems identified by the TPs during the exercise routines while wearing the CB overgarments. A summary of the exercise routine is given in Table 9.

TABLE 9

Summary of CB Overgarment Fitting Assessment - N=8, 60°F

Static Position ^a	Ensemble					
	Flame Resistant Overgarment and CVC Coveralls			Std "A" Overgarment and CVC Coveralls		
1	No problem	-	8	No problem	-	8
2	No problem	-	8	No problem	-	8
3	No problem	-	8	No problem	-	8
4	No problem	-	4	No problem	-	7
	Slight under-			Slight under-		
	arm pressure	-	4	arm pressure	-	1
5	No problem	-	8	No problem	-	8
6	No problem	-	8	No problem	-	8
7	No problem	-	8	No problem	-	8
8	No problem	-	8	No problem	-	8

^aTable 8

Crew Station Interface and External Tasks

No problems were verbally reported by the TPs. A summary of Crew Station Interface Tasks and External Tasks is given in Tables 10 and 11.

TABLE 10

Summary of Crew Station Interface Tasks - N=8, 60°F

Crew Station Task	Overgarment	
	Std "A"	Flame Resistant
Commander:		
Operate machine gun		
Use periscope	No problems	No problems
Operate communications		
Other		
Gunner:		
Sight		
Fire control equipment	No problems	No problems
Turret controls		
Other		
Loader:		
Reach racks for ammo		
Operate breach	No problems	No problems
Other		
Driver:		
Hand controls		
Foot controls		
Instrument display	No problems	No problems
Other		
Transfer from station-to-station	No problems	No problems

Table 11

Summary of External Tasks - N=8; 60°F

External Task	Overgarment	
	Std "A"	Flame Resistant
Subject mounts tank		
Subject enters tank through hatch		
Subject takes seat at crewman's station	No problem	
Subject exits tank		

SUBJECTIVE MEASURES

Introduction

Throughout the testing, the subjects would naturally evaluate and construct attitudes and opinions which were based solely on the recent exposure to the uniforms. An approach to evaluate subjective data was by the use of Semantic Differential Rating Scales (SDRS).³ The data were obtained by using specially constructed questionnaires, wherein the TPs rated the proposed Flame Resistant CB Overgarment against the Std "A" CB Overgarment. Comparisons covered by a number of operational/functional characteristics of the overgarment.

Method

The Semantic Differential Rating Scale questionnaire consists of a number of "bipolar" pairs of adjectives (adverbs, adjective phrases or adverbial phrases are also used). These pairs form the end-points of an equal interval, seven-point scale as shown in Figure 1.

³Osgood, C.E., Suci, G.J., & Tannenbaum, P.H. The measurement of meaning. Urbana, IL: University of Illinois Press, 1965.

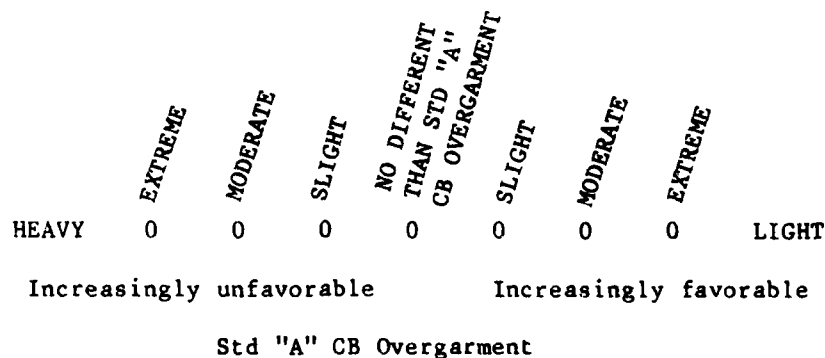


Figure 1. Format for semantic differential scales.

A number of important concepts are incorporated in the construction of this type of scale. First, the mid-point or center of the scale represents the Standard "A" Overgarment. The Std "A" Overgarment served as an "anchor" point for each adjective pair for every comparative judgment. The adjectives at the scale end-points are chosen to represent the extremes of a continuum for a given evaluative dimension such as location and effectiveness. In this example, "heavy" and "light" are opposite poles on the continuum of weight, and are referred to as "bipolar."

Next, depending on the polarity of a given adjective pair, movement to the left or right of the anchor point represents an increasingly favorable or unfavorable judgment. Finally, the scale point modifiers, "slight," "moderate," and "extreme," are positioned to reflect this increasing magnitude of judgment as one approaches the adjective end-points.

