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SERVICE TEST OF  
LIGHTWEIGHT BODY ARMOR,  
BASIC VEST, T66-1  
FINAL REPORT

BY

FIRST LIEUTENANT JAMES A. BRYANT

June 1967

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AMSTE-BC

1 AUG 1967

SUBJECT: Final Report, Service Test of Lightweight Body Armor, Basic Vest T66-1, RDT&E Project No. LM643303D54730, USATECOM Project No. 8-7-6510-02

TO: Commanding General  
US Army Materiel Command  
ATTN: AMCRD-JI  
Washington, D. C. 20315

1. Reference:

a. Letter, AMSTE-BC, HQ USATECOM, 11 May 1967, subject: Final Report, Service Test of Lightweight Body Armor, Basic Vest T66-1, Under Arctic Winter Conditions, RDT&E Project No. LM643303D54730, USATECOM Project No. 8-7-6510-04.

b. Letter, AMSTE-BC, HQ USATECOM, 26 April 1967, subject: Test Schedule for Lightweight Armor Vest T66-1.

2. Subject report is approved. Copies are forwarded for comment and/or concurrence.

3. As was stated in reference 1b, adjustment to test schedules for Lightweight Armor Vest was necessitated by difficulties encountered in delivery of test and standard comparison items. Two engineering test reports and the Tropic service test report will not be available until mid-August. Normally, final conclusions and recommendations cannot be formulated until all reports are available. However, the findings of subject report are of specific merit and allow final conclusions and recommendations to be reached relative to all requirements of the Qualitative Materiel Requirement with the exception of the ballistic protection requirement. Engineering test report will provide this analysis.

4. Summary of Findings:

a. Deficiencies:

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(1) All sizes of T66-1 Vest exceed the maximum allowable weight limitation of four pounds.

(2) The T66-1 Vest was restrictive to head and body movement and breathing and was found not to provide improvement over the standard vest in the wearer's ability to perform combat related activities.

(3) Parachutists were unable to check the entire main canopy for malfunction or damage while wearing the T66-1 Vest.

(4) The T66-1 Vest was not sufficiently durable to meet the requirement of 120 days use under combat conditions. The following were recurring failures;

(a) Separation of the seam located along the top of the ballistic collar.

(b) Tearing of the material of the bellows type breast pocket.

(c) Fraying of the seam located in the closure system.

(d) Holes developed in the polyethylene cover for the ballistic felt filler. These holes permitted undesirable moisture pick up and retention.

(5) The T66-1 Vest was found to be unduly stiff, bulky and restrictive in the neck and arm openings.

b. Shortcomings:

(1) The grenade hanger straps were inadequate. Test soldiers lost hand grenades carried in the grenade hanger straps during the hand grenade assault course and the live fire assault course.

(2) Maintenance instructions of the Preliminary Operating Maintenance Instruction were inadequate since they did not include instructions for working the vest.

(3) The closure on the bellows type breast pocket was inadequate to keep the pocket closed during patrol exercises.

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5. Conclusions:

- a. The T66-1 Vest is unsuitable for US Army use until correction of the deficiencies and as many as practicable of the shortcomings.
- b. The T66-1 Vest is unsuitable for use by parachutists.
- c. The T66-1 Vest is suitable for wear by personnel during lowering with personnel lowering devices.

6. Recommendations. It is recommended that

- a. The T66-1 Vest be considered unsuitable for US Army use.
- b. Development be continued to correct the deficiencies and as many as practicable of the shortcomings.
- c. Modified Lightweight Vests be returned to USATECOM for retest.

FOR THE COMMANDER:

*Robert B. Tully*  
ROBERT B. TULLY  
LTC GS  
Dir, Inf Mat Test

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JT&E PROJECT NO LM643303D54730  
USATECOM PROJECT NO 8-7-6510-02  
USAIB PROJECT NO 3174

SERVICE TEST OF  
LIGHTWEIGHT BODY ARMOR,  
BASIC VEST, T66-1

TEST REPORT

BY

FIRST LIEUTENANT JAMES A. BRYANT

June 1967

APPROVED:

JAMES I. MUIR, JR.  
Colonel, Infantry  
President

UNITED STATES ARMY INFANTRY BOARD  
Fort Benning, Georgia 31905

### ABSTRACT

The Service Test of Lightweight Body Armor, Basic Vest, T66-1, was conducted by the US Army Infantry Board from 6 January 1967 to 6 May 1967.

The purpose of the test was to determine the suitability of the T66-1 vest for US Army use; to determine to what extent the T66-1 vest met the requirements of the LINCLOE QMR; and to determine the suitability of the T66-1 vest for parachutist's use and use with lowering devices.

Four deficiencies and three shortcomings were found. The deficiencies were: Lack of durability of the T66-1 vest; all sizes of the T66-1 vest exceed the weight limitations specified in LINCLOE QMR; the T66-1 vest restricted head and body movement and breathing to a greater degree than the standard vest and consequently failed to improve, over the standard vest, the wearer's ability to perform combat related activity; the T66-1 vest prevented parachutists from checking their entire canopies for malfunction or damage, thus creating a safety hazard to parachutists. The shortcomings were: The inadequacy of the hand grenade hanger straps for proper retaining of hand grenades; inadequacy of the closure system on the ballows-type breast pockets for keeping the pockets closed; and omission of instructions in the POMI for washing the T66-1 vest.

The US Army Infantry Board concludes that the T66-1 vest is unsuitable for US Army use until correction of the deficiencies and as many shortcomings as practicable. The T66-1 vest does not meet the weight limitations of 4 pounds, as set forth in DA approved QMR for LINCLOE, 23 August 1965. The T66-1 vest is unsuitable for use by parachutists until correction of the deficiency noted in Subtest No 4, Parachute and Rappelling. The T66-1 vest is suitable for use with lowering devices.

The US Army Infantry Board recommends that the T66-1 vest be considered unsuitable for US Army use until correction of all deficiencies and as many of the shortcomings as practicable.

FOREWORD

The US Army Infantry Board (USAIB) was responsible for planning, conducting, and reporting the service test.

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## SECTION 1. INTRODUCTION

### 1.1 BACKGROUND

1.1.1 The Department of the Army (DA) Approved Qualitative Material Requirement (QMR) for a System of Lightweight Individual Combat Clothing and Equipment (LINCLOE), 1 September 1965, states that development of LINCLOE is essential to improve the effectiveness and to conserve the energy of the individual soldier (reference 3). Lightweight Body Armor, one of the items of LINCLOE, was designated for immediate development.

1.1.2 Two studies, "A Study to Reduce the Load of the Infantry Combat Soldier" and "A Study to Conserve the Energy of the Combat Infantryman," were conducted at Fort Benning, Georgia, in 1962-1963 (references 1 and 2). Three of the conclusions of the DA-approved study, "A Study to Conserve the Energy of the Combat Infantryman," are stated in part:

a. "The comparatively small number of combat soldiers that should be entitled to special lightweight clothing and equipment without regard for cost is justified by the importance of their mission."

b. "Many items of standard clothing and equipment are unsuited to the needs of the combat infantryman and must be redesigned, developed, and then produced \* \* \*."

c. "Continued research and development effort should be directed toward obtaining lighter weight or expendable items of individual clothing and equipment \* \* \*. During development of new items, priority must be directed toward lighter weight, as opposed to an increased degree of protection or durability requirements." These conclusions, and paragraph 1439b(2), Combat Developments Objectives Guide, 10 January 1966, provided the basis for the LINCLOE QMR.

1.1.3 The US Army Natick Laboratories (USANLABS) initiated a phased development program for a Lightweight Body Armor System (LEAS), designed to replace the Armor, Body, Fragmentation, Protective (standard vest). The LEAS is being designed on a layer principle with selective protection permitted to the vital portions of the upper torso, i.e., heart and spinal areas. The LEAS consists of the Lightweight Body Armor, Basic Vest, T66-1 (T66-1 vest), and is designed to protect soldiers against shell and grenade fragments. Follow-on development will produce separate attachable body armor protective pieces (not included in this test) for increased protection against small arms fire. The total system will provide protection which is not now achieved by the standard vest.

1.1.4 The US Army Infantry Board (USAIB) received 60 T66-1 vests and 60 standard vests for the conduct of this test.

## 1.2 DESCRIPTION OF MATERIEL

1.2.1 The T66-1 vest consists of the following components:

- a. Ballistic protective nylon cover.
- b. Ballistic protective nylon felt filler.
- c. Ballistic protective collar.

1.2.2 The ballistic protective nylon cover (protective cover) forms the outside shell and is made of ballistic protective nylon with a highly abrasion-resistant surface. Shoulder patches are sewn to the front shoulder sections of the protective cover to assist soldiers in positioning shoulder-fired weapons. Two bellows-type breast pockets with flaps and two grenade hanger straps are sewn to the front of the protective cover. Drainage eyelets are positioned at the bottom seam of the protective cover and assist in elimination of moisture.

1.2.3 The ballistic protective nylon felt filler (protective felt filler) is composed of three panels of nylon felt, each one third of an inch thick. The protective felt filler is incased in water-proof polyethylene. The heart area is covered with four additional plies of ballistic nylon, each 8 3/4 inches long, 4 1/2 inches wide, and 1/8 inch thick. The spine area is also covered with four additional plies of ballistic nylon that are each 1/8 inch thick and 6 inches wide, and extend from the base of the neck piece to the bottom of the T66-1 vest.

1.2.4 The ballistic protective collar (protective collar) consists of one panel of nylon felt, covered on both sides with a layer of lightweight nylon cloth. The protective collar is sewn to the neckline of the T66-1 vest.

1.2.5 The front closure system of the T66-1 vest is identical to the front closure system of the standard vest.

1.2.6 Adjustment procedures for proper fit of the T66-1 vest and standard vest are identical, except that the duck webbing of the side adjustment of the T66-1 vest is one piece that extends the length of the side adjustment flaps. The standard vest has two separate pieces of duck webbing that are attached to the side adjustment flaps in two places.

1.2.7 The T66-1 vest is provided in four sizes: small, medium, large, and extra large.

### 1.3 TEST OBJECTIVES

- a. To determine the suitability of the T66-1 vest for US Army use.
- b. To determine to what extent the T66-1 vest meets the requirements of the LINCOLN QMR.
- c. To determine the suitability of the T66-1 vest for parachutists' use and use with lowering devices.

### 1.4 SUMMARY OF RESULTS

- 1.4.1 All T66-1 vests were received complete; however, eight contained minor defects. It was determined that these defects would not affect testing and the vests that contained the defects were used throughout this service test (Subtest No 1).
- 1.4.2 The test soldiers experienced no difficulty in donning and doffing the T66-1 vest (Subtest No 2).
- 1.4.3 The T66-1 vest was restrictive to head and body movement and to breathing of test soldiers, and caused undue discomfort to test soldiers during the Ranger patrol exercises, 106-mm recoilless rifle crew drill exercise, bayonet assault exercise, defense exercise, daylight attack exercise, patrol exercises, and air assault exercise (Subtest No 3) and the parachute exercises (Subtest No 4).
- 1.4.4 The T66-1 vest did not have a soldier acceptance (Subtest No 7).
- 1.4.5 The mobility and efficiency of test soldiers were approximately the same regardless of whether they wore the T66-1 vest or the standard vest during the 4.2-inch mortar crew drill, 106-mm recoilless rifle crew drill, bayonet assault course, patrol exercises, daylight attack exercises, ground surveillance exercises (Subtest No 3), and repelling exercises (Subtest No 4).
- 1.4.6 The mobility and efficiency of test soldiers who participated in a hand grenade course exercise were significantly better while wearing the standard vest.
- 1.4.7 As the test soldiers who participated in a motor convoy exercise dismounted the vehicles and assumed a prone firing position, they attempted to aim their weapons. The vest rode up and the stiff back portion of the neck opening of the vest interfered with the neck movement of each test soldier and made it difficult for him to achieve a correct sight picture on his rifle (Subtest No 3).

1.4.8 Test soldiers who participated in a live-fire attack exercise while wearing the T66-1 vest obtained significantly more target hits at ranges between 243 and 344 meters, than while wearing the standard vest or while wearing no vest; but throughout the entire exercise there was no significant target hit advantage (Subtest No 3).

1.4.9 Due to the added bulk to the body of a parachutist wearing a T66-1 vest and a field jacket, a waist band extension must be attached to the parachute. If a waist band extension is not provided, the T66-1 vest must be placed inside the kit bag containing the parachutist's individual combat equipment and aeriaily delivered (Subtest No 4).

1.4.10 While participating in rappelling exercises rappellers experienced no significant hindrance cause by the wearing of the T66-1 vest (Subtest No 4).

1.4.11 The T66-1 vest, by camouflage coloration and desi features, provides protection equal to that of the standard vest from direct and indirect visual detection, and protection to the maximum extent practicable from electronic, infrared, and other such surveillance systems (Subtest No 3).

