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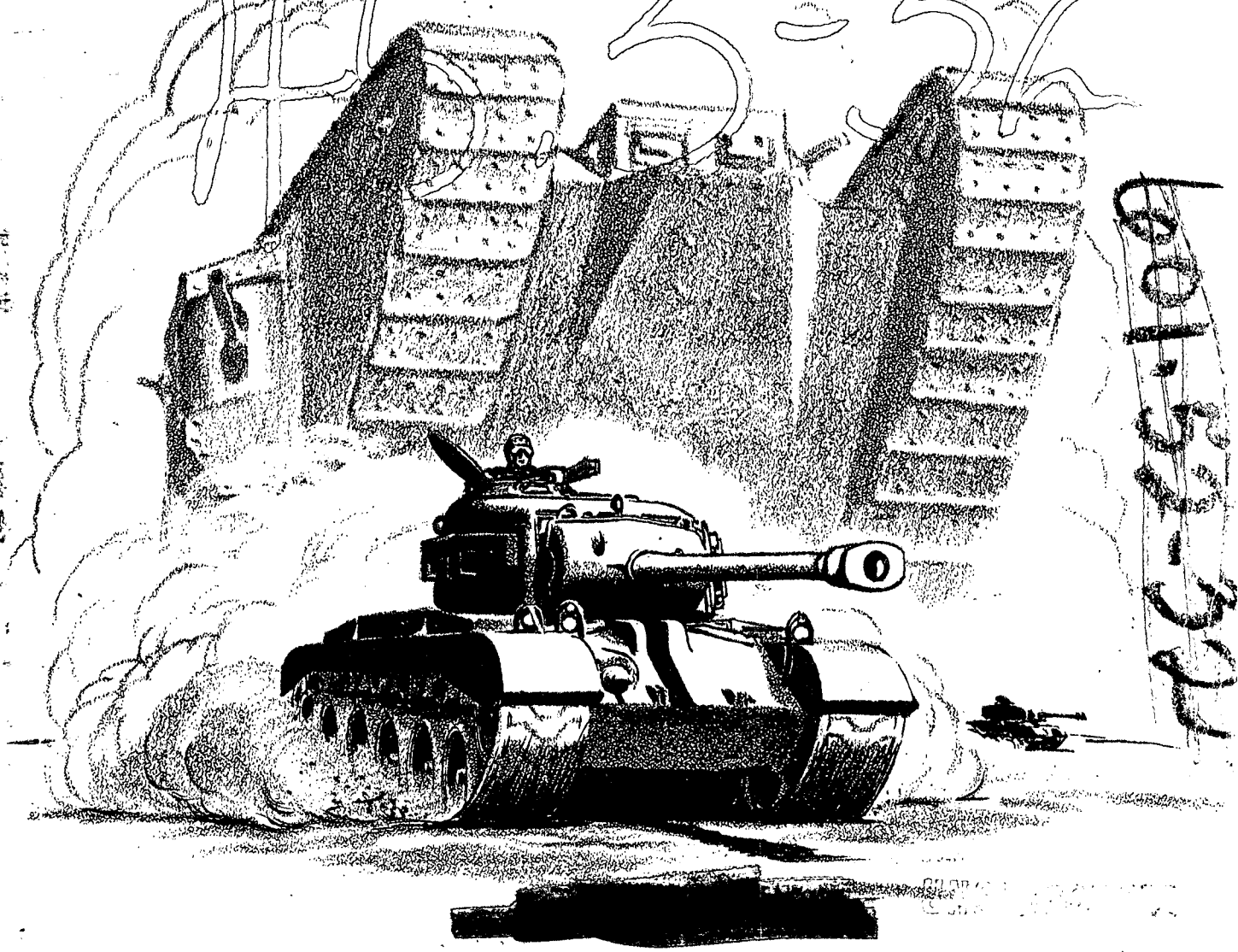
A Tanker's Uniform for a Tanker's Duties



A RESEARCH REPORT

Prepared at
THE ARMORED SCHOOL
Fort Knox, Kentucky
1951 - 1952

[redacted]

A TANKER'S [redacted] DUTIES

A RESEARCH REPORT PREPARED

BY

COMMITTEE 32, OFFICERS ADVANCED COURSE

THE ARMORED SCHOOL

1951 - 1952

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TABLE OF CONTENTS

TABLE OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

The crews of combat vehicles perform many unique duties requiring frequent mounting and dismounting and involving extended periods of relative inactivity within the confines of their vehicles. The purpose of this report is to establish the military characteristics of a suitable combat uniform for these crewmen and to present a typical uniform that meets these requirements. This uniform must insure the maximum comfort and safety consistent with functional requirements. The field of clothing development is, of course, a very extensive one and it is not intended in a report of this scope to cover it in its entirety. Rather, we are concerned only with combat clothing (including headgear) for the temperature range 0° to 110° Fahrenheit.

The general, overall concept of clothing development in the United States Army can be best presented by a quotation from the Cook Board Report of 1945, a section of the Army Ground Forces Equipment Review Board.[1] In this report the policy was formulated that,

> ...The goal of development for outer clothing should be to provide three standard uniforms which will be adequate for the greatest number of troops and a minimum number of special purpose garments. Uniforms for general issue should consist of a dress uniform, a combat uniform, and a fatigue uniform....

For the purpose of this report, only the latter two categories mentioned above, namely the combat and fatigue uniform, will be

considered. With regard to the combat uniform we have limited our research to the development of suitable outer garments and have not delved deeply into those items of wearing apparel such as new winter underwear or socks which can be worn under any type combat uniform. The concept of the fatigue uniform is that it may be worn by itself as an outer garment or that it may be worn under the combat dress when climatic conditions are such that the warmth of added clothing is necessary.[1]

Inasmuch as our basic characteristics include comfort, safety and the ability to operate and function efficiently under all situations, we had, of necessity, to give considerable thought to the development of adequate headgear for the combat vehicle crewman. For him, his headgear not only provides comfort and safety but also, if equipped with radio headset, it provides the medium through which he may communicate with others.

One of the first and most significant problems which confronts the researcher in the field of specialized clothing is the current policy of the United States Army to standardize as much as possible on its uniforms for the sake of economy and simplification of logistics problems; however, there appears throughout the reports of the past few years a tendency to recognize the need for certain specialized uniforms. In the Stilwell Board Report[2] of 1945, the following statement appears:

> ...The needs of specialized groups must receive continuing study. The inclusion of items of a specialized nature should be kept to a minimum and should be instituted only when an item of general issue is proven conclusively to be unfit for a special purpose....

This policy, though written some seven years ago, is essentially the policy in the United States Army today. Since publication of this policy, however, general issue clothing has apparently proven unfit for combat vehicle crewmen since the guide which establishes the most recent development policies for the Army establishes a definite requirement for specialized clothing.

> ...There is a requirement for clothing for the crews of combat vehicles that is comfortable and provides protection from fire and flash. Design should facilitate entering, leaving, and fighting in combat vehicles. Outer clothing -- and tank helmets are <u>critically</u> needed to meet this requirement.[3]...

At present there is no such specialized uniform in our Army for the tanker. As you will see in this report there has not been too great an amount of work done on this in the past. This is understandable inasmuch as the Armored Force as a major component of our armed forces did not come into its own until just prior to World War II. Immediately following that conflict, however, several equipment boards were set up to make an overall study of uniform and equipment requirements for our vastly expanded Army. In the following report we have pointed out the major findings of these boards in relation to our subject, and have amplified them with comments of our own and with photographs. This is done in an attempt to consolidate in one place the concensus that existed on the subject in the United States Army during the post World War II period.

During this same period the other major world powers were engaged in the development of similar items for use within their armed forces. Some of their ideas are worthy of serious

consideration and these we have attempted to set forth for the thought and analysis of the reader.

Since one of our major points is that of the specialized nature of the duties of the men who must live in and fight in our combat vehicles from day to day under all conditions, a report of this sort would be nothing but a collection of theories, suppositions, and words if we did not incorporate in it the ideas and comments of these men, both officer and enlisted. They have lived in and fought in our existing vehicles wearing our present-day uniforms and equipment, both in World War II and in the present "police action" in Korea.

In addition, we have endeavored to touch on the human engineering aspect of the subject to the degree of motion study by members of this committee of the drills and actions required of these crewmen as well as by reviewing past and recent research studies by the Army Medical Research Laboratory.

Finally, based on study and evaluation of all of the foregoing material we have drawn up what we feel are the desirable military characteristics for an armored crewman's combat suit, fatigue uniform, and helmet. Our ideas we know are not new and are in no means revolutionary, but we feel that, if adopted, would provide a uniform definitely superior to any existing today in the United States Army.

We would like our reader to consider while reading this report the factor of the morale of the men who will wear this uniform, their esprit, their pride in being a tanker, and

hence their willingness and desire to live up to their "specialized" role as part of a specialized force -- Armor.

Consider finally that many more experienced minds than ours have studied this subject in the past and have made very sound recommendations on it. Therefore, do not expect from us a new, completely radical solution which will be the panacea for all difficulties. This report contains a compilation of existing data, an analysis of opinion past and present, and a solution based on facts, figures, and recommendations. It is hoped that it may be of assistance to others in future research in this field.