When a number of adjective pairs are collected to form a questionnaire, polarity is counterbalanced as seen in Figure 2, with first a positive and then a negative adjective appearing on the left as one goes down the list.

The questionnaires utilized are shown in Appendix B.

HEAVY	LIGHT
RUGGED	FLIMSY
.	.
.	.
LOSES SHAPE	HOLDS SHAPE

Figure 2. Counterbalancing S.D. adjective pairs for polarity.

This counterbalancing, or alternating of polarity, is done to discourage subjects from perseverating; i.e., from choosing a pattern of predominantly left or right responses without regard to adjective meaning. The S.D. technique was chosen over a number of possible rating scale techniques because of the following advantages:

1. Flexibility of choice--adjective pairs can be chosen to evaluate specific, detailed characteristics of an item.
2. Rapid administration--subjects are required to make one and only one response per adjective pair.
3. Ease of checking by data collectors in the field--forms can be quickly scanned to check perseveration, tendency toward extreme responses, lack of internal consistency, and completeness.

Procedure

Preliminary development of the questionnaire began with the selection of adjective/adverb pairs and uniform characteristics to be assessed. Individual briefing sessions were held to insure familiarization with the Semantic Differential Rating Scale Questionnaire. The questionnaire was designed to assess uniform performance in the following areas:

1. Material
2. Fit (static)
3. Working in the uniform (dynamics)

The Semantic Differential Rating Scale Questionnaire, from 12 subjects, used a total of 27 adjective pairs and produced 210 responses. As shown in Figure 3, numerical values from 1 to 7 were assigned to each scale position with a value of 1 always given to the "extreme" modifier at the negative pole of the adjective pair.

HEAVY	0	0	0	0	0	0	0	LIGHT
	1	2	3	4	5	6	7	
BALANCED	0	0	0	0	0	0	0	UNBALANCED
	7	6	5	4	3	2	1	

Figure 3. Assignment of numerical values to S.D. scale positions.

RESULTS AND DISCUSSION

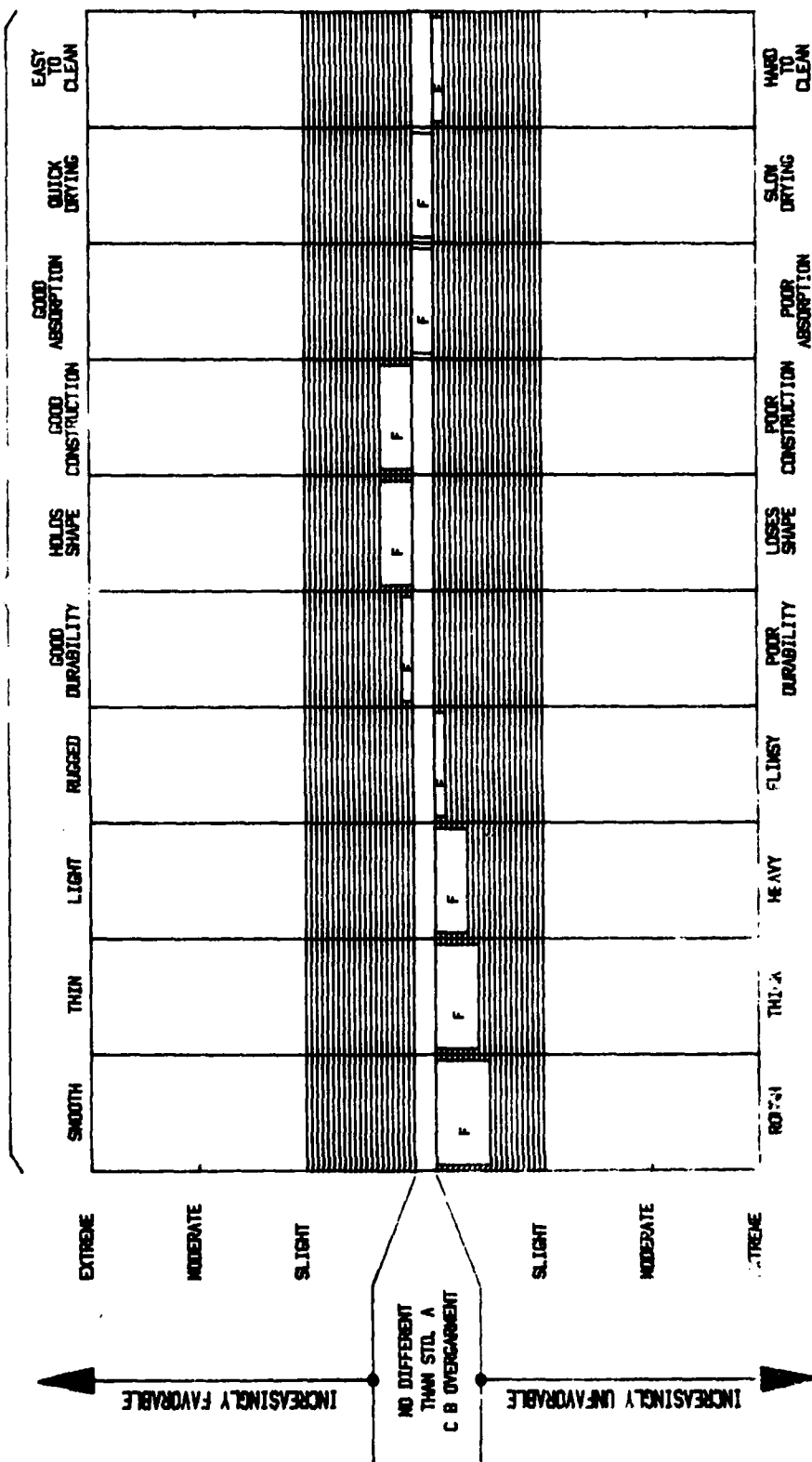
The means and standard deviations of subject scaled scores for each adjective pair is summarized in Table 12. A mean scaled score less than 3.0 denotes a significant disadvantage/negative feature; any mean scaled score greater than 5.0 indicates a significant advantage/positive feature. The mean scaled scores were also graphically displayed in Figures 4 thru 6 to provide the reader with a rapid means of comparison against the Standard "A" Overgarment. The mean scale scores falling within $\pm$ one scale division of the baseline are not considered significant.