1.4.12 Laundering or cleaning of the T66-1 vest with the means available to the combat soldier in the field did not degrade the protective characteristics, to any observable degree, during the service test (Subtest No 6).

1.4.13 No non-essential or "nice-to-have" features were found in the T66-1 vest during testing (Subtest No 8).

1.4.14 The T66-1 vest failed to meet the following requirements of the LINCLOE QMR:

a. "(Essential) The system shall improve, over the current field clothing and equipment, the wearer's mobility and efficiency by reducing the weight of components and by incorporating other design improvements \* \* \*."

b. "(Essential) The system shall improve over the current field clothing, the individual wearer's ability to perform all combat and related activities and shall permit unencumbered use of weapons, fire control equipment, communication-electronic equipment, vehicular equipment and other related items available in the same time frame."

c. "(Essential) The weight of items comprising the system will be in accordance with weight requirements outlined in study referenced in paragraph 4a, above, and Annex A attached."

d. "(Essential) The system shall permit free head movement equal to current field clothing and equipment and shall not restrict breathing, hearing, \* \* \* , or field of vision to a degree greater than current field clothing and equipment."

e. "(Essential) The system of clothing and individual equipment envisioned must have a minimum life expectancy under combat conditions of approximately 120 days."

f. "Investigation of the human engineering ramifications of this clothing and equipment system will be required. Soldier acceptance is necessary. It is desired that the system reduce the performance degradation below that caused by the current field clothing and equipment \* \* \* ."

1.4.15 All sizes of T66-1 vest exceed the maximum allowable weight limitations of 4 pounds. USAIB is mindful of the requirements of the LINGLOE QMR (reference 3) and "A Study to Conserve the Energy of the Combat Infantryman" (reference 2), which have been approved by Department of the Army (DA). It is the opinion of USAIB that the T66-1 vest is a significant step toward the weight reduction directed by the references. Nevertheless, USAIB feels that any relaxation of the standards prescribed in the references can result in a system of clothing and equipment which exceeds the DA approved maximum "fighting load" limitation of 40 pounds. Therefore, the failure to meet the 4 pounds maximum weight limitation of the QMR is a deficiency (Subtest No 1).

1.4.16 The T66-1 vest was restrictive to head and body movement and breathing and consequently does not improve, over the standard vest, the wearer's ability to perform combat related activities. This is a deficiency. (Subtest No 3.)

1.4.17 The inability of a parachutist to check his entire canopy for malfunction or damage while wearing the T66-1 vest is a safety hazard. This is a deficiency (Subtest No 4).

1.4.18 The T66-1 vest is not sufficiently durable to meet the requirement of 120 days use under combat conditions as evidenced by these recurring failures:

a. Separation of the seam located along the top of the ballistic protective collar.

b. Tearing of the material which comprises the bellows-type breast pockets.

c. Fraying of the seam located in the closure system of the T66-1 vest.

d. Holes occurring in the polyethylene bag that acts as water-proofing for the ballistic protective felt filler of the vest. These holes apparently were the result of friction between the polyethylene bag and the ballistic protective cover. It was noted that as long as 2 months after the vests were submerged in water the T66-1 vests which had a significant increase in weight due to moisture absorption during the exercise still retained a great deal of moisture. The amount of moisture picked up and retained by each vest varied depending upon the location and size of the hole or holes in the polyethylene bag. This lack of durability is a deficiency.

1.4.19 Because the T66-1 vest is unduly stiff, bulky, and restrictive in the neck and arm openings, it is determined that the T66-1 vest is not suitably engineered from a human factors standpoint. The presence of engineering factors which are unsuitable from a human factors standpoint was reported as a deficiency in Subtest No 3.

1.4.20 The hand grenade hanger straps on the T66-1 vest are inadequate as test soldiers lost hand grenades carried in the grenade hanger straps during the hand grenade assault course exercise and the live-fire assault course exercise. The inadequacy of the hand grenade hanger straps on the T66-1 vest for proper retaining of hand grenades is a shortcoming (Subtest No 3).

1.4.21 Maintenance instructions as listed in the PONI can be readily accomplished on the T66-1 vest. However, the PONI provided with the T66-1 vest did not include instructions for washing the vest. Omission of these instructions is a shortcoming (Subtest No 6).

1.4.22 The closure system on the bellows-type breast pockets was inadequate to keep the pockets closed during patrol exercises. This inadequacy is a shortcoming (Subtest No 3).

### 1.5 CONCLUSIONS

The US Army Infantry Board concludes that:

a. The T66-1 vest is unsuitable for US Army use until correction of the deficiencies and as many as practicable of the shortcomings.

b. The T66-1 vest is unsuitable for use by parachutists until correction of the deficiency noted in Subtest No 4, Parachute and Rappelling.

c. The T66-1 vest is suitable for use with lowering devices.

#### 1.6 RECOMMENDATION

The US Army Infantry Board recommends that:

The T66-1 vest be considered unsuitable for US Army use until correction of all deficiencies, and as many of the shortcomings as practicable.

## SECTION 2. DETAILS OF TEST

### 2.1 INTRODUCTION

#### 2.1.1 Test Criteria

The T66-1 vest was tested against the requirements prescribed in the DA approved QMR for LINGIOW (reference 3). For the purpose of this service test the terms "T66-1 vest" and "standard vest" are synonymous with the terms "system" and "current field clothing," respectively, as used in the Performance and Physical Characteristics contained in the QMR.

#### 2.1.2 Test Location

Testing was accomplished at Fort Benning, Georgia; Dahlonaga, Georgia; and Eglin Air Force Base, Florida, under the temperate climatic conditions that prevailed.

#### 2.1.3 Test Soldiers

Soldiers used in this test were representative of those expected to use the T66-1 vest. When appropriate, test soldiers were equipped with field uniforms, equipment, and weapons. All test soldiers were instructed as to the objective of this test and the specific objectives of each subtest in which they participated.

#### 2.1.4 Control Item

The standard vest was utilized as the control item for the conduct of this service test.

#### 2.1.5 Test Results

The results of all tests were recorded and analyzed. Qualitative observations and judgments of test personnel concerning the performance or suitability of the T66-1 vest were recorded. However, qualitative observations and judgments are clearly indicated as such and were recorded separately from factual data. The extent to which qualitative observations and judgments have a direct bearing on the interpretation of factual data, or must serve in the absence of factual data, is clearly indicated in the analysis.

#### 2.1.6 Photographic Coverage

Photographic coverage was used where appropriate to supplement data obtained during tests.

## 2.2 SUBTEST NO 1, PREOPERATIONAL INSPECTION AND PHYSICAL CHARACTERISTICS

### 2.2.1 Objectives

2.2.1.1 To determine if all vests were complete and in proper condition for operational testing.

2.2.1.2 To determine the physical characteristics of the T66-1 vest.

2.2.1.3 To determine if the T66-1 vest met the following characteristics:

a. "(Essential) The weight of items comprising the system will be in accordance with weight requirements outlined in paragraph 4a and Annex A of Department of the Army (DA) Approved Qualitative Material Requirement (QMR) for a System of Lightweight Individual Clothing and Equipment (LINCLE), 1 September 1965."

b. " \* \* \* and will be of a style that is not a radical departure from current styling."

### 2.2.2 Method

2.2.2.1 All vests were inspected for configuration, completeness, and serviceability.

2.2.2.2 Five T66-1 vests of each size were weighed and measured; one of each size was photographed (Figures 1 and 2, Appendix I). The average weight and measurements of each size were computed and compared with corresponding data for the standard vests.

### 2.2.3 Results

2.2.3.1 Eight T66-1 vests were found to contain minor defects. These defects were reported on Equipment Failure Reports (EPR) No M1-1 through No M1-5. It was determined that these defects would not seriously affect testing and these vests were used during the conduct of testing.

2.2.3.2 All vests were complete, to include preliminary maintenance, sizing, and fitting instructions.

2.2.3.3 The average weight and dimensions of each size T66-1 vest and each size standard vest appear below:

WEIGHT (Pounds)

T66-1 Vest		Standard Vest	
Small	4.5	Small	7.9
Medium	4.9	Medium	8.9
Large	5.5	Large	9.6
X Large	5.8	X Large	None Received

DIMENSIONS (Inches)

T66-1 Vest				
Size	Length of Back	Width of Back	Width of Right Side	Width of Left Side
Small	21.7	19.9	19.1	13.0
Medium	22.4	22.0	14.1	14.1
Large	23.2	24.0	15.1	15.3
X Large	23.9	25.0	16.1	16.4

Standard Vest				
	Length of Back	Width of Back	Width of Right Side	Width of Left Side
Small	22.4	18.0	12.8	13.6
Medium	23.1	20.3	13.7	14.5
Large	24.0	23.0	16.2	17.2
X Large	None Received			

#### 2.2.4 Analysis

2.2.4.1 All sizes of the T66-1 vest exceed the maximum allowable weight limitation of 4 pounds as specified in Annex A of the DA approved QMR for LINCLOE dated 1 September 1965. USAIB is mindful of the requirements of the LINCLOE QMR (reference 3) and "A Study to Conserve the Energy of the Combat Infantryman" (reference 2), which have been approved by Department of the Army (DA). It is the opinion of USAIB that the T66-1 vest is a significant step toward the weight reduction directed by the references. Nevertheless, USAIB feels that any relaxation of the standards prescribed in the references can result in a system of clothing and equipment which exceeds the DA approved maximum "fighting load" limitation of 40 pounds. Therefore, the failure to meet the 4 pounds maximum weight limitation of the QMR is a deficiency.

2.2.4.2 The style of the T66-1 is not a radical departure from current styling. (See Figures 1 and 2, Appendix I.)

2.2.4.3 The minor defects discovered during preoperational inspection, as outlined in paragraph 2.2.3.1, indicate a lack of satisfactory quality control.

### 2.3 SUBTEST NO 2, DONNING AND DOFFING

#### 2.3.1 Objectives

2.3.1.1 To determine the ease of donning and doffing the T66-1 vest.

2.3.1.2 To determine if the T66-1 vest met the following characteristic:

"(Essential) The system shall permit maximum ease of donning and doffing \* \* \*. Closures shall be designed to permit easy opening and closing while wearing appropriate handwear \* \* \*."

#### 2.3.2 Method

2.3.2.1 Each of 10 test soldiers was required to first don and then doff the T66-1 vest. This exercise was repeated four times.

2.3.2.2 The exercise in paragraph 2.3.2.1 was repeated, except that the test soldiers were equipped with the standard vest.

2.3.2.3 The exercises described in paragraphs 2.3.2.1 and 2.3.2.2 were repeated, except that the test soldiers wore Gloves, Shell, Leather, with wool inserts.

### 2.3.3 Results

2.3.3.1 The test soldiers experienced no difficulty in donning and doffing either the T66-1 vest or the standard vest.

2.3.3.2 The average times required to don and doff the T66-1 vest and the standard vest appear below:

TIME (SECONDS) REQUIRED WITHOUT HANDWEAR			
T66-1 Vest		Standard Vest	
Don	Doff	Don	Doff
6.1	3.9	7.2	3.0

TIME (SECONDS) REQUIRED WITH HANDWEAR			
T66-1 Vest		Standard Vest	
Don	Doff	Don	Doff
6.8	3.2	6.9	3.0

### 2.3.4 Analysis

The T66-1 vest meets the essential characteristic concerning donning and doffing.

## 2.4 SUBTEST NO 3, FUNCTIONAL SUITABILITY

### 2.4.1 Objectives

2.4.1.1 To determine the functional suitability of the T66-1 vests.

2.4.1.2 To determine if the T66-1 vest met the following characteristics:

a. "(Essential) The system shall improve, over the current field clothing and equipment, the wearer's mobility and efficiency by reducing the weight of components and by incorporating other design improvements \* \* \*."

b. "(Essential) The system shall improve over the current field clothing, the individual wearer's ability to perform all combat and related activities and shall permit unencumbered use of weapons, fire control equipment, communication-electronic equipment, vehicular equipment and other related items available in the same time frame."

c. "(Essential) The system shall permit free head movement equal to current field clothing and equipment and shall not restrict breathing, hearing, \* \* \*, or field of vision to a degree greater than current field clothing and equipment."

d. "(Essential) The system shall permit simple adjustment or adaptation without assistance to various levels of physical activity, body functions and environmental conditions."

e. "The system shall, by camouflage coloration or other means, provide protection from direct or indirect visual detection from the ground or air and, to the maximum extent practicable, from electronic, infrared and other such surveillance systems."

#### 2.4.2 Method

2.4.2.1 Fifty-seven soldiers of a Ranger course conducted by the Ranger Department, US Army Infantry School, Fort Benning, Georgia, were each issued one T66-1 vest. Each of these students wore a T66-1 vest while participating in Ranger patrol problems that were conducted at Dahlonaga, Georgia, and Eglin Air Force Base, Florida.