NOTES FOR CHAPTER 1

[1] Army Ground Forces Equipment Review Board -- Cook Board Report, Annex V, Section II.

[2] War Department Equipment Board Report, Stilwell Board Report, Item 9, pp 76-78.

[3] Army Equipment Development Guide 1950, par 127, Chapter 2.

CHAPTER 2

UNIFORM DEVELOPMENT THROUGH WORLD WAR II

In a research such as this which has as its aim the recommendation of either continued use of items presently standard or the adoption of a new type uniform for the specialized use of armored vehicle crewmen, the logical approach is to trace the development through the years noting the progression of ideas. In our particular field, however, this study of the past is considerably limited since little had been done in the development of clothing for combat vehicle crewmen prior to World War II. The main reason for this was, of course, the fact that prior to this time we did not have in our Army sufficient armored experience to justify specialized equipment. Armor as we know it today was in its infancy and to all practical purposes its parents had not reached the point of wondering about how to clothe the infant. As a result of this our trace of development will actually begin with uniforms used in World War II.

Before World War II, we find in the Army an erroneous basic concept on the subject of uniforms and equipment. Essentially this concept was that no requirement for extensive research existed since, it was contended, in case of mobilization, civilian manufacturers would be able to convert their products to military uses with a minimum of effort and expense and at the same time satisfy the military requirement.[1] This policy

was undoubtedly not the fault of the military entirely but to a great extent was forced upon them by the inadequate budget within which they were compelled to operate.

Subsequent events proved the reasoning behind this was entirely fallacious. Our armed forces instead of being committed in a temperate climate were involved in a world-wide conflict employing new equipment which departed radically from that formerly used. Troops were performing numerous specialized duties which had no counterpart either in civilian applications or former military organizations. In this sudden expansion and change of the armed forces, the tank grew to unprecedented importance on the battlefield. Thus, the Armored Force as we saw it in North Africa was born.

Introduction of a Tank Suit

Coupled with this development of the tank and the Armored Force was an early recognition of the need of a uniform for the crewmen of these new armored vehicles. Armored personnel were faced with the problem of operating in cramped quarters necessitating the elimination of bulkiness in their clothing while at the same time requiring sufficient warmth during extended periods in cold weather where they were confined within the vehicle. A specialized uniform was dictated by the very nature of the specialized duties of combat vehicle crewmen. We have but to look around us in our everyday living to see that every specialized job is logically associated with a peculiar clothing. For example, let us compare our present day fire

departments in various cities to the fire-fighting organizations of many large industries. We can all picture one of the city firemen, clad in his bulky rubber boots, rubber coat, and cumbersome hat, in his familiar pose of training a stream of water on a fire. This is suited to his needs as he is operating where his movement is not restricted and where he is concerned with remaining dry. In contrast to this consider the fairly recent development of the comparatively lightweight and less cumbersome asbestos suit for use when fighting high-temperature fires in closed areas where access is limited. Here we see the design of a definitely specialized garment for personnel who are performing a specialized task. This is only one example of many where it has been found that one type of clothing cannot be suitably adapted to many types of varied work. So it was found in the early phases of the Armored Force that a need existed for a special uniform and the Armored Force combat suit, familiar to all veterans of World War II, was created. See illustrations 1 through 4.

This committee was unable to uncover the detailed history of the development of this suit but it is believed that first issue of the suit was early in 1942. At this time it was an item of organizational property. The suit consisted of a helmet, jacket, and overall-type trousers. The component parts were all constructed of a lightweight, tan cotton material lined with OD blanket wool. The helmet was the old aviator type, covering the entire head and ears and was provided with a chin

strap. It was designed exclusively for warmth with no provisions for shock or ballistic protection and no means of adaption to earphones. The trousers were held up by suspenders and included a zipper closure from the crotch to the top of the bib, zipper fly, and zipper closed slits on the side to enable the wearer to reach into pockets of clothing worn underneath. Cuffs of these trousers were intended to be worn around the boot tops and not tucked in. The jacket, which met with much popularity, is also equipped with a zipper closure along the front center. An elastic knit band permits a snug fit around the wrists, waist, and neck. Two slash pockets are provided in the front of the jacket.

This suit was worn extensively in combat throughout Africa and Europe and is still in the hands of many military personnel though no longer an item of issue except to US Marine tank units. It is believed that the suit was withdrawn from issue sometime in 1945 due to the apparent suitability of the standard issue field uniform at that time and the desirability of standardization of US military clothing. Certain deficiencies of the combat suit were probably considered also in this decision; namely, the lack of durability of the lightweight material in its makeup and of the knit cuffs, waist, and collar. See illustration 3 for evidence of wear around cuffs of jacket.

Tank Helmet Development

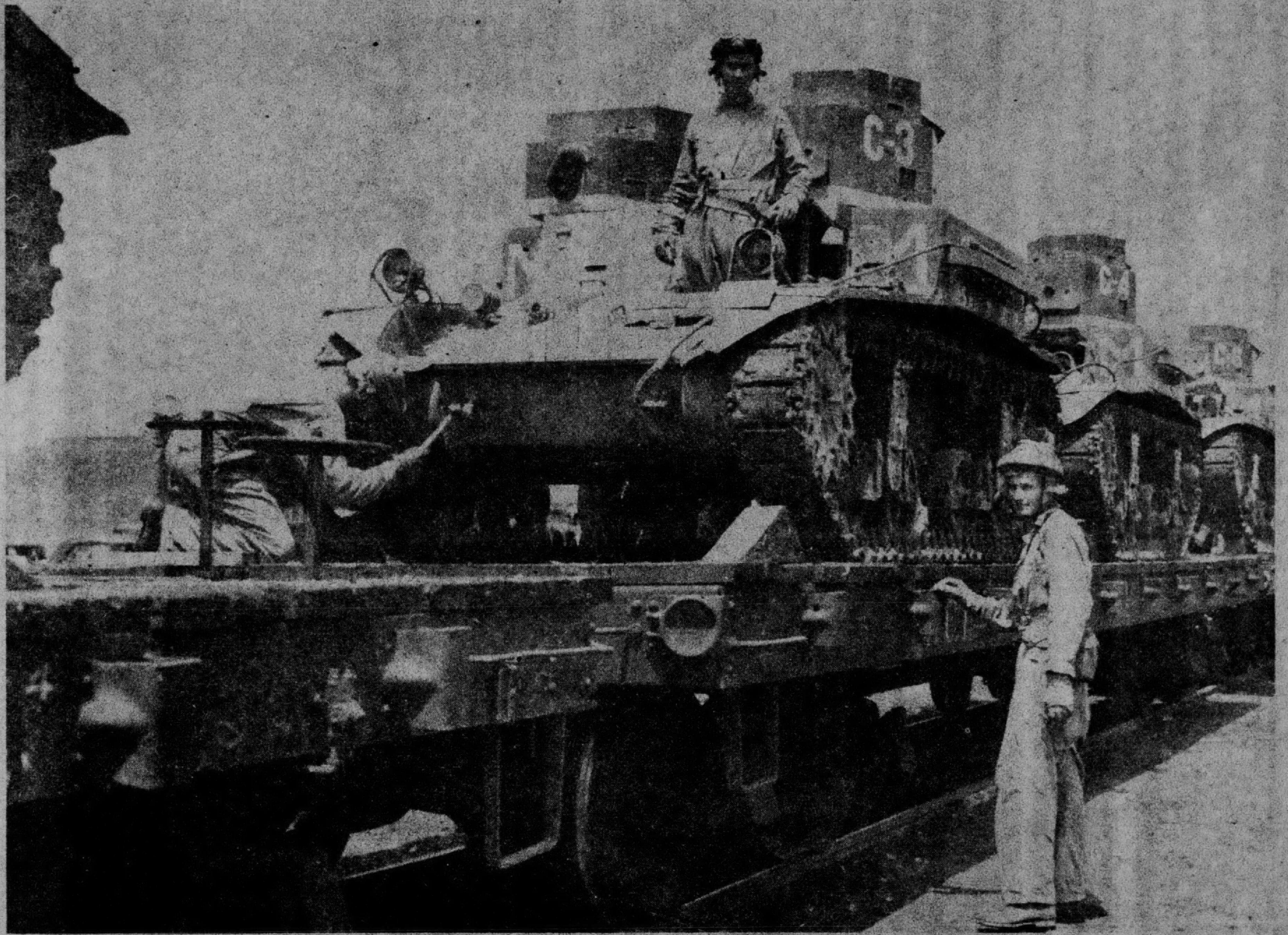
The general lack of research in the field of combat clothing for combat vehicle crewmen prior to World War II was

somewhat offset by an extensive study of tank helmets in the same period. Here again, though, appears a certain complacency to accept existing commercial equipment such as football and mine safety helmets. The earliest available source of material on the development of the tank helmet goes back to a letter written on 14 October 1940, the subject of which was, "Military Characteristics of the Tank Helmet."[2] This letter stated: "The prime purpose of the tank helmet is to provide maximum protection and comfort to tank personnel while not interfering with the performance of their duties." It continued with the specific requirements such a helmet would have to meet. Before this time and until the adoption and procurement of the Rawlings football-type helmet, the standard steel helmet (World War I type) and a commercial-type football helmet were used.