TABLE 12

Flame Resistant CB Overgarment Evaluation
Semantic Differential Rating Questionnaire

	Statistics	
	Mean	Std
Material		
Smooth-Rough	3.5	0.93
Thick-Thin	3.6	0.52
Light-Heavy	3.7	0.46
Rugged-Flimsy	3.9	0.83
Good-Poor Durability	4.1	0.35
Holds-Loses Shape	4.3	0.46
Good-Poor Construction	4.3	0.46
Good-Poor Absorption	4.0	0.00
Quick-Slow Drying	4.0	0.00
Easy-Hard to Clean	3.9	0.35
Fit Static		
Trim-Bulky	3.7	0.46
Good-Poor Fit	4.1	0.35
Loose-Tight	4.1	0.35
Long-Short	4.0	0.00
Good-Poor Proportions	4.1	0.35
Easy/Quick-Hard/Slow to Don	4.0	0.00
Easy/Quick-Hard/Slow to Doff	4.0	0.00
Comfortable-Uncomfortable	4.0	0.53
Working Dynamics		
Smooth-Rough on Skin	3.3	0.71
Dry-Sweaty	3.7	0.46
Cool-Hot	3.7	0.46
Trim-Bulky	3.6	0.52
Stays Flat-Bunches Up	4.3	0.46
Aids Movement-Restricts	3.7	0.46
Moves Freely-Binds	3.9	0.35
Comfortable-Uncomfortable	3.7	0.46
Compatible-Incompatible	4.0	0.00