2.4.2.2 Each member of a TOE 4.2-inch mortar platoon, equipped with a fighting load and a T66-1 vest, participated in crew drill as prescribed in Section 3, Chapter 2, FM 23-92. This exercise was repeated 9 times, except that during 3 of the crew drills the test soldiers wore the standard vest. The fire direction center personnel of the 4.2-inch mortar platoon also participated in this exercise by operating the fire direction center.

2.4.2.3 Each member of a TOE 106-mm recoilless rifle squad, equipped with a fighting load and a T66-1 vest, participated in crew drill as prescribed in Section 2, Chapter 6, FM 23-82. This exercise was repeated 9 times, except that during 3 of the crew drills the test soldiers wore the standard vest.

2.4.2.4 Thirty test soldiers, each equipped with a fighting load and a T66-1 vest, traversed a bayonet assault course as prescribed in FM 21-50. This exercise was repeated 9 times, except that during 3 of the bayonet assaults the test soldiers wore the standard vest.

2.4.2.5 Thirty test soldiers, each equipped with a fighting load and a soft cap in lieu of a helmet, and a T66-1 vest, were divided into three groups of 10 soldiers each. Each group negotiated a hand grenade assault course consisting of five stations as prescribed in FM 23-30. Each group was placed at a different station, and after each soldier of each group had completed the station, the groups rotated to the next station. This was repeated until each group had completed all five stations. This exercise was repeated five

tizes, except that during three of the exercises the test soldiers wore the standard vest.

2.4.2.6 Sixty test soldiers of a reinforced TOE rifle platoon, each equipped with a fighting load and a soft cap in lieu of a helmet, participated in a 2-day combat patrol. The route of the patrol required the test soldiers to traverse various types of terrain including open areas, heavily wooded areas, marshy areas, and areas covered with thick underbrush. During the conduct of the patrol, simulated tactical situations were introduced which required the test soldier to run, jump, and crawl for various distances. The test soldiers were required to employ their weapons from various positions, such as prone, kneeling, squatting, and standing. The 60 test soldiers were divided into two 30-man groups which were designated as Group A and Group B. During the first half of the first day, Group A wore the T66-1 vest and Group B wore the standard vest. At noon, the two groups exchanged vests, and during the second half of the first day, Group A wore the standard vest and Group B wore the T66-1 vest. During the second day the order of wear was reversed.

2.4.2.7 At the completion of the combat patrol exercise described in paragraph 2.4.2.6, the platoon withdrew and occupied a defensive position. At this location, the 60 test soldiers, each equipped with a T66-1 vest, prepared their individual primary and alternate defensive positions. In addition, the test soldiers prepared a command post-observation post bunker, and emplacements for crew-served weapons, i.e., the machine gun, 7.62-mm, M60, and the 90-mm recoilless rifle, M67. The improvement of defensive positions was continuous and test soldiers exercised the proper technique of camouflage.

2.4.2.8 At the conclusion of the exercise described in paragraph 2.4.2.7, the platoon conducted a daylight attack and secured an objective. The test soldiers were each equipped with a fighting load and a T66-1 vest. During the attack they were required to advance by fire and maneuver over different types of terrain. After the objective had been secured, a hasty defense was prepared by the test soldiers. This exercise was repeated, except that the test soldiers wore the standard vest.

2.4.2.9 At the completion of the exercise described in paragraph 2.4.2.8, the platoon leader was alerted to prepare his platoon for a helicopter air assault. Forty-eight test soldiers, each equipped with a fighting load and a T66-1 vest, were transported by helicopters to an area of suspected guerrilla activity. They searched the suspected area and simulated the destruction of all supplies and equipment found.

2.4.2.10 The patrol exercises described in paragraph 2.4.2.6 were repeated three times.

2.4.2.11 Thirty-three test soldiers, 17 equipped with the T66-1 vest and 16 equipped with the standard vest, were transported by motor convoy for 50 miles cross-country and over unimproved roads. The motor convoy consisted of a Truck, Cargo, Utility, 1/4-Ton, 4x4, M151; Truck, Cargo, 3/4-Ton, 4x4, M37; and a Truck, Cargo, 2 1/2-Ton, M135. During the conduct of this exercise, simulated combat situations were introduced which required the test soldier to dismount rapidly from the vehicles.

2.4.2.12 Twenty-seven test soldiers, each armed with an M-16 rifle and equipped with a fighting load to include four practice hand grenades attached to the vest in the grenade hanger straps, were divided into 9 groups of 3 men each, and negotiated the USAIB Instrumented Attack Range. During the conduct of the attack, each group was required to engage 10 hit-sensitive, 3-dimensional, silhouette targets from 16 kneeling positions. The instrumentation system gathered data to reflect the number of rounds fired by each individual, number of targets hit by each individual, number of target hits by each individual, and the magazine change time per group. Each group negotiated this range 9 times; 3 times while wearing the T66-1 vest, 3 times with the standard vest, and 3 times without a vest.

2.4.2.13 Each member of a TOE Battalion Ground Surveillance Section, equipped with a T66-1 vest, conducted training utilizing organic surveillance devices. In addition, the Ground Surveillance Section was equipped with periscopes and infrared weapon sights. The surveillance devices were used at night to detect stationary and moving test soldiers. Three of these test soldiers were equipped with T66-1 vests, 3 were equipped with standard vests, and 3 wore no vests. During the hours of daylight, test soldiers equipped with a T66-1 vest and the standard vest were observed by ground observation posts at various ranges and terrain conditions.

2.4.2.14 During all exercises of this subtest, test supervisory personnel, by observation and by interview as appropriate, obtained data necessary to evaluate the use of the T66-1 vest in comparison with the standard vest.

### 2.4.3 Results

2.4.3.1 Results of interviews with Ranger students at the conclusion of the Dahlonga, Georgia, phase, and at the conclusion of the Florida phase of Ranger training appear below:

Question	Dahlonga		Florida	
	Yes	No	Yes	No
1. Did the T66-1 vest restrict head movement?	11	46	27	30
2. Did the T66-1 vest hinder your arm movement?	20	37	24	43
3. Did the T66-1 vest restrict breathing?	12	45	8	49
4. Did the T66-1 vest restrict hearing?	0	57	0	57
5. Was the T66-1 vest comfortable?	26	31	35	22

It was noted by test supervisory personnel who observed the Rangers preparing their equipment for patrol exercises that the entire load carrying system must be adjusted in order to fit properly when worn with the T66-1 vest. The load carrying system must be readjusted when the vest is removed.

2.4.3.2 The test soldiers who participated in crew drill on the 4.2-inch mortar reported that they experienced no discomfort or hindrance while wearing the standard vest. Two of the test soldiers reported that they experienced discomfort in the area of the neck while wearing the T66-1 vest. Times required to perform crew drill appear below:

Drill	T66-1 Vest		Drill	Standard Vest	
	Time (Minutes)			Time (Minutes)	
1	10.0		1	8.0	
2	8.4		2	8.9	
3	9.0		3	9.3	
4	9.1		4	10.0	
5	8.9		5	9.3	

2.4.3.3 All test soldiers who participated in 106-mm recoilless rifle crew drill stated that they preferred to wear the standard vest because it allowed them more freedom of movement, and was more flexible than the T66-1 vest. When test soldiers were seated on the 106-mm recoilless rifle carrier (1/4-ton vehicle), it was observed by test supervisory personnel that the T66-1 vest had a tendency to ride up on the wearer's body until the front portion of the neck area was pressing into the throat of the wearer (Figure 3, Appendix I). All test soldiers pointed out that this condition was very uncomfortable and would have caused them to remove the vests if they had to remain on the vehicle for a long period of time. Times required to perform crew drill appear below:

<u>T66-1 Vest</u>		<u>Standard Vest</u>	
<u>Drill</u>	<u>Time (Seconds)</u>	<u>Drill</u>	<u>Time (Seconds)</u>
1	23	1	30
2	32	2	24
3	14	3	13
4	12	4	16
5	7	5	12

**NOTES**

a. During drills 1 and 2, the 106-mm recoilless rifle was removed from the vehicle and employed in a ground-mounted role for a simulated round, and returned to the vehicle. Time required for crew drill was taken from the time the squad leader gave the command of "Action" until the weapon was placed back on the vehicle.

b. During drills 3, 4, and 5, the 106-mm recoilless rifle was employed in a vehicle mounted role. Time required to perform crew drill was taken from the time the squad leader gave the command of "Action" until a simulated fire mission had been completed.

2.4.3.4 The average times required to negotiate the bayonet assault

course appear below:

<u>T66-1 Vest</u>		<u>Standard Vest</u>	
<u>Assault</u>	<u>Time (Minutes)</u>	<u>Assault</u>	<u>Time (Minutes)</u>
1	6.5	1	6.8
2	7.2	2	7.1
3	7.1	3	7.0
4	7.1	4	7.6
5	6.5	5	6.7

2.4.3.5 Recurring comments made by test soldiers throughout the bayonet assault course exercise appear below:

a. The stiffness and the bulkiness of the underarm portion of the T66-1 vest restrict arm movement and make the vest very uncomfortable.

b. The stiffness of the neck area of the T66-1 vest restricts head movement and causes discomfort to the wearer.

c. The lower edge of the T66-1 vest rides on top of and cuts into the hip of the wearer. The standard vest does not do this.

d. The T66-1 vest seemed to retain body heat to a greater degree than did the standard vest. This condition quickly resulted in discomfort to the wearer.

2.4.3.6 At the conclusion of each assault of the bayonet exercise in which the test soldiers were equipped with the T66-1 vest, approximately 20 percent of the test soldiers complained that the vest restricted their breathing.

2.4.3.7 At the conclusion of all bayonet assaults, 11 test soldiers indicated that they preferred the T66-1 vest because it was lighter than the standard vest. Nineteen test soldiers indicated that they preferred the standard vest, regardless of the increased weight, because it allowed them more freedom of movement and was more flexible than the T66-1 vest.

2.4.3.8 The average times required to negotiate the hand grenade assault course per group appear below:

<u>T66-1 Vest</u>		<u>Standard Vest</u>	
<u>Station</u>	<u>Time (Minutes)</u>	<u>Station</u>	<u>Time (Minutes)</u>
1	3.8	1	3.7
2	4.3	2	4.2
3	4.4	3	4.7
4	3.1	4	3.3
5	2.0	5	2.2

2.4.3.9 The average number of grenades thrown and the average number of hits obtained per group during the hand grenade assault course appear below:

<u>T66-1 Vest</u>			<u>Standard Vest</u>		
<u>Station</u>	<u>Grenades Thrown</u>	<u>Hits</u>	<u>Station</u>	<u>Grenades Thrown</u>	<u>Hits</u>
1	16	11	1	14	12
2	19	6	2	19	10
3	15	10	3	17	14
4	15	9	4	13	12
5	14	10	5	10	10

2.4.3.10 At the completion of the hand grenade assault course exercise, 21 test soldiers indicated that they preferred the standard vest. Eight of the twenty-one test soldiers who preferred the T66-1 vest stated that the T66-1 vest retained body heat to a greater degree than did the standard vest. See paragraph 2.6.3.3, Subtest No. 5, for temperatures. The test soldiers who preferred the standard vest stated that they would rather wear the standard vest because the shoulders of the vest did not interfere with the arm as they threw grenades. These test soldiers complained that the stiff shoulders on the T66-1 vest cut into their arms when they threw grenades.

2.4.3.11 During the exercise described in paragraph 2.4.2.5, hand grenades carried in the grenade hanger straps on both types of vests were frequently dropped off the grenade hanger straps.

2.4.3.12 At the completion of the first day of patrol, as described in paragraph 2.4.2.6, 32 test soldiers indicated that they preferred the T66-1 vest because it was lighter than the standard vest. Twenty-eight test soldiers indicated that they preferred the standard vest because it was more comfortable, more flexible, and allowed them more freedom of movement, especially in the neck and underarm area, as they participated in the patrol exercise. One test soldier stated that in his opinion the shoulder pads on the standard vest were more suitable for carrying the weight of the 90-mm recoilless rifle, and that he had been more comfortable while wearing the standard vest and carrying the 90-mm recoilless rifle, than while wearing the T66-1 vest and carrying the 90-mm recoilless rifle. At the conclusion of the second day of patrolling, 35 test soldiers indicated that they preferred the standard vest, and 25 indicated that they preferred the T66-1 vest.

2.4.3.13 At the conclusion of the defense exercise described in paragraph 2.4.2.7, 23 test soldiers indicated that during the exercise they had experienced hindrance and discomfort caused by wearing the T66-1 vest. They stated that the T66-1 vest restricted their breathing as they dug positions and that it was restrictive to neck and head movement. Each of these 23 test soldiers also stated that as he bent over to dig, the stiff lower portion of the T66-1 vest cut into the lower part of his stomach area and the neck portion of the vest cut into his throat. Thirty-seven test soldiers indicated that they experienced little hindrance or discomfort as they participated in the exercise.