A letter[3] of November 1940 states as follows:

> 1. It is understood that the Ordnance Department is shortly to purchase tank helmets for the tanks now under manufacture.
>
> 2. At the present time there are two types of tank helmets in existence, one known as the Infantry type and one as the Cavalry type. Neither of these helmets is considered entirely satisfactory and a considerable number of complaints have been received from time to time by this Board.
>
> 3. In general these complaints are as follows:
>
> a. Infantry-type helmet is too heavy and bulky.
>
> b. Neither type is particularly comfortable.
>
> c. There are not a sufficient number of sizes to insure a good fit for all personnel. Cavalry type comes in three sizes only, small, medium, and large.
>
> d. There is no adjustment in the size to permit the wearing of a winter cap of some sort under the helmet.
>
> e. The rubber ring on the Infantry-type helmet, besides adding considerable weight, interferes in some cases with the proper use of sights....

See illustration 5. The letter concluded with a statement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that the Board was endeavoring to have a suitable tank helmet designed.

As a result of this endeavor, field tests were completed by May 1941 on five types of helmets to determine the most suitable tank helmet for armored force units. The five helmets tested were the Rawlings, Clark, Goldsmith, Riddell and Mine Safety Helmet. Based on a survey of the reports[4] received from the test organizations, the Rawlings helmet was the most desirable. The Clark helmet, because of its material of construction and design, was second in order of choice. It was also felt that the Rawlings-type helmet modified so as to use the Clark (molded rubber composition) head and neck body with the Rawlings (hinged) ear flaps would afford the most protection with the maximum comfort. It was recommended that the Rawlings-type helmet, with the modifications noted above be adopted and standardized for issue to the tank units of the Armored Force. A description of the helmets, which were tested appears in the following paragraphs.

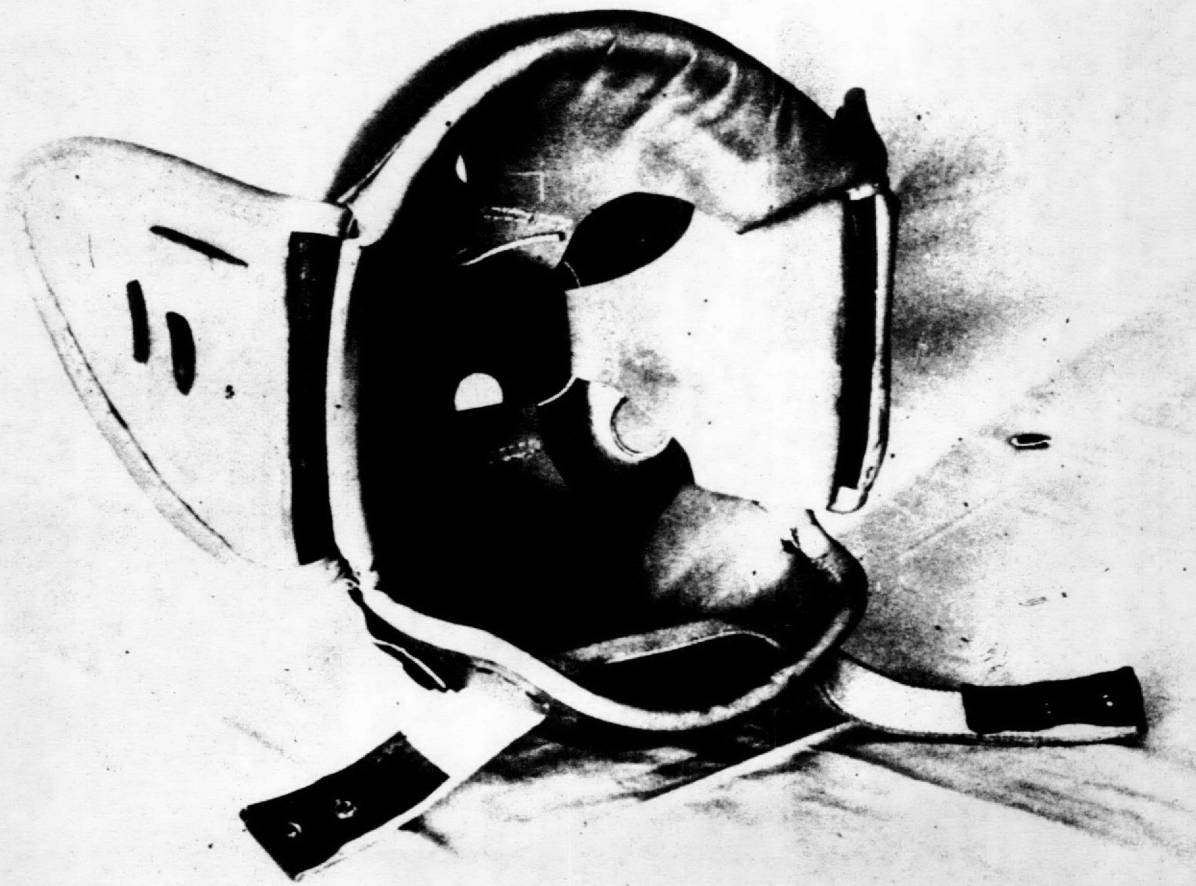
The Rawlings helmet is made from pressed fiber and lined with leather and sponge rubber. It has an adjustable head suspension but no adjustment for head size. The ear flaps are of leather, sewed to the body of the helmet and lined with soft leather and sponge rubber. A recess in each ear flap is provided for holding ear phones of the HS-18 type. Pressure of the ear flaps against the ears is maintained by means of springs fastened to the sides of the helmet. The ear flaps

may be raised and held away from the ears, when desired, by means of leather strips with glove-type fasteners. An adjustable elastic band with glove-type fasteners extending across the back of the helmet secures it to the head of the individual. Two leather straps with glove fasteners secure the goggles of tank crews to the helmet. Details enumerated above are shown in illustrations 6 and 7.

The Clark helmet is made from molded rubber composition in single-piece construction. It is lined with soft leather and sponge rubber. The ear covers are soft and pliable. The ear covers are slotted to hold molded rubber cups which fit into ear cushions, MC-162. The cups and ear cushions in turn hold the ear phones of the HS-18 type. Pressure of the ear covers against the ears is maintained by virtue of the helmet design. The lining and helmet suspensions are adjustable. There is no adjustment for head size. Two leather straps with glove fasteners secure the goggles of tank crews to the helmet. Details enumerated above are shown in illustration 8.

The Goldsmith helmet like the Rawlings helmet is made of pressed fiber and lined with soft leather and sponge rubber. The helmet suspension is adjustable. There is no adjustment for head size. The helmet proper is constructed of four pieces; namely, a skull guard, a skull-base guard, and two side face guards; all stitched and riveted together to form the composite helmet. The side face guards have circular openings approximately 4 inches in diameter. Ear pads fit into their openings

P-5 Helmet, Tank, Rawlings, fibre, w/springs.
Head set, HS-18, installed.

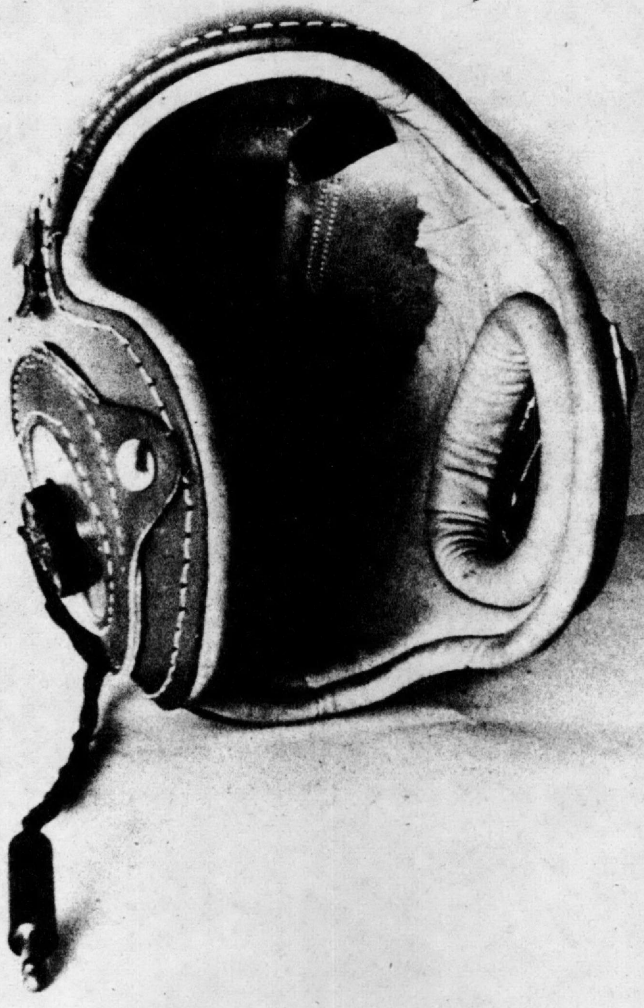


331 : P-5 Helmet, Tank, Rawlings, fibre, w/o springs.