MATERIAL

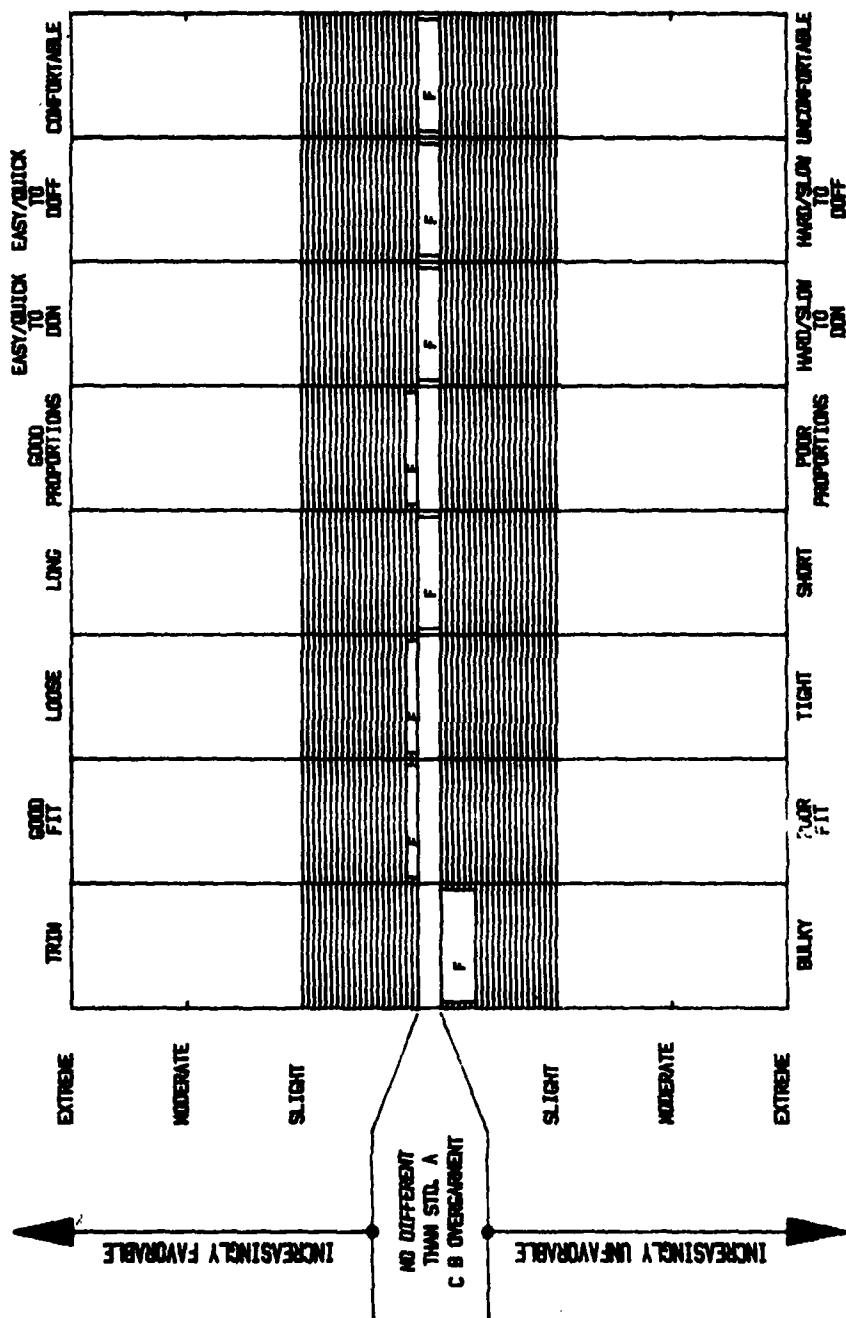


LEGEND
F - FLAME RESISTANT

DIFFERENCE BETWEEN FLAME RESISTANT AND
STD. A CHEMICAL BIOLOGICAL OVERGARMENT
NOT CONSIDERED PRACTICALLY SIGNIFICANT
EVEN IN THIS AREA

Figure 4. Flame resistant CB overgarment compared to standard
"A" CB overgarment reference to material.