2.4.3.14 At the conclusion of the daylight attack exercise described in paragraph 2.4.2.8, 39 test soldiers indicated that they preferred the standard vest because it was cooler, more comfortable, more flexible, and allowed them more freedom of head and arm movement than did the T66-1 vest. Twenty-one test soldiers indicated that they preferred the T66-1 vest because it was lighter than the standard vest. However, these test soldiers stated that they noticed that the T66-1 vest retained more body heat than the standard vest and was uncomfortable because of this.

2.4.3.15 During the air assault and search and destroy exercises described in paragraph 2.4.2.9, it was noted that the test soldiers became unusually wet with perspiration. This exercise took place on a sunny, mild day. After the test soldiers traversed approximately 14 miles of lightly wooded terrain, they were instructed to remove the load carrying equipment and the T66-1 vests. Except for the sleeves, the entire shirt of each test soldier was completely wet with perspiration. The test soldiers reported that the T66-1 vest did not interfere with or hinder their movements as they boarded or exited the helicopter. Each of 12 test soldiers stated that while he was riding in the helicopter he became uncomfortable because the T66-1 vest rode up and cut into his throat.

2.4.3.16 The number of test soldiers who preferred the T66-1 vest and the number who preferred the standard vest after each day of patrolling exercises described in paragraph 2.4.2.10 appear below:

	<u>T66-1 Vest</u>	<u>Standard Vest</u>
1st day patrol	37	23
2d day patrol	31	29
3d day patrol	20	40
4th day patrol	25	35
5th day patrol	23	37
6th day patrol	29	31

2.4.3.17 At the completion of the exercise described in paragraph 2.4.2.10, test soldiers made generally the same comments pertaining to the T66-1 vest and the standard vest, as they made during the interview at the completion of the patrol exercise described in paragraph 2.4.2.6, except as noted below:

- a. Shouldering the M-14 rifle while wearing either the T66-1 vest or the standard vest was difficult because the butt of the rifle was continually sliding off the vest onto the arm. This required frequent repositioning of the weapon in order to maintain a correct firing position.
- b. The T66-1 vest was uncomfortable because the neck opening was too small and irritated the neck.
- c. The T66-1 vest was uncomfortable because the bottom of the T66-1 vest cut the lower portion of the stomach area of the wearer when he assumed the squatting position and fired his weapon.
- d. It was easier to crawl while wearing the standard vest because it allowed more freedom of movement to the arms than the T66-1 vest. The T66-1 vest would bind against the arm of the wearer as he crawled.

2.4.3.18 It was noted by test supervisory personnel through interviews and by observation that the closure system on the bellows-type breast pockets would not keep the pocket closed during patrol exercises.

2.4.3.19 Test soldiers were interviewed at the completion of the motor convoy exercise described in paragraph 2.4.2.11. Nine of the

test soldiers who wore the T66-1 vest complained that when they dismounted from the vehicle and assumed the prone firing position, the vest rode up until the back of the vest hockles pressed into the back of their necks, making it difficult for them to raise their heads in order to aim their weapons. No other comments were made concerning either the T66-1 vest or the standard vest.

2.4.3.20 During the first six assaults of the attack course exercise in which test soldiers wore the T66-1 vest, and the first six in which test soldiers wore the standard vest, each test soldier lost the four grenades that he carried in the grenade hanger straps prior to reaching the assault line. The assault line was the nearest position at which hand grenades could have been used against the objective. Results of this exercise recorded by the instrumentation system are shown in Test Data, Appendix I.

2.4.3.21 At the completion of the attack course exercise 12 test soldiers indicated that they preferred the T66-1 vest because it was lighter, and because the stock of the M-16 rifle seemed to fit in the shoulder better (Figure 4, Appendix I) than with the standard vest. Seventeen test soldiers indicated that they preferred the standard vest because it was not as bulky, it allowed them more freedom of movement as they participated in the assaults, and because it did not retain as much body heat.

2.4.3.22 During the exercise described in paragraph 2.4.2.19, test soldiers reported that they experienced no hindrance or discomfort while wearing either the T66-1 vest or the standard vest. Surveillance devices detected simultaneously test soldiers wearing the T66-1 vest, the standard vest, and no vest.

#### 2.4.4 Analysis

2.4.4.1 As noted in paragraphs 2.4.3.1, 2.4.3.5, 2.4.3.6, 2.4.3.12, 2.4.3.13, 2.4.3.14, and 2.4.3.17, the T66-1 vest was restrictive to head and body movement and to breathing, and consequently does not improve, over the standard vest, the wearer's ability to perform combat related activities. This is a deficiency.

2.4.4.2 Inadequacy of the closure system in the bellows-type breast pockets is a shortcoming. This was reported on NFR No KL-11.

2.4.4.3 As noted in paragraphs 2.4.3.11 and 2.4.3.20, the hand grenade hanger straps in the T66-1 vest are inadequate for retaining hand grenades. Inadequacy of the hand grenade hanger straps on the T66-1 vest for proper retaining of hand grenades is a shortcoming.

2.4.4.4 During the live-fire attack exercise test soldiers obtained significantly more target hits at ranges from 263 to 366 meters while wearing the T66-1 vest than while wearing the standard vest or while wearing no vest; but throughout the entire exercises there was no significant target hit advantage with the T66-1 vest.

2.4.4.5 The surveillance exercise indicated that the T66-1 vest by camouflage coloration and design features provides protection equal to that of the standard vest, from direct and indirect visual detection, and protection from electronic, infrared, and other such surveillance systems.

## 2.5 SUBTEST NO 4, PARACHUTE AND RAPPELLING

### 2.5.1 OBJECTIVE

To determine the suitability of the T66-1 vest for use by parachutists and for use by soldiers rappelling from a hovering helicopter.

### 2.5.2 Method

2.5.2.1 Ten parachutists, each equipped with a T66-1 vest, made a parachute jump from a U6A aircraft. Test supervisory personnel interviewed each parachutist to determine if he experienced any hindrance or discomfort attributable to the T66-1 vest.

2.5.2.2 The exercise described in paragraph 2.5.2.1 was repeated, except that the parachute jumps were made from a C119 aircraft, and the parachutists were each equipped with a field jacket worn under the T66-1 vest.

2.5.2.3 The exercise described in paragraph 2.5.2.2 was repeated, except that the parachute jumps were made from a C-130 aircraft by two parachutists each equipped with a T66-1 vest and a parachutist adjustable equipment bag; six parachutists, each equipped with a T66-1 vest, and individual weapons container, and a kit bag containing individual combat equipment; and two parachutists, each equipped with a T66-1 vest and carrying no additional equipment. During this exercise the field jacket was worn as an outer garment over the T66-1 vest.

2.5.2.4 Ten test soldiers, each equipped with a fighting load and a T66-1 vest rappelled three times from a helicopter hovering at 140 feet. (Figure 3, Appendix I.) This exercise was repeated one time except that each test soldier wore a standard vest.

### **2.5.3 Results**

2.5.3.1 At the conclusion of the exercise described in paragraph 2.5.2.1, four parachutists indicated that they had experienced hindrance due to the wearing of the T66-1 vest. Each of the four parachutists stated that when checking the canopy for malfunction or damage, the stiff back portion of the neckline of the T66-1 vest blocked his neck and head and prevented him from moving his head back far enough to see the entire canopy.

2.5.3.2 At the conclusion of the exercise described in paragraph 2.5.2.2, five parachutists indicated that they experienced hindrance when checking the canopy for malfunction or damage. Seven parachutists indicated that they had been very uncomfortable while wearing the T66-1 vest during this exercise, and especially while riding in the aircraft.

2.5.3.3 At the conclusion of the exercise described in paragraph 2.5.2.3, seven parachutists indicated that they had experienced hindrance when checking the canopy for malfunction or damage.

2.5.3.4 During donning of the T-10 parachute and the T-10 reserve parachute in the exercises described in paragraphs 2.5.2.2 and 2.5.2.3, test supervisory personnel noted that due to the added bulk to the parachutist's body caused by the wearing of a T66-1 vest and a field jacket, the waist band of the T-10 parachute was not long enough to allow a proper quick release after the waist band had been secured in the waist band adjuster end. (Reference TM 57-220, Chapter 2, Section II, paragraph 12.)

2.5.3.5 At the conclusion of the exercise described in paragraph 2.5.2.4, eight rappellers indicated that they preferred to wear the standard vest because it allowed them more freedom of movement while rappelling than the T66-1 vest. However, they indicated that they had experienced no significant hindrance while wearing the T66-1 vest.

### **2.5.4 Analysis**

2.5.4.1 The inability of a parachutist to check his entire canopy for malfunction or damage while wearing the T66-1 vest is a safety hazard. This is a deficiency.

2.5.4.2 It was determined that the discomfort experienced by the seven parachutists in paragraph 2.5.3.2 was caused by the field jacket under the T66-1 vest. When the parachutist wore the field jacket,

over the T66-1 vest (paragraph 2.5.3.3) there were no complaints of discomfort.

2.5.4.3 Inability to form a proper quick release in the waist band of the T-10 parachute due to increased bulk to the parachutist's body is readily correctible by the addition of a waist band extension. This is described in detail in TM 57-220, Chapter 7, Section I, paragraph 120b. Each parachutist required to make a parachute jump while wearing the T66-1 vest and a field jacket must be equipped with a waist band extension. If the waist band extension is not provided the T66-1 vest must be placed in the kit bag containing the parachutist's individual combat equipment.

2.5.4.4 Due to the deficiency noted in paragraph 2.5.4.1 the T66-1 vest is not suitable for use by parachutists.

2.5.4.5 The rappellers experienced no significant hindrance when wearing the T66-1 vest while participating in rappelling exercises. The T66-1 vest is functionally suitable for use by soldiers rappelling from a hovering helicopter.

## 2.6 SUBTEST NO 5, DURABILITY AND RELIABILITY

### 2.6.1 RECEIPTS

2.6.1.1 To determine if the T66-1 vest was durable and reliable.

2.6.1.2 To determine if the T66-1 vest met the following characteristic:

"(Essential) The system of clothing and individual equipment envisioned must have a minimum life expectancy under combat conditions of approximately 170 days."

### 2.6.2 Method

2.6.2.1 Throughout all testing, note was made of failures and other occurrences or incidents having a bearing on the durability and reliability of the T66-1 vest. Particular note was made of increased weight due to moisture absorption.

2.6.2.2 In addition to other exercises, thirty test soldiers from Headquarters and Headquarters Company, USAIN, each wore the T66-1 vest during duty hours for a period of approximately 60 days while participating in other test projects.

### 2.6.3 Results

2.6.3.1 The number and types of failures and days of wear prior to failure appear below:

Failure Description	No. of Vests w/Failure	Days of Wear Prior to Failure	Reference Appendix I	Reported on EPA No
1. Separation of seam in ballistic protective collar.	5	25	Figure 6	KL-6
2. Recurrence of separation of seam.	6	90	Figure 6	KL-6-1
3. Rips in bellows-type breast pockets.	13	25	Figure 7	KL-7
4. Recurrence of rips in bellows-type breast pocket.	13	90	Figure 7	KL-7-1
5. Fraying of seam in closure system.	11	26	Figure 8	KL-8

Failure Description	No of Vests w/Failure	Days of Wear Prior to Failure	Reference Appendix 1	Reported on Form No.
6. Recurrence of fraying of seam in closure system.	4	90	Figure 8	KL-8-1
7. Separation of seam in underarm area of vest.	3	25	Figure 9	KL-9
8. Recurrence of separation of seam in underarm area of vest.	2	90	Figure 9	KL-9-1
9. Holes in polyethylene bag which encases the ballistic protective nylon felt.	35	Detected after 104 days of test.	Figure 10	KL-12 and KL-12-1

2.6.3.2 Separation of the seam located along the top of the ballistic protective collar caused the loss of one half of the protective collar of four vests during this service test, thereby reducing the protective capabilities of the T66-1 vests.

2.6.3.3 The average increase in weight in all sizes of T66-1 vest as a result of moisture absorption and becoming soiled during certain exercises appears below:

Exercise	Date	Average Weight Increase (Ounces)	Weather Conditions	Average Temperature
1-day Ranger Patrol	8 Jan	2.5	9 hours rain	51°
1-day Ranger Patrol	9 Jan	.8	clear	46°
2-day Ranger Patrol	10 Jan & 11 Jan	1.5	clear	22°
3-day Ranger Patrol	12, 13, & 14 Jan	6.4	14 hours rain	41°
3-day Ranger Patrol	15, 16, & 17 Jan	.5	clear	41°
8-day Ranger Patrol	18 through 25 Jan	1.2	1 hour rain	47°

Exercise	Date	Average Weight Increase (pounds)	Weather Conditions	Average Temperature
19-day Ranger Operation	31 Jan through 12 Feb	6.6	5 days rain	50°
Bayonet Assault Course	21 Feb	1.5	clear	45°
2-day Patrol	13 Mar & 14 Mar	1.5	clear	71°
Hand Grenade Assault Course	16 Mar	.0	clear	79°
1-day Patrol	20 Mar	.0	clear	61°
1-day Patrol	21 Mar	2.1	clear	69°
1-day Patrol	22 Mar	.0	clear	60°
1-day Patrol	23 Mar	.0	clear	64°
1-day Patrol	24 Mar	.0	clear	69°
1-day Patrol*	25 Mar	12.7	clear	71°
Submerging of vests in water for 1 hour	19 Apr	96.9	clear	70°

\*During this exercise the T66-1 vests were submerged in water during a stream crossing exercise by the test soldiers (Figure 11, Appendix I).