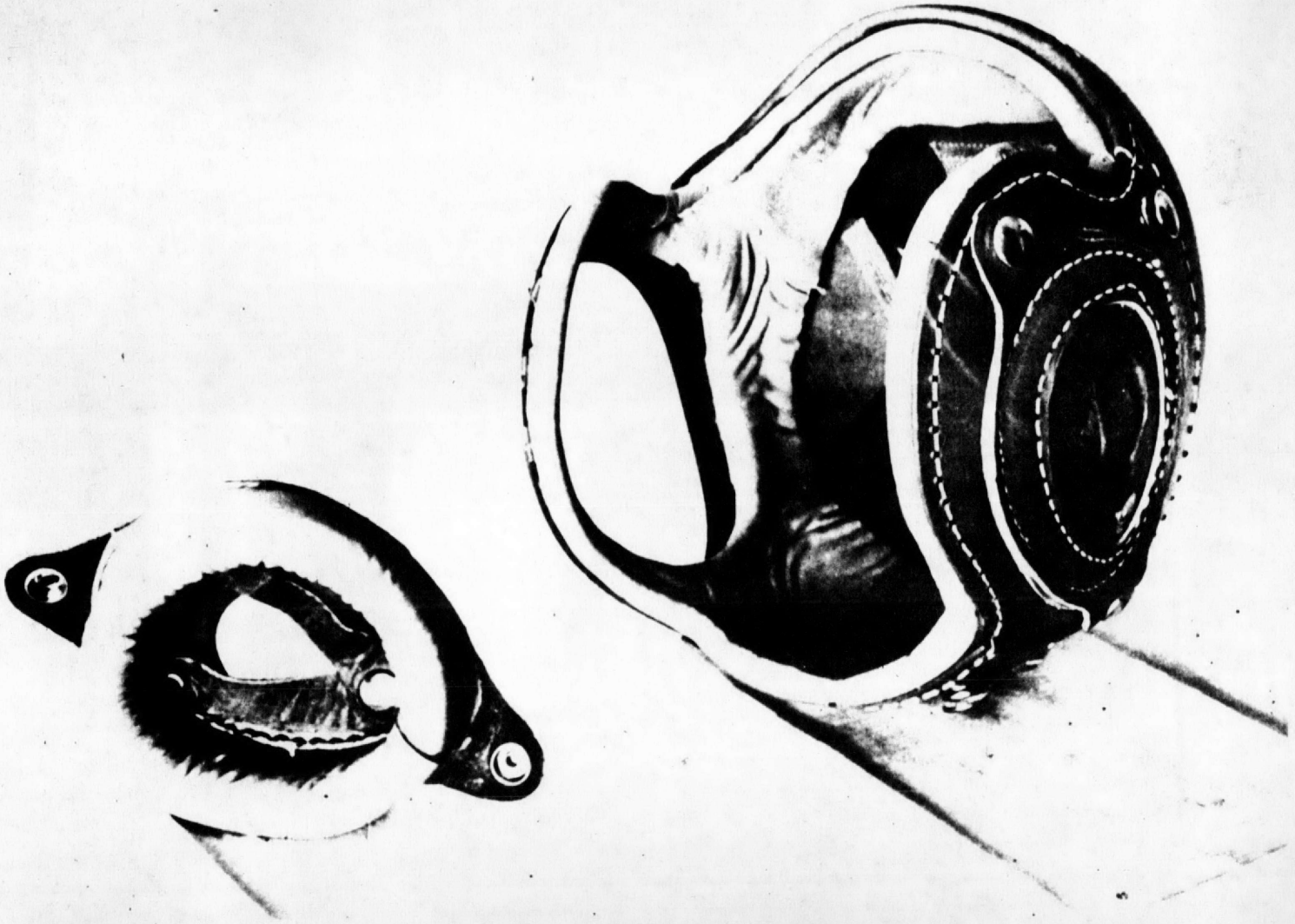
343 : P-5 Helmet, Tank, Clark, plastic.
Note provision for holding head set in place

and are fixed to the side face guards by means of glove fasteners. The ear pads carry an arrangement for holding the earphones of head set, HW-18. It is necessary to disconnect the ear phones from the head set before installation in the ear pads. Three leather straps with glove fasteners are available for holding the goggles in position. Details enumerated above may be seen in illustrations 9 through 11.

The Riddell helmet is constructed of molded plastic in two sections. Padding of soft leather and sponge rubber is provided only at the contact of the helmet with the face just below the ears and jaws. The helmet suspension is adjustable. Head bands of webbing may be interchanged to fit various head sizes by removing the necessary rivets. Openings, about 2½ inches in diameter, are provided at the ears. Molded rubber holders fit into these openings. The holders are designed to retain the ear phones of head set HS-18. A soft leather curtain snaps to the helmet at the skull base to give added protection against wind and cold. A molded rubber strip is riveted across the forehead to give protection against shock. Sponge rubber ear cushions, MC-162, were not to be used; however, these ear cushions when installed were found to be far superior to the original ear phone holders. Some of the helmets were provided with draw strings to which goggles are attached when worn. There is no other provision for holding goggles. A molded plastic face mask with plastic lenses snaps to the helmet and is intended for use in place of goggles. Details described above are shown in illustrations 12 through 14.

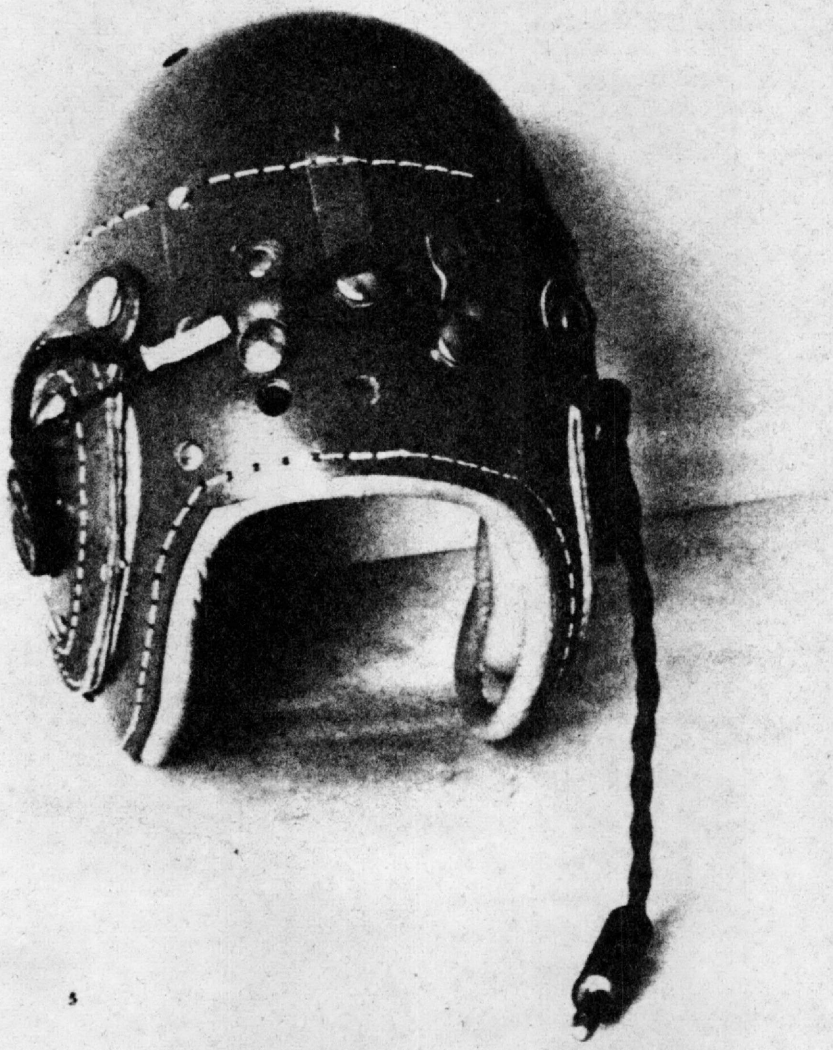


AFB 362 : P-5 Helmet, Tank, Goldsmith, fibre.
Head set, HS-18, installed.



AFB 323 :

P-5 Helmet, Tank, Goldsmith, molded fibre.
Cushions, ear, detached.