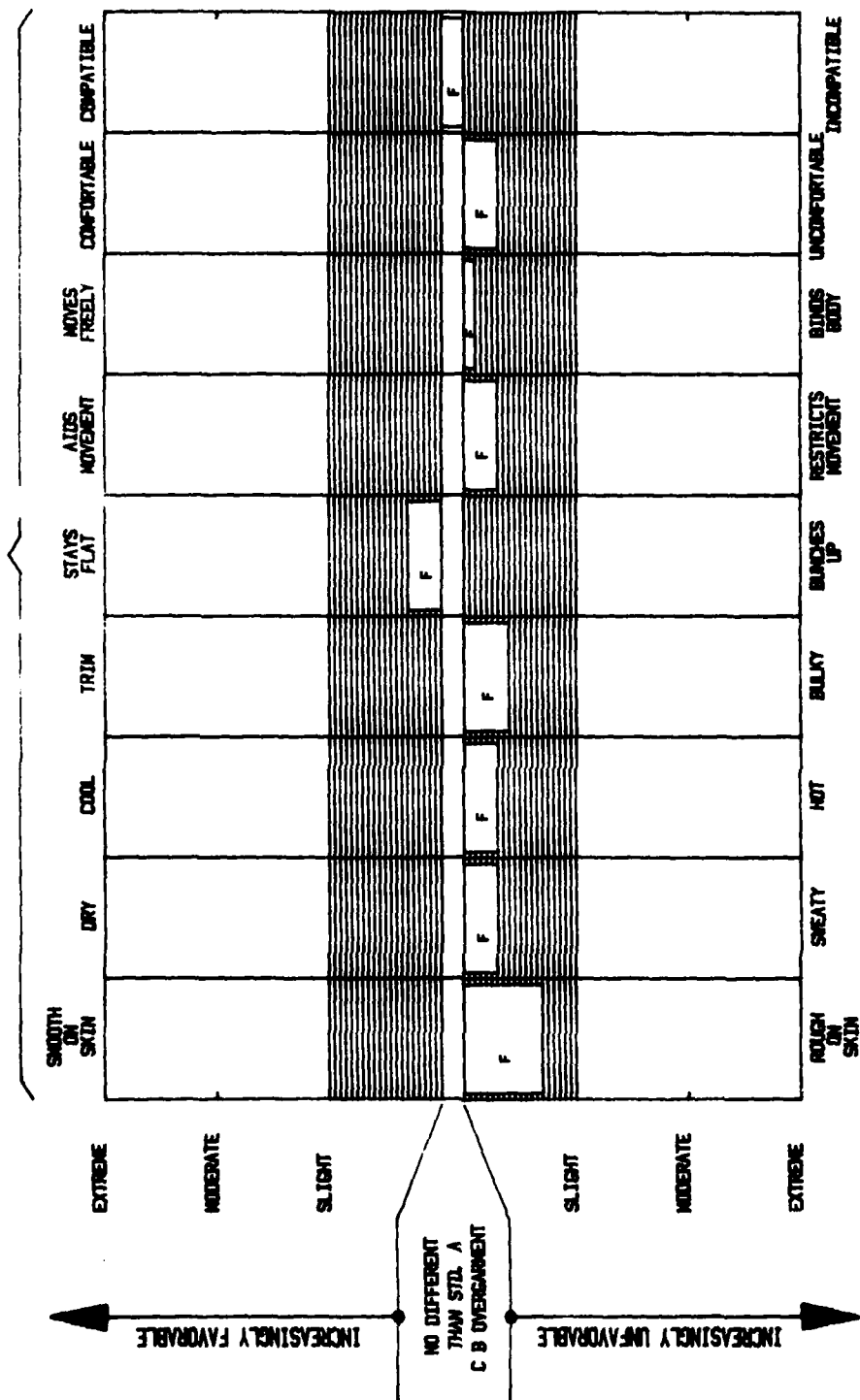
FIT STATIC



N=8 TEST PARTICIPANTS

Figure 5. Flame resistant CB overgarment compared to standard "A" CB overgarment reference to fit-static.

WORKING IN THE OVERGARMENT - DYNAMICS



DIFFERENCE BETWEEN FLAME RESISTANT AND
STD. A CHEMICAL BIOLOGICAL OVERGARMENT
NOT CONSIDERED PRACTICALLY SIGNIFICANT
WITHIN THIS AREA

N=8 TEST PARTICIPANTS

Figure 6. Flame resistant CB overgarment compared to reference to working in the CB overgarment-dynamics.

CONCLUSIONS

The objective and subjective data showed that no differences were found in the Flame Resistant CB Overgarment when compared to the Standard CB Overgarment.

The Flame Resistant CB Overgarment is virtually identical to the Standard "A" CB Overgarment except for the Nomex covering material.

APPENDIX A

SUIT, CHEMICAL PROTECTIVE, FLAME RESISTANT OVERGARMENT FACT SHEET

FACT SHEET

ITEM NAME: Suit, Chemical Protective, Flame Resistant (FR Overgarment)

CLIMATIC CATEGORY: Zones I thru VII

CONCEPT OF USE: This overgarment is intended to provide the combat vehicle and air crewmen with protection from flame hazards and chemical agents.