2.6.3.4 To determine the reason for the significant increase in the weight of the T66-1 vests after being submerged in water for 1 hour one T66-1 vest was opened and the polyethylene bag removed and inspected. It was found that the bag contained nine holes which were apparently caused by friction between the bag itself and the ballistic protective cover of the vest. Water had entered the bag through these holes and soaked into the ballistic protective nylon felt filler. It was noted that as long as 2 months after the vests were submerged in water the T66-1 vests which had a significant increase in weight due to moisture absorption during the exercise still retained a great deal of moisture. The amount of moisture picked up and retained by each vest varied depending on the location and size of the hole or holes in the polyethylene bag.

2.6.3.5 The test schedule for the service test of the T66-1 vests is shown in Test Data, Appendix I.

#### 2.6.4 Analysis

The T66-1 vest is not sufficiently durable, as noted in paragraphs 2.6.3.1, 2.6.3.2, and 2.6.3.4, to meet the requirement of a 120-day life expectancy under combat conditions. Lack of durability of the T66-1 vest is a deficiency.

### 2.7 SUBTEST NO 6, MAINTENANCE

#### 2.7.1 Objectives

2.7.1.1 To determine if the maintenance functions, as listed in the Preliminary Operating and Maintenance Instructions (POMI), could be readily accomplished on the T66-1 vest.

2.7.1.2 To determine if the T66-1 vest met the following characteristics:

a. "(Essential) laundering or cleaning the system with the means available to the combat soldier in the field shall not degrade the protective characteristics during the period of life expectancy required of the item."

b. "Maintenance of this system by the individual will not exceed that of the present standard field clothing and individual equipment."

#### 2.7.2 Method

2.7.2.1 The instructions in the POMI were analyzed by test supervisory personnel for clarity, suitability, errors, and omissions.

2.7.2.2 Throughout the conduct of each subtest all maintenance performed on the T66-1 vest and standard vest was accomplished in accordance with the applicable operating and maintenance instructions. A record was kept of all scheduled and unscheduled maintenance performed.

2.7.2.3 All T66-1 vests and standard vests were laundered and cleaned in the field in accordance with the maintenance instructions.

2.7.2.4 Test soldiers were observed while performing maintenance functions, and were questioned to determine whether maintenance required for the T66-1 vest was more difficult or time-consuming than maintenance required for the standard vest.

**2.7.3 Results**

2.7.3.1 The POMI is clear, correct, and adequate, except that it does not state that the vest can be washed with mild soap or synthetic detergent and warm water (reference FM 21-15, Chapter 5, Paragraph 24c(1)(c)).

2.7.3.2 The types and amount of maintenance performed on the T66-1 vest and the standard vest and the average times required to perform each maintenance function are shown below:

No and Type of Vest	Maintenance Performed	Subtest in Which Performed	No of Times Performed	Average Time (Minutes) Required per Individual to Perform Maintenance	
				T66-1 Vest	Standard Vest
60 - T66-1	Brushed off and shaken out	Subtest No 3, para 2.4.2.1	7	2	2
30 - T66-1 30 Standard	Brushed off and shaken out	Subtest No 3, para 2.4.2.4	1	2	2
60 - T66-1 30 Standard	Washed with mild soap and water	Subtest No 3, para 2.4.2.6	2	5	5
27 - T66-1 27 - Standard	Brushed off and shaken out	Subtest No 3, para 2.4.2.12	1	24	24
30 - T66-1	Washed with mild soap and water	Subtest No 3, para 2.6.2.2	1	5	5

2.7.3.3 The test soldiers who performed maintenance as described in paragraph 2.7.3.2 indicated that they encountered no difficulties while performing maintenance on the T66-1 vest and the standard vest. No other maintenance was required during the conduct of this test.

2.7.3.4 Test supervisory personnel determined that the maintenance described in paragraph 2.7.3.2 was adequate for proper cleaning of both types of vest. Inspections of the vests after each maintenance function revealed no observable adverse or degrading effects on the protective characteristics of either the T66-1 vest or the standard vest which could be attributed to the maintenance performed.

#### 2.7.4 Analysis

2.7.4.1 The omission of instructions in the POMI for washing the T66-1 vest is a shortcoming.

2.7.4.2 The maintenance functions, as listed in the POMI, can be readily accomplished on the T66-1 vest.

2.7.4.3 Maintenance of the T66-1 vest by the individual does not exceed that of the standard vest.

2.7.4.4 Laundering or cleaning the T66-1 vest with the means available to the combat soldier in the field did not degrade the protective characteristics to any observable degree.

### 2.8 SUBJECT NO. 7, HUMAN FACTORS ENGINEERING

#### 2.8.1 Objectives

2.8.1.1 To determine if the T66-1 vest was suitably engineered from a human factors standpoint.

2.8.1.2 To determine if the T66-1 vest met the following characteristic:

"Investigation of the human engineering ramifications of this clothing and equipment system will be required. Soldier acceptance is necessary. It is desired that the system reduce the performance degradation below that caused by the current field clothing and equipment \* \* \*."

#### 2.8.2 Method

2.8.2.1 During all testing, particular note was made as to whether the T66-1 vest is compatible with the skills, aptitudes, and limitations of the test soldier.

2.8.2.2 Interviews, inspections, qualitative observations, and judgments were made during other subtests to determine troop acceptance of the T66-1 vest. A comparative analysis was made of test soldiers' performance utilizing the T66-1 vest and standard vest.

### 2.8.3 Results

2.8.3.1 As noted in paragraphs 2.4.3.1, 2.4.3.5, 2.4.3.6, 2.4.3.10, 2.4.3.12, 2.4.3.13, 2.4.3.14, 2.4.3.17, 2.4.3.19 of Subtest No 3 and in paragraphs 2.5.3.1, 2.5.3.2 and 2.5.3.3 of Subtest No 4, the T66-1 vest is not compatible with all skills, aptitudes, and limitations of the test soldier.

2.8.3.2 As noted in paragraphs 2.4.3.1, 2.4.3.3, 2.4.3.5, 2.4.3.12, 2.4.3.13, 2.4.3.14, 2.4.3.15, and 2.4.3.17 of Subtest No 3, the T66-1 vest caused discomfort to a large portion of the soldiers who participated in this service test.

### 2.8.4 Analysis

2.8.4.1 The T66-1 vest is not compatible with all skills, aptitudes, and limitations of test soldiers because it is unduly stiff, bulky, and restrictive in the neck and arm openings. It is determined that the T66-1 vest is not suitably engineered from a human factors standpoint. The presence of engineering factors unsuitable from a human factors standpoint was reported as a deficiency in paragraph 2.4.4.1, Subtest No 3.

2.8.4.2 The discomfort experienced by test soldiers who wore the T66-1 vest during this service test was caused by the same factors, i.e. unduly stiff, bulky and restrictive in the neck and arm openings, as discussed in paragraph 2.8.4.1.

2.8.4.3 The T66-1 vest does not have the acceptance of the test soldiers who participated in this service test.

2.8.4.4 The T66-1 vest does not meet the characteristic outlined in paragraph 2.8.1.2.

## 2.9 SUBTEST NO 6, VALUE ANALYSIS

### 2.9.1 Objective

To determine if the T66-1 vest has any unnecessary, costly, or "nice-to-have" features which might be eliminated without adversely affecting its performance or reliability.

### 2.9.2 Method

During all testing, note was made of any non-essential or "nice-

to-have" features which may be modified or deleted without compromising the effectiveness of the T66-1 vest.

2.9.3 Results

No non-essential or "nice-to-have" features were found in the T66-1 vest during testing.

2.9.4 Analysis

N/A

SECTION 3. APPENDICES

APPENDIX 3

Vest No	TEST RESULTS CHART																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2.2.2.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Inspected	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.2.2.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Released	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.2.2.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Measured	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.2.2.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Photo-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
stripped	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.3.2.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Don't Hoff	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bagger	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Clips	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
4.2-inch	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Mortar Gren	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Drill	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
106 mm IR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bayonet	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Assault	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Course	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Band gre-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
nade As-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
ault Gren	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2-day pa-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
trol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Defense	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2.4.2.8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Attack	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

TEST RESULTS CONT. (continued)

Test No	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
2.2.2.1 Inspected	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.2.2.2 Weighed	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.2.2.2 Measured	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.2.2.2 Photo-																														
2.3.2.1 Graphed																														
2.3.2.1 Ion & Doffe																														
2.4.2.1 Ran per																														
2.4.2.1 Class	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.2 4.2-inch Mortar																														
2.4.2.3 Grey Br III	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.4 106-mm M1																														
2.4.2.4 Bayonet Assembl Course																														
2.4.2.5 Hand Ste- made As- sembl Course																														
2.4.2.6 2-dy 78- cm	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.7 Refuge	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.8 Attack	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TEST RECORDS CHART (cont.)

Test No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2.4.2.10 Alt As- sault	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.11 Patrol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.12 Patrol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.13 Convoy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.14 Instru- mented Attack	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.15 Surveil- lance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.5.2.1 Parachute Jump	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.5.2.2 Rappel	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.6.2.2 Parachute	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.6.2.3 Race by COP. PSAT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.7.2.3 Lander- log	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

TST. SCHEDULE C-IV (continued)

Vest No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
2.4.2.10 Alt As- sault	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.11 Patrol	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.12 Exercise	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.4.2.13 Convoy																														
2.4.2.13 Instru- mented Attack																														
2.4.2.14 Range																														
2.4.2.14 Survell- lance																														
2.5.2.1 Parachute																														
2.5.2.2 Jump																														
2.5.2.2 Rappel																														
2.5.2.2 Exercise																														
2.6.2.2 Wear by																														
2.7.2.3 EMC IHAIB	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.7.2.3 Landscape	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2.7.2.3 Map	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X



Figure 1. T66-1 Vest

App I

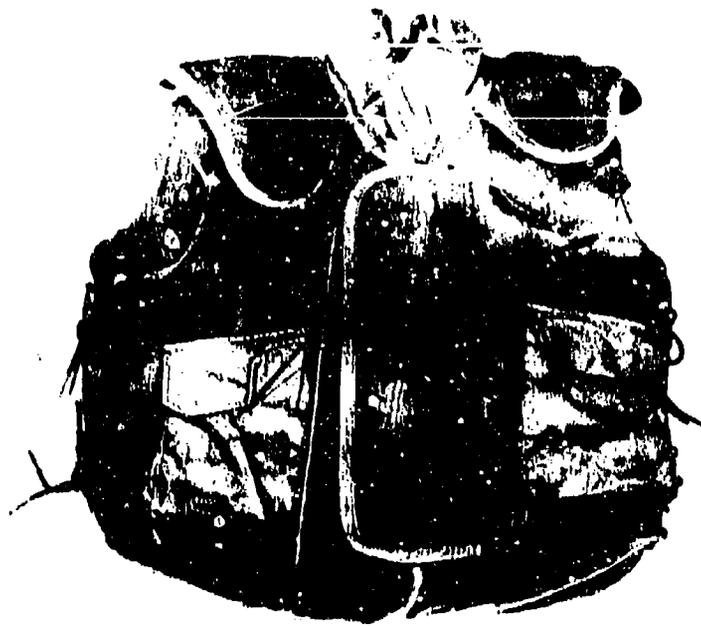


Figure 2. Standard Vest

App I



Figure 3. The soldier is equipped with a T66-1 vest and a fighting load. He is seated on a 106-mm RR carrier.



Figure 4. The soldier is equipped with a T66-1 vest and a combat load. He is shouldering an M-16 rifle.



Figure 5. The soldier is equipped with a T66-1 vest, a combat load, and lowering device, 300 pounds.



Figure 6. Collar of T66-1 vest.  
The arrow points to  
the rip in the seam of  
the collar.