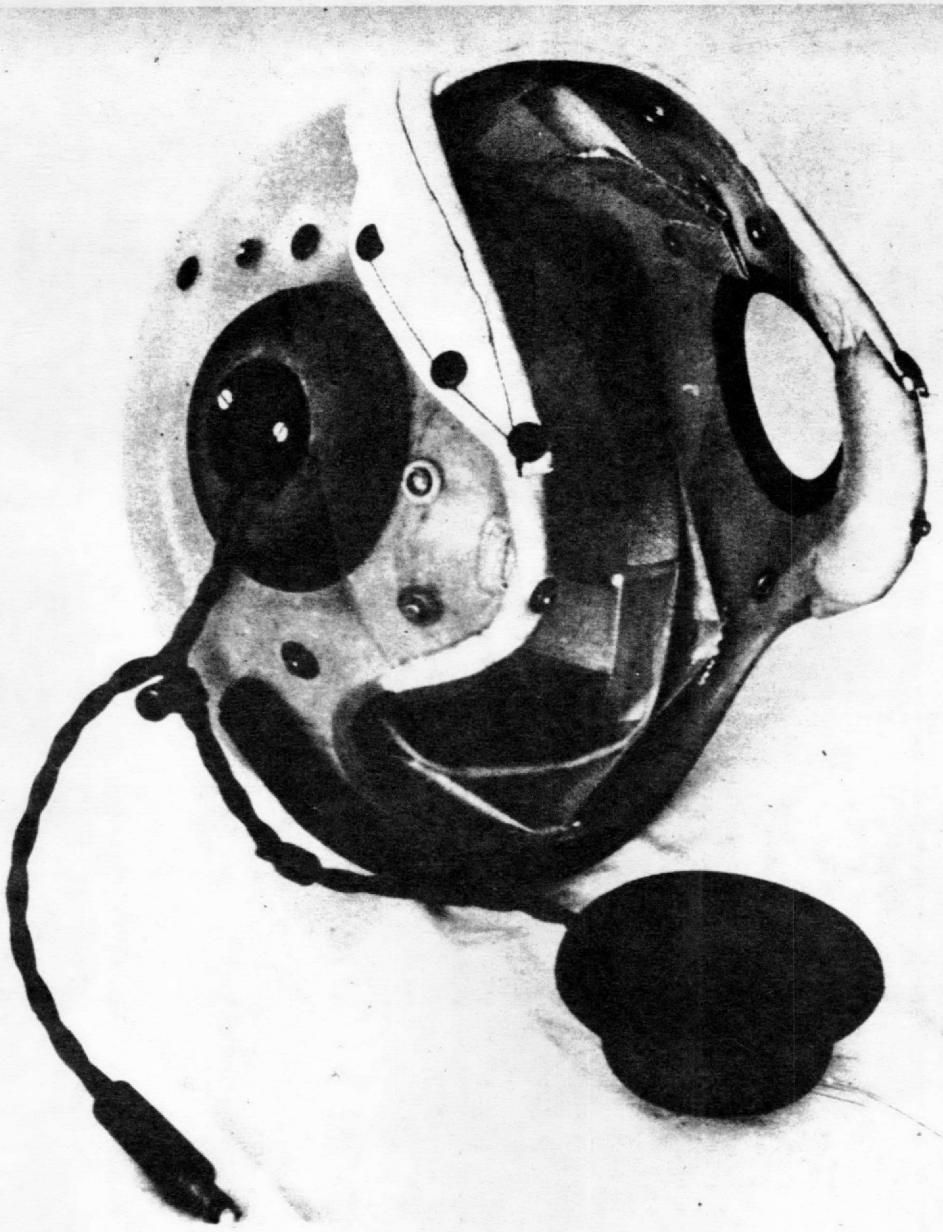


AFB 361 : P-5 Helmet, Tank, Goldsmith, fibre.
Head set, HS-18, installed.

360 : P-5 Helmet, Tank, Riddell, w/o face mask, plastic.
Head set, MS-18, installed.

340 :

P-5 Helmet, Tank, Riddell, plastic.
Mask, Face, Riddell, plastic.
Head set HS-18, installed.
Cushions, ear, rubber, MC 162.



P-5 Helmet, Tank, Riddell, plastic, w/o face mask.
Head set HS-18, installed.
Cushions, ear, rubber, MC 162.

The Mines Safety helmet is constructed of canvas impregnated with phenol formaldehyde resin and molded to produce the typical Bakelite-type product. The helmet suspension is adjustable. Adjustment within limits for head size is possible through elastic insets in the head band and the use of pad strips in the head band. Bakelite ear flaps are fastened to the helmet by small bolts through three position spring hinges. The ear flaps are lined on the inside with sponge rubber. The ear phones of head set HS-18 are held by means of spring clips. The spring clips are fastened to threaded pins that can slide in slots in the ear flaps, a knurled nut on the pin secures the ear phone in the desired position. The three position spring hinges should provide the necessary pressure to secure the helmet on the head; however, this was difficult to achieve and an adjustable chin strap was provided. See illustrations 15 and 16.

Since 1941 many more helmets have been tested for use by crewmen of armored vehicles. Excessive weight and bulk, discomfort, absence of ballistic protection, inadequacy of the suspension system, and inability to use fire control instruments have contributed largely to the general unsuitability of the helmets tested. From 1941 until 1943 a football-type crash helmet (modified Rawlings helmet) was standard headgear for tank crewmen. At an Ordnance Committee meeting on 3 March 1943 the Helmet, steel, M1 was approved as the replacement for the football-type crash helmet and became limited standard. The football-type crash helmet was dropped because it lacked ballistic protection properties. See Appendix 1 item 1.

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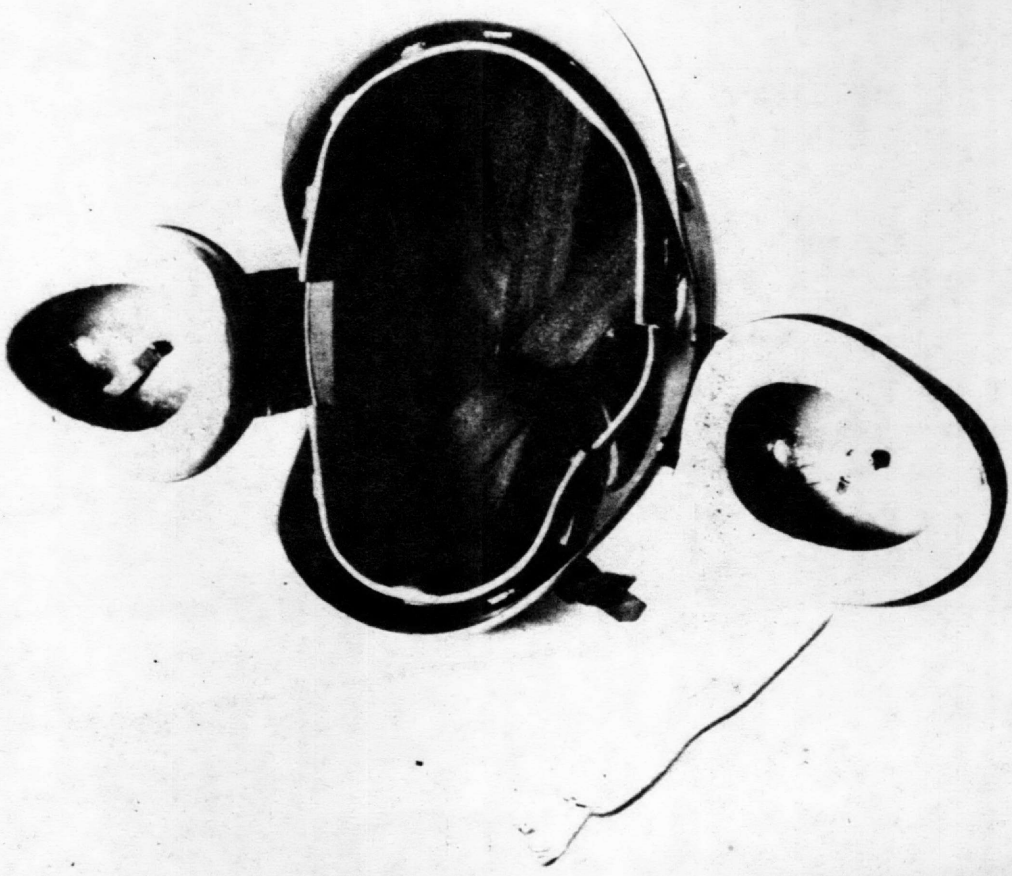
Helmet, Mine Safety Appliances Co., Bakelite. Front View.



ARMORED FORCE BOARD 493 P-5 3/29/41 FORT KNOX KENTUCKY

Helmet, Mine Safety Appliances Co., Bakelite.
Note: Ear pads in open horizontal position and clips for holding earphones.

So we see that by 1944, the United States Army had ceased issue of all component parts of the uniform so familiar to tankers all over the world during World War II. Since then, as we shall see in the following chapters, no suitable replacement uniform or helmet has been conceived. Now, let us turn to this post World War II period and trace the efforts to develop a combat vehicle crewman's uniform.

NOTES FOR CHAPTER 2

[1]War Department Equipment Board Report; Stilwell Board, Item 9, pp 73-76.

[2]Letter, The Armored Force Board, Fort Knox, Kentucky, October 14, 1940, subject: "Military Characteristics of the Tank Helmet."

[3]Letter, The Armored Force Board, Fort Knox, Kentucky, November 16, 1940, subject: "Tank Helmets."

[4]Report of Armored Force Board, Fort Knox, Kentucky, May 24, 1941, Project number 5 "Report of Tank Helmets."