DESCRIPTION: This FR overgarment is identical in design to the standard chemical protective overgarment. It is a two-piece garment--coat and trousers--packaged as a single unit. The coat has a short stand-up collar to protect the neck, elasticized sleeve cuffs, drawcord at the coat hem, and two cargo pockets. The trousers have two cargo pockets and leg openings with side closures for convenient donning of the CB overboots and the cold weather insulated footwear.

MATERIALS USED:

Outer Shell: Cloth, 95% Nomex and 5% Kevlar, plain weave, 4.3 oz/sq yd.

Lining: Cloth, laminated, nylon tricot knit, polyurethane foam charcoal impregnated and treated for flame resistance.

COLOR: Sage Green (test items only)
Olive Green (regular procurements)

WEIGHT: 4 lbs (size medium)

SIZE: 8 sizes - XXX-Sm thru XX-Lg

COST: \$80.00

LOOP END, BARTACK AT 45° ANGLE



SUSPENDER LOOP PLACEMENT

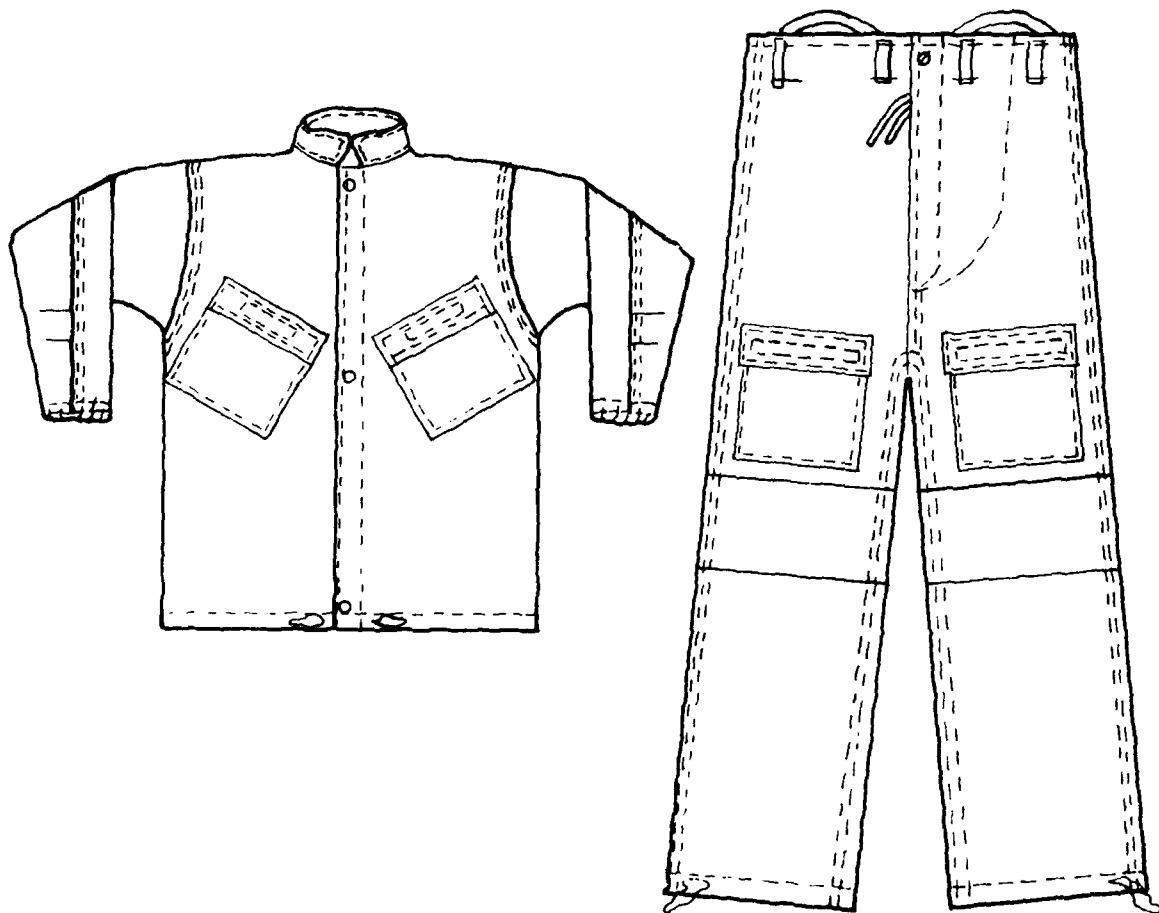


Figure 1A. Suit, chemical protective.