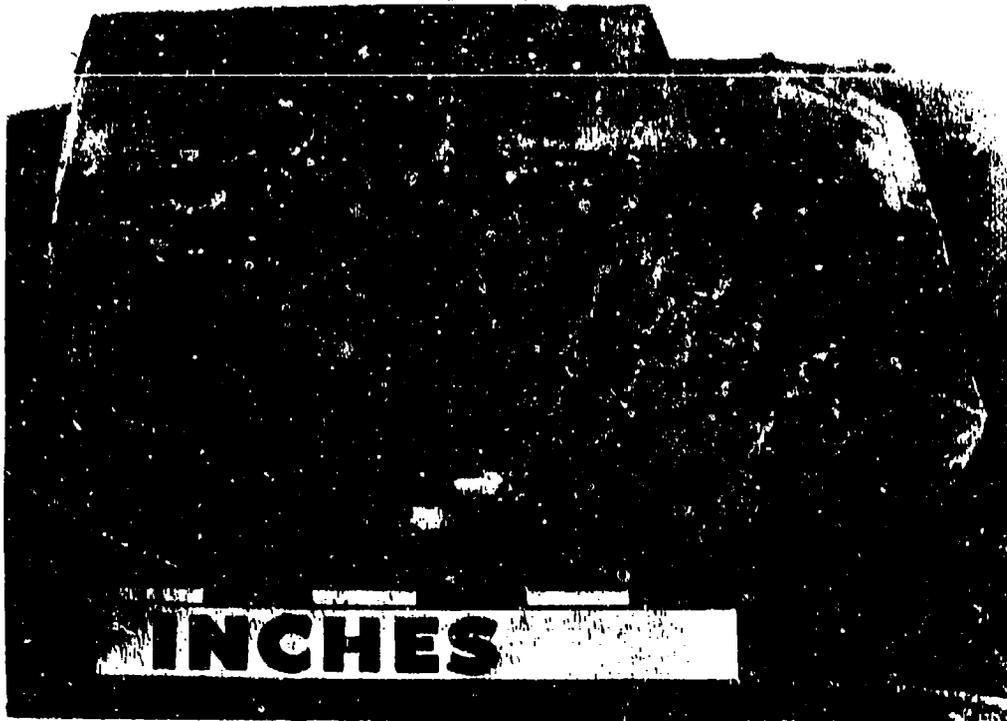


Figure 7. Nylon bellows-type breast pocket of a T66-1 vest with rips in the material.

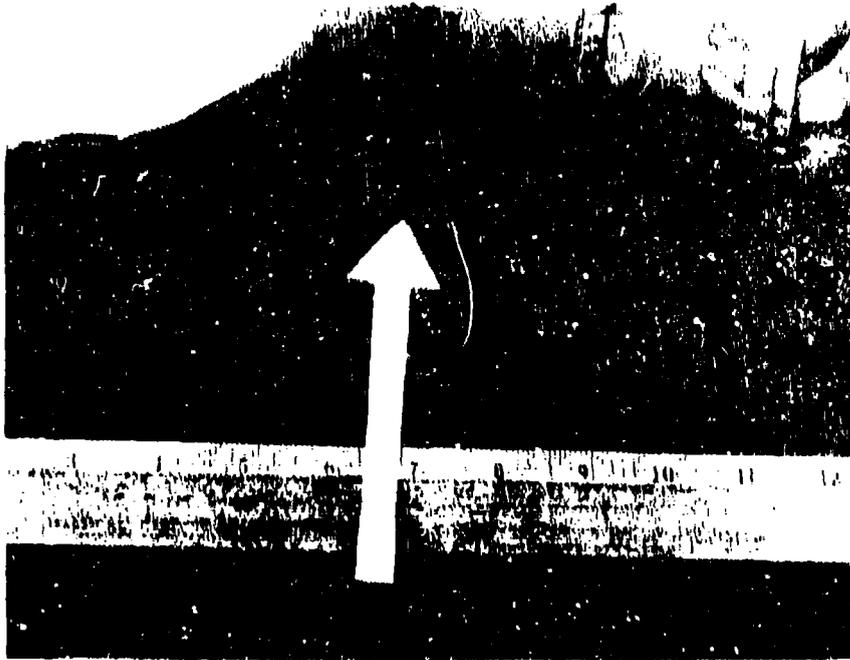


Figure 8. Frayed seam on the closure flap on the T66-1 vest.

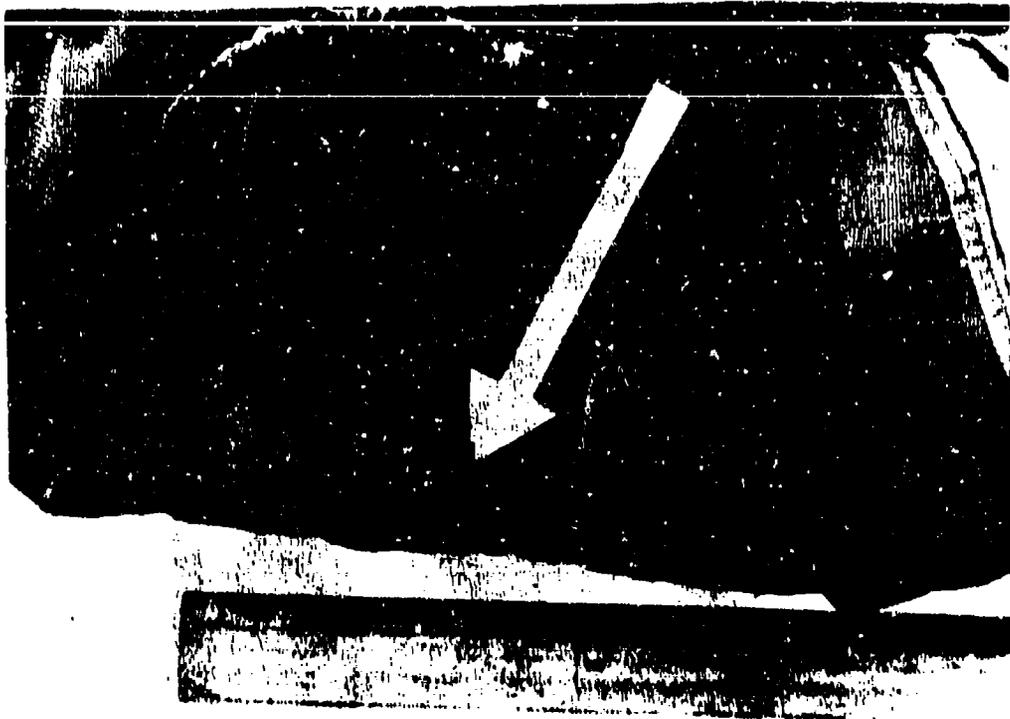


Figure 9. Arrow points to separation  
of seam in the underarm area  
of a T66-1 vest.



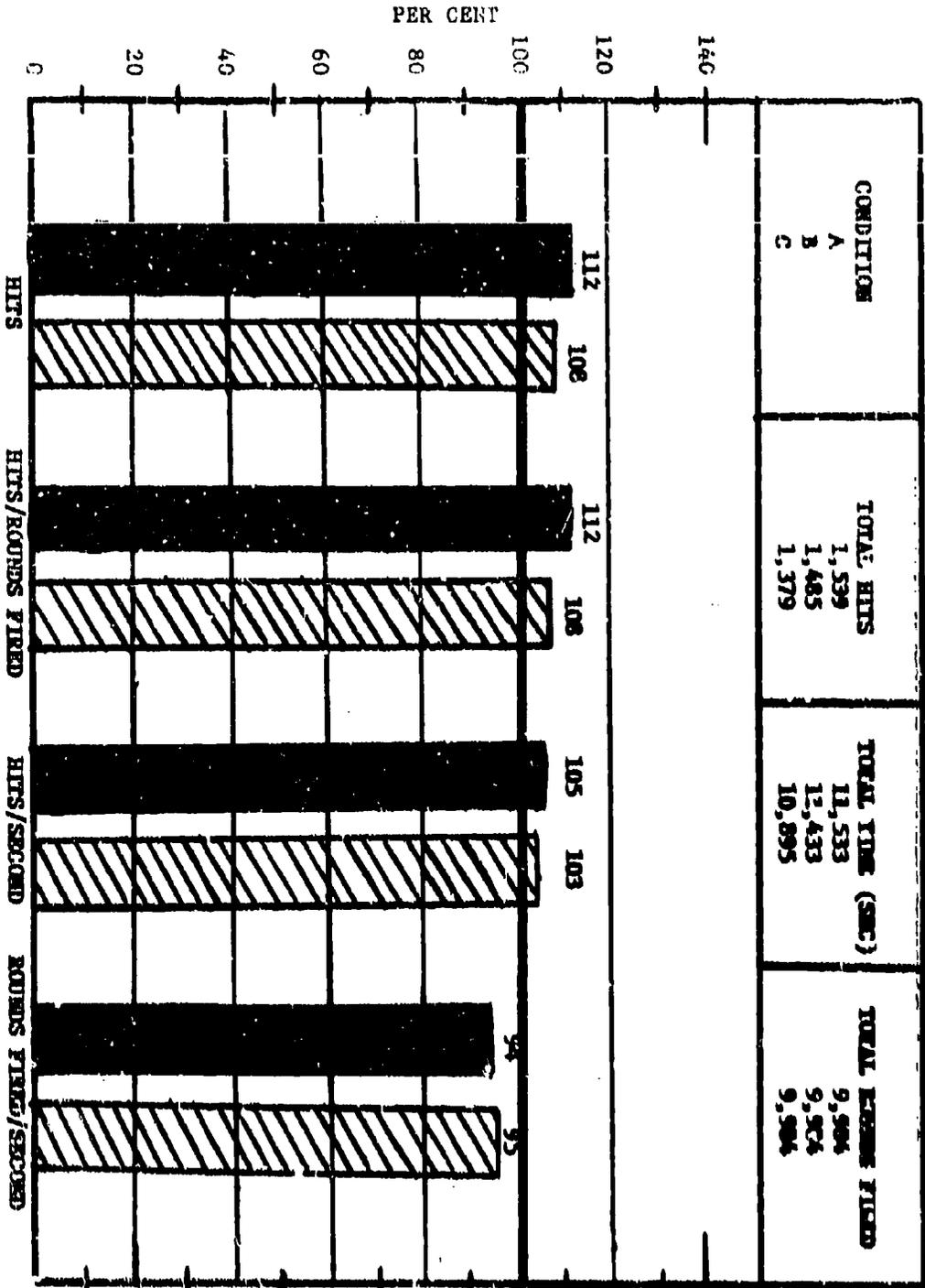
Figure 10. The dark lines outline holes worn in the polyethylene bag of a T66-1 vest.



Figure 11. The soldier is equipped with a T66-1 vest and appropriate patrol uniform. He is participating in a stream crossing exercise.

App I

ALL FIGURES  
(88-344 N)



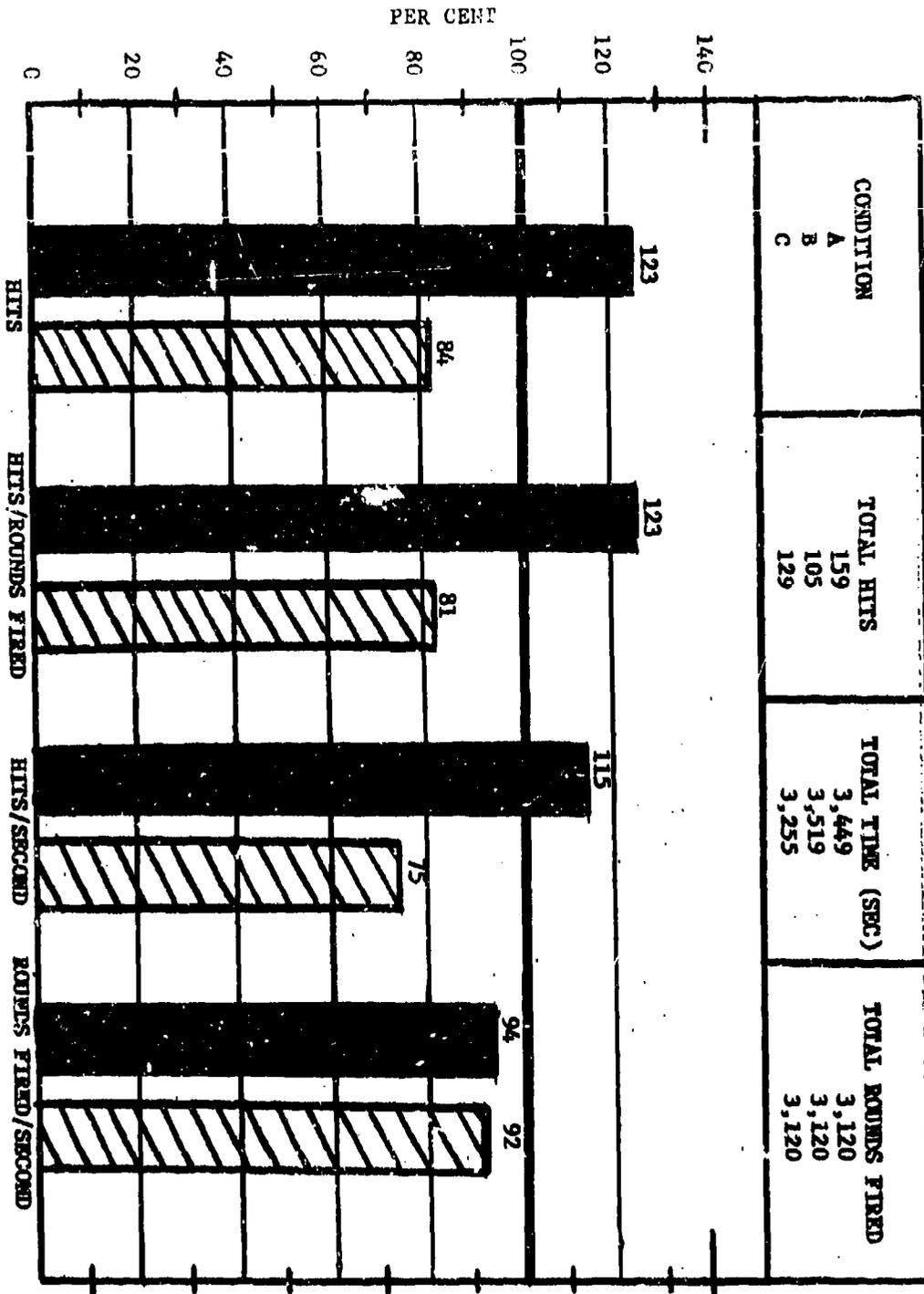
LEGEND:  
 SOLID = CONDITION A (TEST VEST)  
 CROSSED SECTION = CONDITION B (CONTROL VEST)  
 BASE LINE (100%) = CONDITION C (NO VEST)



\* Does Not Include Assault

Firing data obtained during the live fire attack exercise (Subtest No 3) by means of the USAIN instrumentation system. See page 55 for explanation of graph.