CHAPTER 3

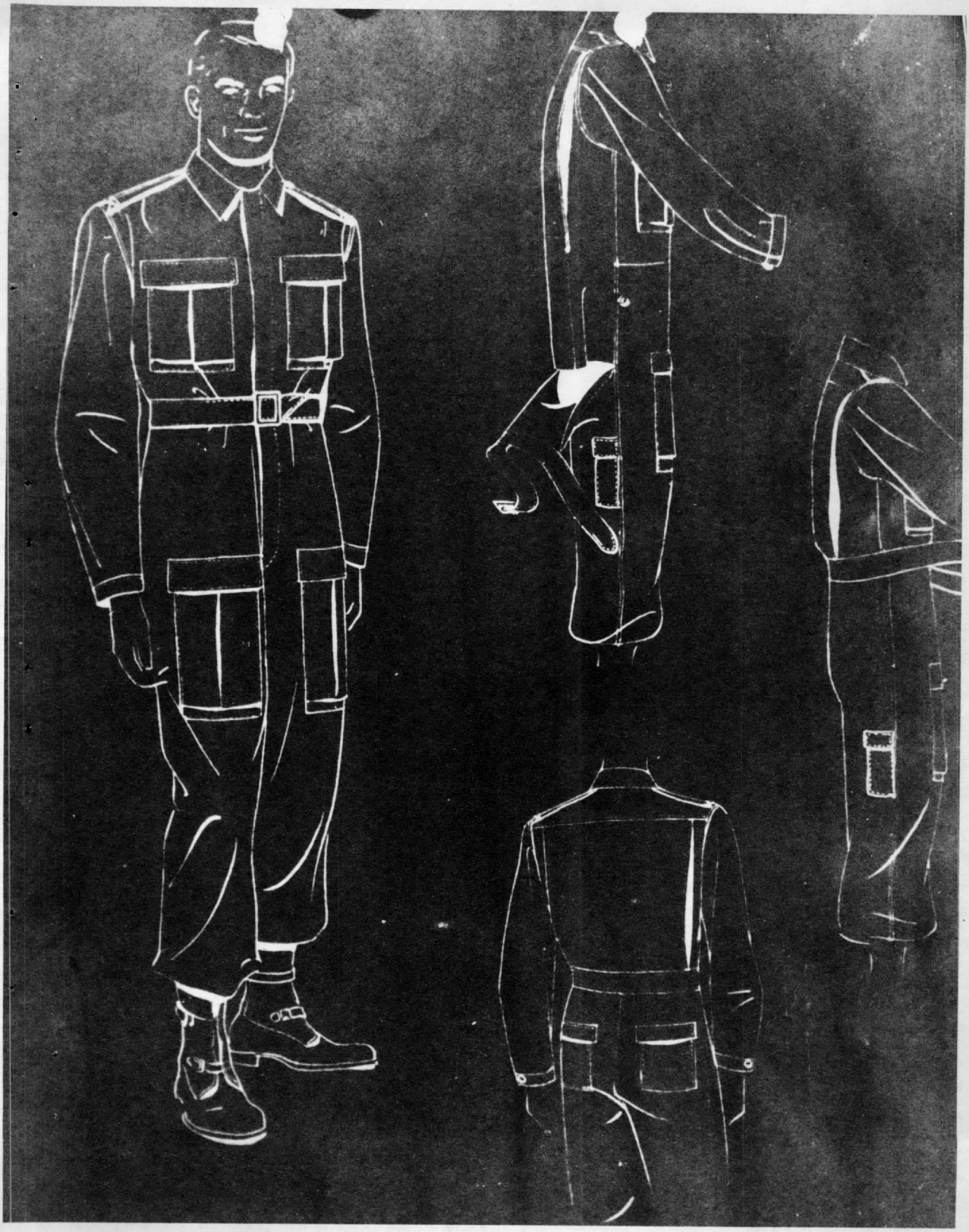
POST WAR DEVELOPMENT

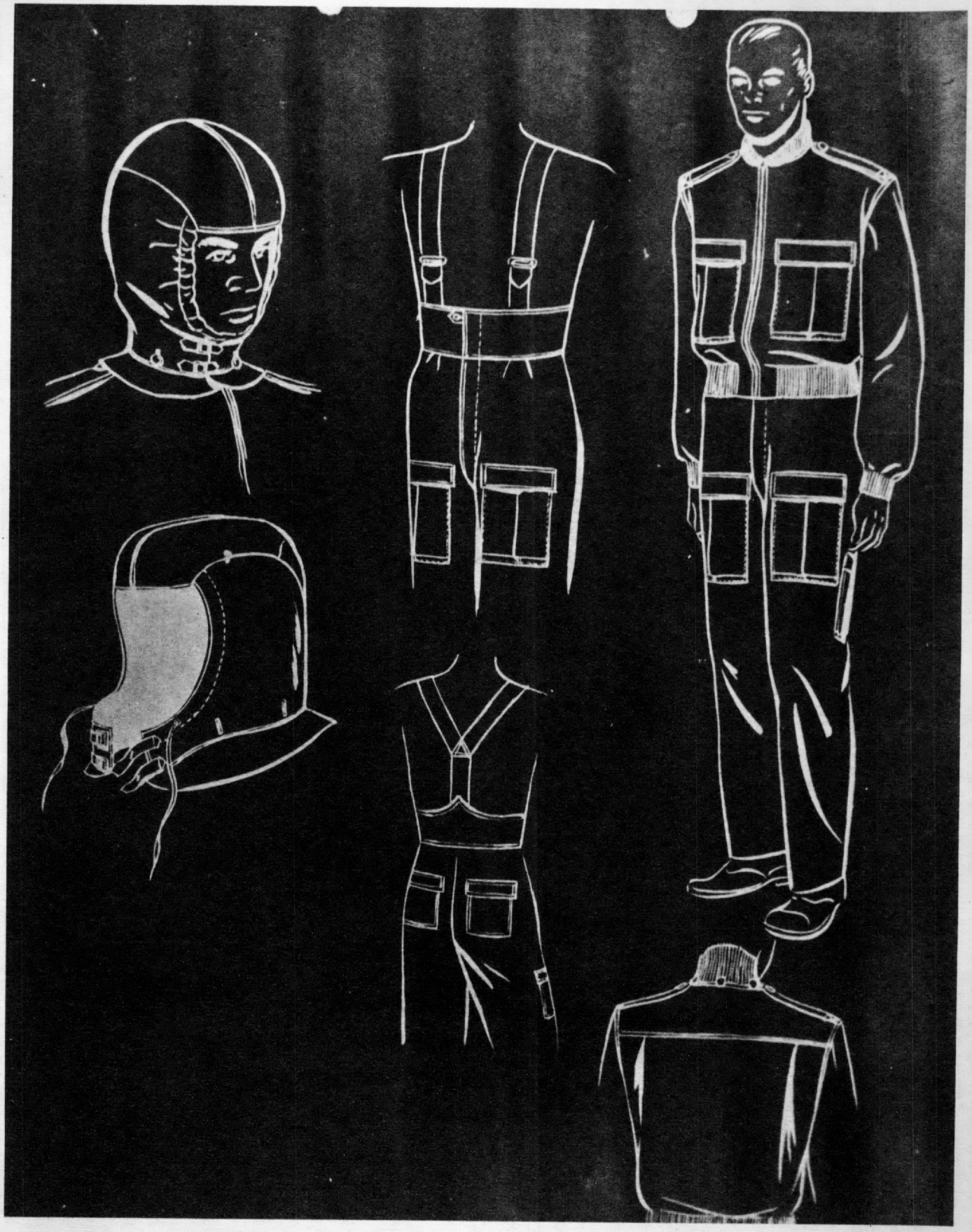
Many of the lessons in equipment development taught the Army in World War II were costly and to repeat the mistakes would be inexcusable. To preclude such a situation and to provide a basis for continuing research in the matter of equipment, the Department of the Army set up several boards consisting of senior officers of the Army to study the problem and submit their recommendations. We shall study four of these board reports in detail; namely, "The Robinett Board Report, 1944"; "The General Board USFET, 1945"; "The Cook Board Report, 1945"; and "The Stilwell Board Report, 1946." The findings of these boards were based on personal experiences and information obtained through interviews with returning officers and enlisted veterans of World War II.

Post War Board Studies

1. The Robinett Board Report, 1944. This board came to the conclusion that the items of Quartermaster clothing and equipment, in addition to some other items, required modification or redesign. These recommendations were deduced from reports of armored units in combat and recommendations of armored officers overseas or returned from overseas and are as follows:

> ...a. Suit, working, one-piece, to replace Jacket, HBT and Trousers, HBT. See illustration 17.
>
> b. Jacket, field, and trousers, field -- to replace Jacket, field, M1943, and Trousers, field, cotton, OD. See illustration 18.





c. Cap, field and dress, with visor. See illustration 19. (Presented only as a matter of interest.)

(1) Military characteristics of suit, working, one-piece.

(a) Purpose: To replace Jacket, HBT and Trousers, HBT. This uniform was recommended for all armored personnel mounted in vehicles; for ease in entering, leaving and fighting in combat vehicles and for safety reasons.