APPENDIX B

SEMANTIC DIFFERENTIAL RATING SCALE (S.D.) QUESTIONNAIRE

CHEMICAL BIOLOGICAL OVERGARMENT

NAME _____

POSITION _____

	EXTREME	MODERATE	SLIGHT	STD "A" CB OVERGARMENT	SLIGHT	MODERATE	EXTREME	
MATERIAL								
SMOOTH	0	0	0	0	0	0	0	ROUGH
THIN	0	0	0	0	0	0	0	THICK
HEAVY	0	0	0	0	0	0	0	LIGHT
FLIMSY	0	0	0	0	0	0	0	RUGGED
GOOD DURABILITY	0	0	0	0	0	0	0	POOR DURABILITY
LOSES SHAPE	0	0	0	0	0	0	0	HOLDS SHAPE
GOOD CONSTRUCTION	0	0	0	0	0	0	0	GOOD CONSTRUCTION
POOR ABSORPTION	0	0	0	0	0	0	0	GOOD ABSORPTION
QUICK DRYING	0	0	0	0	0	0	0	SLOW DRYING
HARD TO CLEAN	0	0	0	0	0	0	0	EASY TO CLEAN
FIT								
TRIM	0	0	0	0	0	0	0	BULKY
POOR FIT	0	0	0	0	0	0	0	GOOD FIT
LOOSE	0	0	0	0	0	0	0	TIGHT
LONG	0	0	0	0	0	0	0	SHORT
GOOD PROPORTIONS	0	0	0	0	0	0	0	POOR PROPORTIONS
HARD/SLOW TO DON	0	0	0	0	0	0	0	EASY/QUICK TO DON
EASY/QUICK TO DOFF	0	0	0	0	0	0	0	HARD/SLOW TO DOFF
UNCOMFORTABLE	0	0	0	0	0	0	0	COMFORTABLE

CHEMICAL BIOLOGICAL OVERGARMENT (Continued)

	EXTREME	MODERATE	SLIGHT	STD "A" CB OVERGARMENT	SLIGHT	MODERATE	EXTREME	
WORKING IN THE CB OVERGARMENT (DYNAMICS)								
ROUGH ON SKIN	0	0	0	0	0	0	0	SMOOTH ON SKIN
DRY	0	0	0	0	0	0	0	SWEATY
HOT	0	0	0	0	0	0	0	COOL
TRIM	0	0	0	0	0	0	0	BULKY
BUNCHES UP	0	0	0	0	0	0	0	STAYS FLAT
AIDS MOVEMENT (WHOLE BODY)	0	0	0	0	0	0	0	RESTRICTS MOVEMENT (WHOLE BODY)
BINDS (BODY PART)	0	0	0	0	0	0	0	MOVES FREELY
COMFORTABLE	0	0	0	0	0	0	0	UNCOMFORTABLE
INCOMPATIBLE	0	0	0	0	0	0	0	COMPATIBLE

APPENDIX C

DATA FORMS--TASKS ASSESSMENTS

CREW STATION INTERFACE TASKS

1. Commander:

Operate machine gun

Use periscope

Operate communications

Other

2. Gunner:

Sight

Fire control equipment

Turret controls

Other

3. Loader:

Reach racks for ammo

Operate breach

Other

4. Driver:

Hand controls

Foot controls

Instrument display

Other

5. Transfer from station-to-station

EXTERNAL TASKS ASSESSED WITH OVERGARMENTS

TP mounts tank

TP enters tank through hatch

TP takes seat at crewman's station

TP exits tank

APPENDIX D

FLAME RESISTANT CB OVERGARMENT--ILLUSTRATED VIEWS



Figure 1D. Tank crewmember wearing Flame Resistant CB Overgarment and associated equipment (front view).



Figure 2D. Tank crewmember wearing Flame Resistant CB Overgarment and associated equipment (side view).



Figure 3D. Tank crewmember wearing Flame Resistant CB Overgarment and associated equipment (side view).



Figure 4D. Tank crewmember wearing Flame Resistant CB Overgarment and associated equipment (rear view).



Figure 5D. Tank crew reloading ammunition into M60A1 wearing Flame Resistant CB Overgarment.



Figure 6D. Tank crewmember conducting fluid level check wearing Flame Resistant CB Overgarment.



Figure 7D. Tank crewmember checking track on M60A1 tank wearing Flame Resistant CB Overgarment.