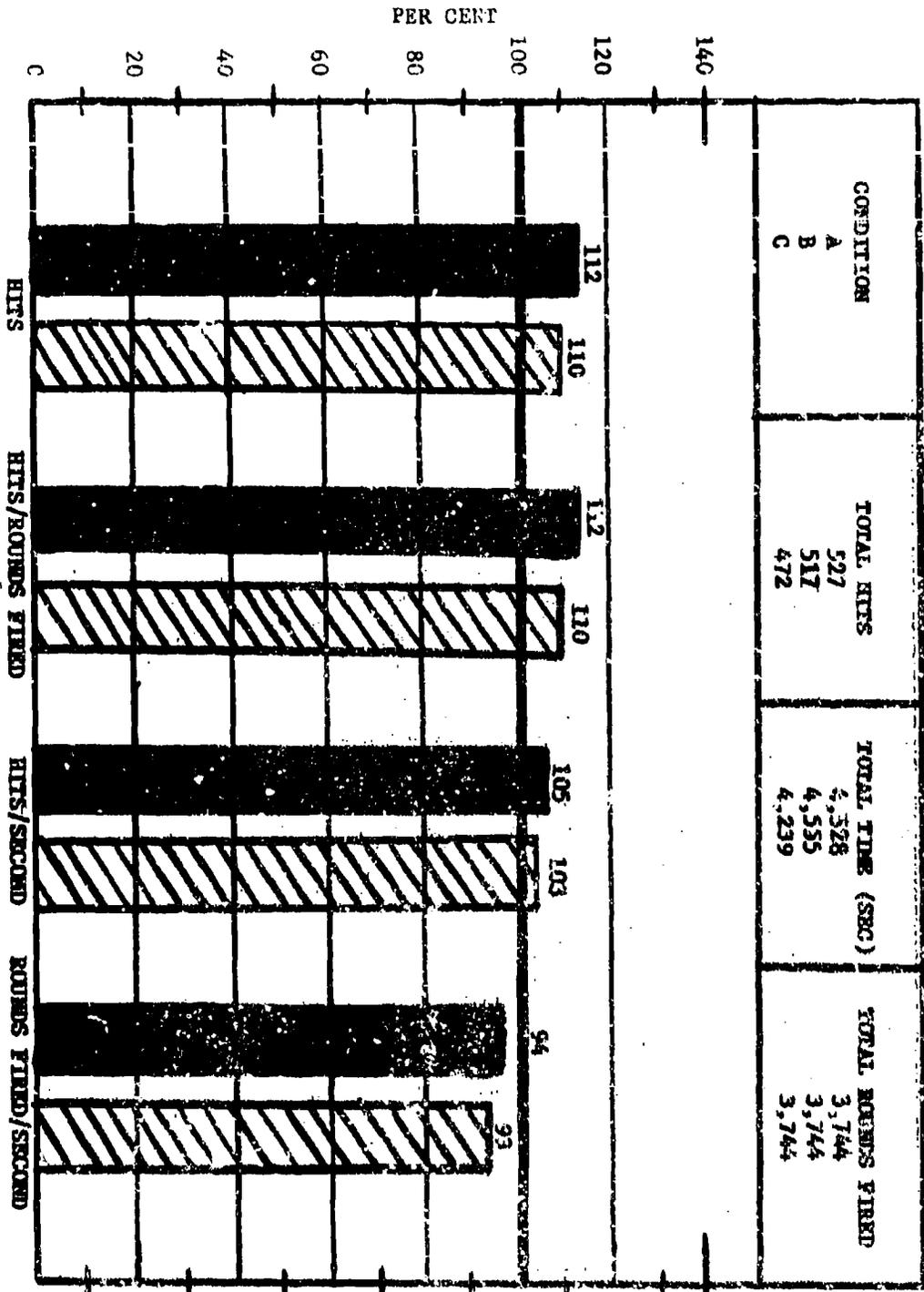
LONG RANGE  
(283-344 m)



LEGEND:  
 SOLID = CONDITION A (TEST VEST)  
 CROSSED SECTION = CONDITION B (CONTROL VEST)  
 BASE LINE (100%) = CONDITION C (NO VEST)

Firing data obtained during the live fire attack exercise (Subtest No 3) by means of the USAIB instrumentation system.

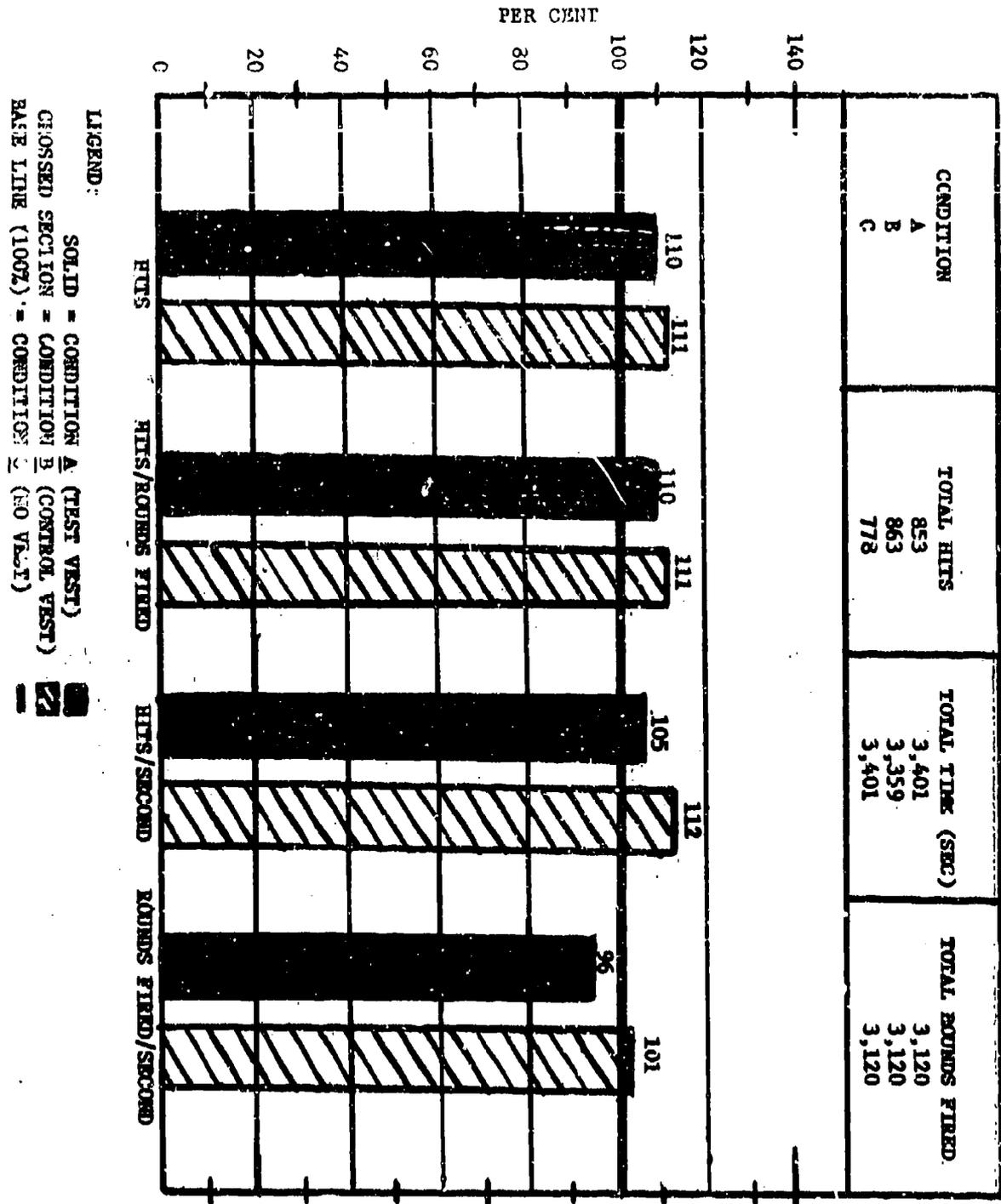
MEIUM BARRAGE  
(165-257 #)



LEGEND:  
 SOLID = CONDITION A (TEST VEST)  
 CROSSED SECTION = CONDITION B (CONTROL VEST)  
 BASE LINE (100%) = CONDITION C (NO VEST)

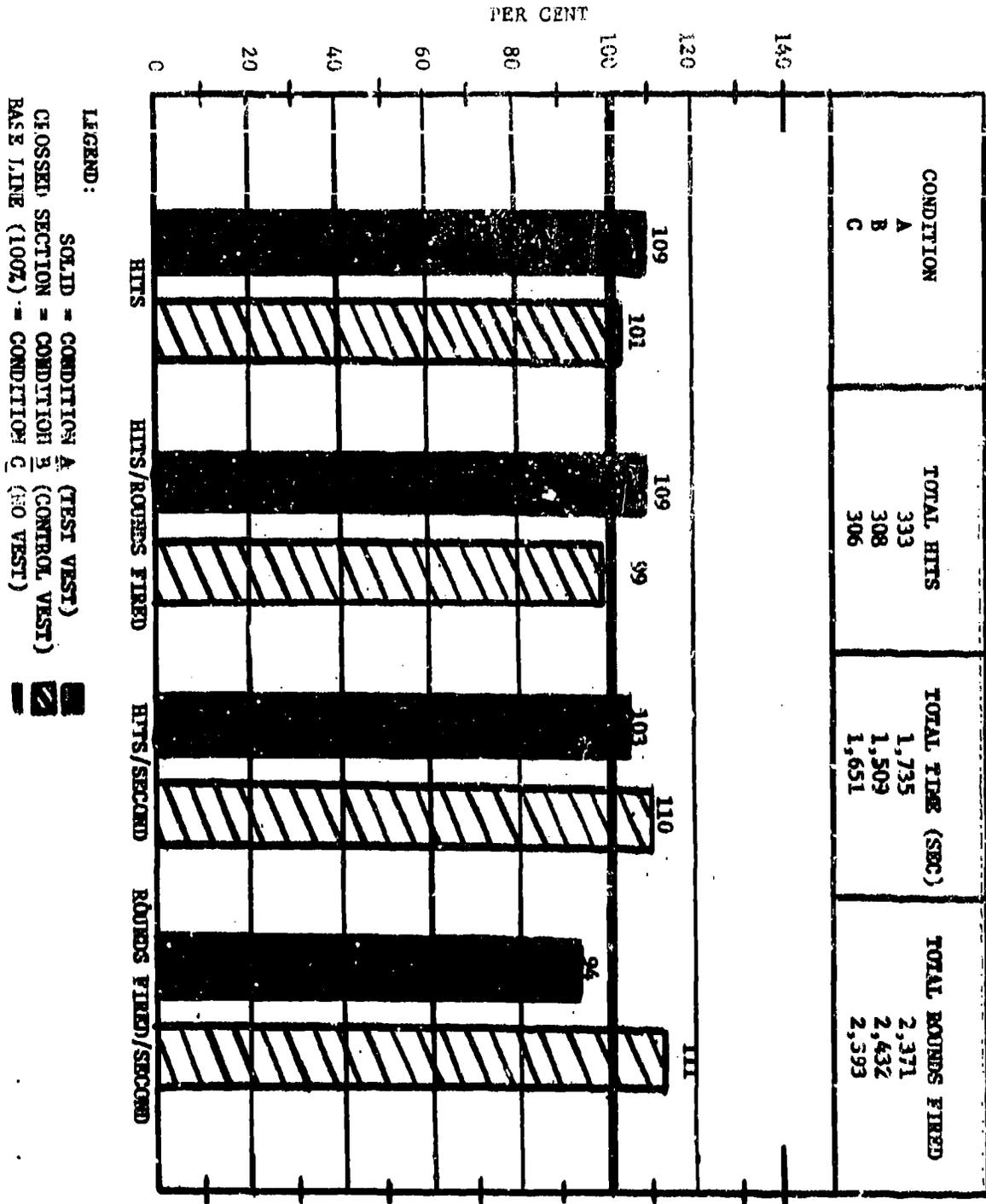
Firing data obtained during the live fire attack exercise (Subtest No 3) by means of the USAIB instrumentation system.