(b) General:

1. Shall offer minimum resistance to entering or leaving vehicles.

2. Shall have provisions for carrying out of natural functions with minimum exposure.

3. Shall be of lightweight, poplin-type, snag-resistant fabric for temperate summer or tropic wear, treated with fire retardant process.

4. Shall be shrink-proof and capable of being worn over battle dress uniform.

(c) Specific:

1. Design -- one-piece coverall type.

2. Drop seat -- integral with belt -- shirt tail effect on back of garment. Drop seat shall be fastened by snaps or buttons on sides.

3. Front closure -- concealed single slide, #7 crown zipper from crotch to neck.

4. Pockets -- two breast pockets, two hip pockets, two leg pockets, one pocket for first aid packet on outer seam of right leg, and corresponding rule pocket on outer seam of left leg.

5. Color — OD #7.

6. Belt — adjustable with flat buckle.

(2) Military characteristics of Jacket, field, and Trousers, field.

(a) Purpose: To replace Jacket, field, M1943, and Trousers, field, cotton, OD. This uniform was recommended for all personnel mounted in combat vehicles for ease in entering, leaving, and fighting in the vehicles, and for reasons of safety.

(b) General:

1. Shall offer minimum resistance to entering and leaving tank.

2. Shall have provisions for carrying out natural functions with minimum exposure.

3. Shall be windproof, water repellant, snag resistant fabric equal to that used in Jacket, field, M1943, treated with fire retardant process. (If 9-ounce sateen is used, poplin lining shall be incorporated in jacket.)

4. Trousers shall be of sufficient height and jacket of sufficient length to insure complete overlap of both garments even under extremes of articulation of arms and shoulders.

(c) Specific:

1. Design -- two-piece type, including jacket and high-waisted trousers held in place with wide elastic suspenders.

2. Jacket -- waist length, with high knitted neck capable of being turned down into a collar, wristlet and waistband knitted also. Front closure shall be concealed, Nr 7 crown zipper with single slide from neck to waist band.

3. Trousers -- trousers shall be cut with snug, high waistband, full seat, and full hips and legs. Fly closure shall be concealed, Nr 7 crown zipper or buttons.

4. Pockets -- two breast pockets on jacket, two hip pockets, two leg pockets, and one pocket for first aid packet on outside seam of right leg, and corresponding rule pocket on outer seam of left leg.

5. Size -- garments must be of such size and cut as to fit over jacket, field, wool; sweater, high neck; shirt, flannel, OD; undershirt, wool; trousers, wool, OD; and drawers, wool.

6. Color -- OD #7.

7. Jacket shall be provided with a detachable hood of same material and equipped with draw cord for close fit around the face.

NOTE: Buttons and flaps will not be included on trouser cuffs....

2. The General Board USFET, 1945. This board was established in 1945 to conduct a general study of the war in Europe and the lessons to be learned therefrom. On winter clothing, the board made this comment:

> ...During the three year period in the ETO efforts were made consistently to develop a winter combat uniform suitable for all troops under the climatic conditions prevailing. Of the six different types of jackets issued during the winter 1944-45, only two are recommended to be retained:
>
> (1) Jacket, field, wool.
>
> (2) Jacket, combat, winter. (Armored Force combat suit.)
>
> It is recommended that the combat jacket be modified to include breast pockets, and that the outer fabric be made of tough, wind resistant and water repellent material.
>
> Of the seven types of trousers issued, only two are recommended to be retained:
>
> (1) Trousers, wool.
>
> (2) Trousers, combat, winter. (Armored Force combat suit.)

It is recommended that the combat trousers be made tougher, more wind resistant, and water repellent and that they be modified to include cargo pockets....

3. The Cook Board Report, 1945. This board recommended that the following guides be used in the development of Quartermaster equipment for ground forces:

...a. Clothing, general:

(1) Development must keep pace with industry in the utilization of the best fabrics, hardware, dyes, and plastics. Standard designs and patterns must be developed, and tolerances for variations from these standards held to an absolute minimum if we are to achieve uniformity and present industry with a definite productive demand.

(2) Research and development must be continuous to find improved methods of making uniform fabrics water repellent, flame proof, and gas proof. Laundering processes must be developed which will quickly restore these characteristics to fabrics.

(3) In development the policy should be adhered to of providing a maximum number of general purpose garments and a minimum of individual and special purpose garments.

b. Outer clothing: The goal of development for outer clothing should be to provide three standard uniforms which will be adequate for the greatest number of troops, and a minimum number of special purpose garments. Uniforms for general issue should consist of a dress uniform, a combat uniform, and a fatigue uniform.

(1) Dress Uniform --

(2) Battle Dress -- There is an urgent requirement for a suitable battle dress or combat uniform for our Army which will combine smartness of appearance, comfort, and utility. A battle dress should be designed for temperate climates and the layer principle applied for colder climates. The cut and design should be the subject of special study. In this connection the British type of battle dress is worthy of consideration. A battle dress of similar design but of a lighter weight fabric should be developed for tropical service.

(3) Fatigue Uniform -- There is a need for all troops to be equipped with a one-piece fatigue suit of durable, washable, lightweight material, which may be worn as an outer garment or over the battle dress. Development of this article should include the use of improved slide fasteners in lieu of buttons, properly placed and properly shaped pockets, and convenient seat and crotch openings.

(4) Special Clothing -- The needs of specialized groups must receive continuing study. The first answer to each specialized need is modification of the general purpose

garment in order to give it a still broader utility. If this proves impractical, special garments must be designed.

(5) Inner Clothing and Miscellaneous Items -- Size tariffs and designs of battle dress, fatigue clothing, and underwear should be studied with a view to reducing the range of sizes through introduction of universal adjustments and of other expedients which will accomplish this end.

(6) Fastenings -- Slide fastenings,,buckles, snaps, and hooks should be improved to make them simple, lighter, more secure, and easier of operation....

Of clothing for armored personnel in particular the Cook Board had the following comments:

...Clothing for armored personnel should be designed to provide a reasonable amount of safety and to facilitate entering, leaving, and fighting in armored vehicles. The clothing should permit minimum opportunity for catching on protruding parts in the interior of the tank, and should be fire resistant. The boot should provide adequate flexibility for articulation of the ankle joint to permit easy operation of foot controls, and the sole of the boot should give the maximum traction on metal surfaces. The following items of clothing should be especially designed to meet the above requirements:

(1) Suit, working, one-piece.

(2) Jacket, field; Trousers, field; and Hood, field.

(3) Boot, service, combat....

4. The Stilwell Board Report, 1946. This board pointed out the fallacy of depending on civilian research to provide suitable clothing for wartime needs and advised that in the future vigorous and continued research and development be initiated by the Army and continued during war or peace. It also recommended that a maximum number of general purpose items be provided and a minimum number of distinctive or special purpose items. It was also felt that every effort should be made to modify general purpose items in order to broaden their utility before new items should be provided for specialized groups. This by no means precluded the development of such items, however, once the need for them had been definitely established.

Particular attention was to be given to reducing the weight of the equipment which the soldier is to carry consistent with the military characteristics required. Priority was to be given to use of light metals and materials for this type of equipment.

It was established also that three types of uniforms should be provided for all personnel as follows:

> ...a. Dress Uniform --
> b. Field or Combat Uniforms -- Research should be continued to improve the design, color and camouflage, fit and sizing of the component parts of the combat uniform.
> c. Fatigue Uniform -- For general use including combat, an improved two-piece fatigue uniform is required. There is a limited requirement for an improved one-piece fatigue uniform for use by mechanics. A cap with visor should be provided for wear with the fatigue uniform....

It was recognized that the needs of specialized groups must receive continuing study; that clothing for armored troops should be suitable for wear in cramped quarters and should provide protection against fire, and that there is a requirement for a special helmet for armored troops.

Now let us analyze briefly the conclusions reached by these separate boards working over a period of three or four years, covering the latter stages of World War II and the ensuing postwar era. It is highly significant that all of them agreed on the following points with a few exceptions which shall be pointed out. They are as listed:

1. It is imperative that research on clothing and equipment be carried on continuously in war and peace if we are to obtain the best equipment possible.

2. In general, the boards advocated three uniforms for the armed forces:

a. Dress uniform for passes and special occasions such as parades and ceremonies where troops come under the public eye.

b. Battle dress for performance of everyday duties and for combat.

c. Fatigue uniform for performance of manual labor and combat.

3. All recognized the desirability of developing general purpose items, insofar as possible, that would serve the greatest number of troops.

4. Each agreed also that the combat uniforms should be made of fabrics that are durable, lightweight, water repellent, fire resistant and gas proof.

5. Most noted that a need did exist (might in one case) for special uniforms for specialized troops, but that they should be obtained by modifying the general purpose uniforms decided on wherein possible, and where not possible that a suitable uniform should be designed.

6. Most recommended a one-piece fatigue uniform which would facilitate entering, leaving and fighting in combat vehicles and for safety reasons.

7. All agreed that most uniforms in use during World War II and the periods during which these researches were conducted were not suitable due to the fact that they failed to meet most of the military characteristics set up for them.