SHORT RANGE  
(88-149 m)



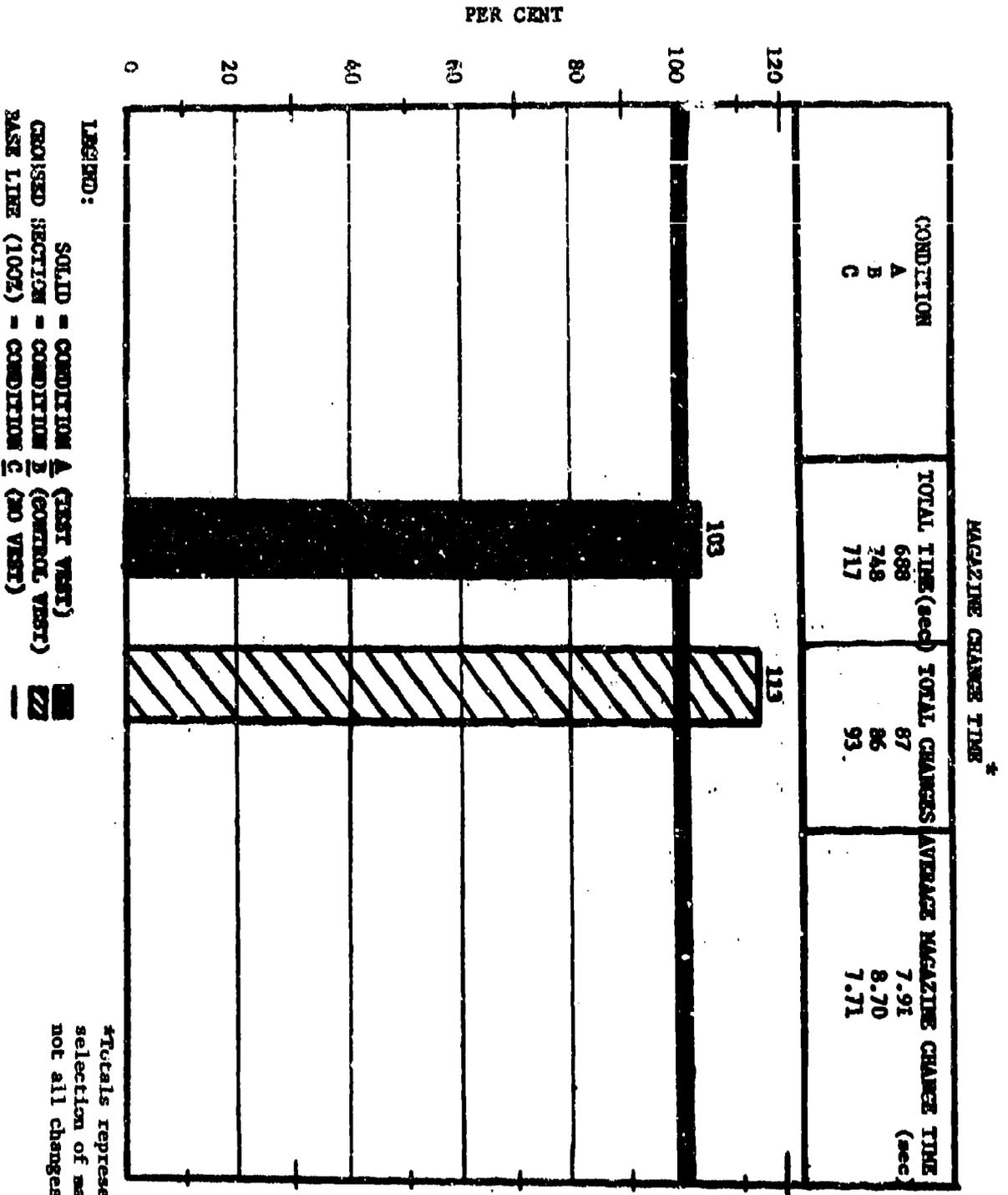
Firing data obtained during the live fire attack exercise (Subtest No 3) by means of the USAIB instrumentation system.

ASSAULT



Firing data obtained during the live fire attack exercise (Subtest No 3) by means of the USAIB instrumentation system.

App I



\*Totals represent a random selection of magazine changes, not all changes.

Firing data obtained during the live fire attack exercise (Subtest No 3) by means of the USAIB instrumentation system.

#### Explanation of Charts.

The no-vest condition was used as a standard in terms of what is expected of the soldier. The test vest and control vest were presented on the graph as per cent deviations from the no-vest condition. For example, on the "all ranges" graph which encompasses ranges from 88-344 meters, the graphs for hits were obtained as follows: the total number of hits for the no-vest condition (1,379) was used as the base line, represented on the graph by the dark, heavy line which was as stated above what is expected of a soldier or "100% efficiency." There were 1,539 total hits for the test vest condition and 1,485 total hits for the control vest condition. When the ratios of test vest to no vest and control vest to no vest were computed, it was found that there was a 12% increase of total hits with the test vest, and an 8% increase of total hits with the control vest over the no-vest condition. The other items on the graph, hits/rounds fired, hits/second, rounds fired/second, were calculated in same manner.

## APPENDIX II. FINDINGS

The T66-1 vest was tested against the requirements prescribed in the DA Approved (MR for LINCLOE (reference 3)).

### Requirements

1. "The weight of items comprising the system will be in accordance with weight requirements outlined in study referenced in paragraph 4a, above, and Annex A attached," (reference 3).
2. " \* \* \* and will be of a style that is not a radical departure from current styling."
3. "The system shall permit maximum ease of donning and doffing \* \* \*. Closures shall be designed to permit easy opening and closing while wearing appropriate handwear \* \* \*."
4. "The system shall improve, over the current field clothing and equipment, the wearer's mobility and efficiency by reducing the weight of components and by incorporating other design improvements \* \* \*."
5. "The system shall improve over the current field clothing, the individual wearer's ability to perform all combat and related activities and shall permit unencumbered use of weapons, fire control equipment, communication, electronic equipment, vehicular equipment, and other items available in the same time frame."
6. "The system shall permit free head movement equal to current field clothing and equipment and shall not restrict breathing, hearing, \* \* \*, or field of vision to a degree greater than current field clothing and equipment."

### Findings

Requirement not met. All sizes of T66-1 vest exceed the weight limitations of the LINCLOE QMR (Subtest No 1).

Requirement met (Subtest No 1).

Requirement met (Subtest No 2).

Requirement not met. (Subtests No 3 and 4).

Requirement not met (Subtest No 3).

Requirement not met. The T66-1 vest restricted head and body movement and breathing of test soldiers (Subtest No 3).

Requirements

7. "The system shall permit simple adjustment or adaptation without assistance to various levels of physical activity, body functions and environmental conditions."

8. "The system shall, by camouflage coloration or other means, provide protection from direct and indirect visual detection from the ground or air and, to the maximum extent practicable, from electronic, infrared and other such surveillance systems."

9. "The system of clothing and individual equipment envisioned must have a minimum life expectancy under combat conditions of approximately 120 days."

10. "Laundering or cleaning the system with the means available to the combat soldier in the field shall not degrade the protective characteristics during the period of life expectancy required of the item."

11. "Maintenance of this system by the individual will not exceed that of the present standard field clothing and individual equipment."

12. "Investigation of the human engineering ramifications of this clothing and equipment system will be required. Soldier acceptance is necessary. It is desired that the system reduce the performance degradation below that caused by the current field clothing and equipment \* \* \*."

Findings

Requirement met (Subtest No 3).

Requirement met (Subtest No 3).

Requirement not met. The T66-1 vest lacked durability required to meet approximately 120 days life expectancy under combat conditions (Subtest No 5).

Requirement met (Subtest No 6).

Requirement not (Subtest No 6).

Requirement not met. The T66-1 vest does not have soldier acceptance (Subtest No 7).

APPENDIX III. DEFICIENCIES AND SHORTCOMINGS

1. DEFICIENCIES

<u>Deficiency</u>	<u>Suggested Corrective Action</u>	<u>Remarks</u>
1.1 All sizes of the T66-1 vest exceed the maximum allowable weight limitation of 4 pounds, as specified in Annex A of RA approved QMR for LIMCLOS, 1 September 1965.	Unknown	See paragraph 2.2.4.1, Subtest No 1.
1.2 The T66-1 vest increased the degree of restriction to head and body movement and to breathing of test soldiers over that of the standard vest and consequently does not improve the wearer's ability to perform a combat related activity over the standard vest.	Unknown	See paragraph 2.4.4.1, Subtest No 3.
1.3 Parachutists could not check their entire canopies for malfunction or damage while wearing the T66-1 vest. Thus the T66-1 vest creates a safety hazard to parachutists.	Unknown	Paragraph 2.5.4.1, Subtest No 4.
1.4 Due to lack of durability the T66-1 vest failed to meet the requirement of a 120-day life expectancy under combat conditions.	Unknown	Paragraph 2.6.4, Subtest No 3.

## 2. SHORTCOMINGS

<u>SHORTCOMING</u>	<u>SUGGESTED CORRECTIVE ACTION</u>	<u>REMARKS</u>
2.1 Hand grenades fell out of hand grenade hanger straps on the T66-1 vest during live-fire attack exercises and during the hand grenade assault course exercise.	Unknown	See paragraph 2.4.4.3, Subtest No 3.
2.2 The closure system on the bellows-type breast pockets failed to keep the pocket closed during patrol exercises.	Replace the small square of nylon hook tape and matting nylon pile with a strip extending from one side of the top front of the pocket to the other side.	See paragraph 2.4.4.2, Subtest No 3 and XL-11.
2.3 The POMI did not include instructions for washing the T66-1 vest.	Add instructions in the POMI for washing the T66-1 vest.	Paragraph 2.7.-4.1, Subtest No 6.

APPENDIX IV. REFERENCES

1. A Study to Reduce the Load of the Infantry Combat Soldier, US Army Infantry Board, September 1962.
2. A Study to Conserve the Energy of the Combat Infantryman, US Army Combat Developments Command, 5 February 1964.
3. Department of the Army (DA) Approved Qualitative Materiel Requirement (QMR) for System of Lightweight Individual Combat Clothing and Equipment (LINCLOE), 1 September 1965.

Security Classification

**DOCUMENT CONTROL DATA - R&D**

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

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12. ABSTRACT The Service Test of Lightweight Body Armor, Basic Vest, T66-1, was conducted by the US Army Infantry Board from 6 January 1967 to 6 May 1967. The purpose of the test was to determine the suitability of the T66-1 vest for US Army use; to determine to what extent the T66-1 vest met the requirements of the LINGLOE QMR; and to determine the suitability of the T66-1 vest for parachutist's use and use with lowering devices. Four deficiencies and three shortcomings were found. The deficiencies were: Lack of durability of the T66-1 vest, all sizes of the T66-1 vest exceed the weight limitations specified in LINGLOE QMR; the T66-1 vest restricted head and body movement and breathing to a greater degree than the standard vest and consequently failed to improve, over the standard vest, the wearer's ability to perform a combat related activity; the T66-1 vest prevented parachutists from checking their entire canopies for malfunction or damage, thus creating a safety hazard to parachutists. The shortcomings were: The inadequacy of the hand grenade hanger straps for proper retaining of hand grenades; inadequacy of the closure system on the bellows-type breast pockets for keeping the pockets closed; and omission of instructions in the POMI for washing the T66-1 vest. The US Army Infantry Board concludes that the T66-1 vest is unsuitable for US Army use until correction of the deficiencies and as many shortcomings as practicable. The T66-1 vest is unsuitable for use by parachutists until correction of the deficiency noted in Subtest No 4, Parachute and Rappelling. The T66-1 vest is suitable for use with lowering devices. The US Army Infantry Board recommends that the T66-1 vest be considered unsuitable for US Army use until correction of all deficiencies.			

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