The USFET General Board, the Cook Board and the Stilwell Board dealt with these problems generally on an army-wide basis whereas the Robinett Board dealt with the subject more from the viewpoint of obtaining suitable uniforms and equipment for Armored Troops. Hence, for the purposes of our research, the Robinett Board findings are the more significant.

Current Uniforms

Let us look briefly now at our uniforms in present-day use and consider their characteristics. We shall not cover the dress uniform here since our primary purpose is to find a suitable combat uniform which will embody the military characteristics required today.

The battle dress authorized for general issue is the "Ike Jacket," OD, shade 33 and trousers, the shade 33 trousers being worn with a khaki or OD shirt and shade 51 necktie. This uniform is designed to conform with the layer principle recommended for adoption by the Quartermaster Corps and approved by Department of the Army. This means that the uniform must be of such size that woolen underwear, socks, shirts, and high-neck sweaters may be worn underneath it as required. It also means that the uniform loses its dressy appearance, for without the full complement of underclothing the outfit is baggy and ill-fitting -- nor does this uniform allow freedom of movement of the arms and shoulders. When the arms are extended at shoulder height or above for short periods of time, it results in binding at elbows and shoulders. This cuts off circulation and results in unbearable fatigue very quickly.

The fatigue and combat uniforms are very controversial in all branches today. Both one-piece and two-piece fatigues made of HBT are in general issue. With these are issued the Field Jacket, M1943; field, cotton trousers, OD; HBT fatigue caps, and cotton field caps, OD. The fatigue uniform is also designed to accommodate several layers of wool underclothing as desired. This poses no particular problem, however, since this clothing is supposed to be loose-fitting and baggy. The fact that the Army issues two types of fatigues is in itself proof that it has not yet discovered the all-purpose type fatigue uniform.

Now let us briefly analyze the desirable and undesirable features of both as they appear from our viewpoint for armored use. First let us take the two-piece fatigue suit. It is desirable in that it lends itself to the performance of natural functions with little exposure. One piece may be worn at a time according to the dictates of body temperature (the shirt may be removed). In case of damage to one piece it is not necessary to salvage the whole suit. Possibly it is easier to pack and will take less room in that in certain situations it might be more desirable to take two pairs of trousers and one shirt or vice versa.

Some of the undesirable features are as follows: a belt must be worn with this suit which might cause undue binding and discomfort in close quarters. Due to this feature also there is a greater tendency to get hung on knobs and gadgets inside

a tank; the baggy pockets on this suit are on top of the legs and cause undue rubbing by heavy objects if required to work while sitting as in a tank; there is a greater tendency for trouser legs to be pulled out of boot tops while sitting in a vehicle because of the close-fitting belt at the waistline; there is an overlap of material, too, where the shirt is tucked into the trousers.

As for the one-piece suit, most of the undesirable features of the two-piece suit are eliminated, but it also eliminates some of the good features. For instance, with the one-piece suit it is not as likely to hang on knobs and projections. There is no overlap of material. It may be made to fit loosely at the waist. The trouser legs are easier to keep in the boots and it gives generally greater comfort and ease of motion in cramped quarters. Weight is carried for the most part on the shoulders where it is well distributed. On the other hand, as this suit is designed today it causes maximum exposure in carrying out natural functions, and when it is damaged, the whole suit must be salvaged. Neither the one-piece nor the two-piece suit is water repellent, flame resistant, or flash proof -- very important considerations for any branch of the service and particularly in the Armored branch.

The Field Jacket, M1943 and cotton field trousers, OD, give some degree of water proofing, but they are suitable only for cold weather as cover clothing for the fatigue uniform. Neither of these are flame, flash, or water proof and they do not afford sufficient warmth for their added bulk.

Current Development

In attempts to determine what the current trend is in research and development of clothing for combat vehicle crewmen, our committee has written to several organizations engaged in this kind of work. Their responses will be summarized in the following paragraphs.

A letter from Army Field Forces Board Nr 3, dated 29 November 1951,[1] stated that Army Field Forces Board Nr 3, Project Nr 2422, Military Characteristics for Jacket, Field, for Combat Vehicle Crewmen was the only current study relating to development in tanker's uniforms and equipment available. See Appendix 1 item 2.

In a letter dated 7 November 1951 from the Operations Research Office at Johns Hopkins University,[2] the following information was received on the subject, "Tanker's Uniforms and Equipment." See Appendix 1 item 3.

Attention was directed to ORO-R-1 (FEC) wherein the conclusion was drawn that clothing issued to tank crewmen was too bulky and uncomfortable. Since it could not be worn with ease inside the tank and since tank heaters were inadequate, the crewmen were provided with inadequate protection. Clothing furnished in Korea was similar to that worn by infantrymen. It was recommended that based on interrogation of crews we should resume the use of the type of clothing worn by tankers in World War II. Mention was also made of ORO-T-9 (FEC) which dealt with clothing and equipment for infantry only and ORO-R-5

which deals with an intensive investigation of all means for protection of military personnel, including all types of clothing. Of these three documents referred to above, none are available for study. The first one is under review by Department of the Army prior to official distribution and the last two are currently in editorial process.

A letter from D/A, OQMG, Washington 25, D. C., dated 28 November 1951[3] (Appendix 1 item 4) had this to say:

> ...This office has made a search of its files and can locate no studies or documents relating to recent developments in tankers' uniforms as such. Since World War II when the Army found it logistically impossible to supply distinctive uniforms to specialized troops, all the functional requirements of the various arms and services have been incorporated to the best possible degree into a general uniform for wear by all field forces....

It pointed out further that new combat uniforms for cold-wet and cold-dry climates have recently been standardized in which the incorporation of special design features were attributed to functional requirements of tank personnel. To enumerate -- some of these design features included concealed buttons on the front closures of jackets and parkas, concealed buttons on all pocket flaps, drawstrings on waist and skirt of jackets and parkas, drawstrings on the cuffs of trousers, and elimination of buckles on combat boots.

It was mentioned also that a new helmet was under development consisting of a ballistic liner and aluminum shell. The helmet liner was designed to meet the needs of tank forces and was to be worn without the shell. The combination was to meet the needs of all other forces.

In light of the foregoing information it is obvious that very little, if any research is being conducted at present with a view to developing a specialized uniform suitable for tank or combat vehicle crewmen. The current trend is toward a general purpose uniform that will conform to the needs of the armed forces as a whole. It has been recognized and accepted by most authorities that a certain amount of specialization for combat vehicle crewmen is desirable -- indeed necessary. This recognition for specialization insofar as it pertains to tank helmets has been consistent almost since the tank was conceived. The matter, consequently, received continuing study through the post war period to the present.

Tank Helmets Investigated During Post War Period

At present there is no standard helmet specifically designed for crews of armored vehicles. Both the M1 and the football-type helmets are currently used by crewmen of armored vehicles. During 1944 the Ordnance Department developed four tank helmets. This was necessary because the M1 steel helmet did not satisfy all the requirements for an armored crewman's headgear.[4] These four tank helmets were the T-10, T-12, T-13, and the T-16. These helmets were designed to provide ballistic as well as crash protection. Three of the helmets, the T-10, T-12, and T-16, were one-piece helmets and differed only in internal dimensions and method of attaching the suspension to the helmet. The fourth helmet, T-13, is a two-piece helmet with

a shell design similar to that of the other three. The liner of helmet, steel, M-1 can be worn under the shell of tank helmet, T-13. All of these helmets have a removable skirt which provides protection for the wearer's neck. It was recommended that all four of these helmets be considered unsatisfactory.[5]

Efforts to develop a tank helmet during the period 1945 to 1949 were principally directed toward modifying the helmet, steel, M-1. The following is a summary of results of service tests on helmets developed during this period. First was the tank helmet, T19E1, which was a modified version of the helmet, steel, M-1. There was a large cut-out at the rear which allowed the wearer to push the helmet onto the back of the head, thus permitting the use of fire control instruments. It was recommended that the steel portion of the T19E1 be considered unsatisfactory, but that the crash liner be adapted as an interim measure for immediate issue to tank units.[6]

Next was the tank helmet, T19E2. This was another modification of the helmet, steel, M-1. The front of both the shell and the liner were raised and rimless to permit the use of fire control instruments. There was no cut-out in the rear. It was recommended that this helmet be considered unsatisfactory for use by tank units.

The tank helmet, T-20, was another modification of the helmet, steel, M-1. The suspension was fastened directly to the steel shell, thus providing a one-piece helmet. The suspension used was almost identical with the suspension of the liner

that accompanied tank helmet, T19E1. It was recommended that this helmet be considered unsatisfactory for use in armored units.[8]

The tank helmet, T20E1, was a one-piece modification of the shell of the helmet, steel, M-1, with a modified M-1 liner suspension. The front was raised and the rim was removed. The rear was raised slightly with a shallow rim that ran to a point 1 inch in front of the chin strap holders. The inside of the helmet was coated with a sound-absorbant material. It was recommended that this helmet be considered unsatisfactory for use by armored units. See illustration 20.

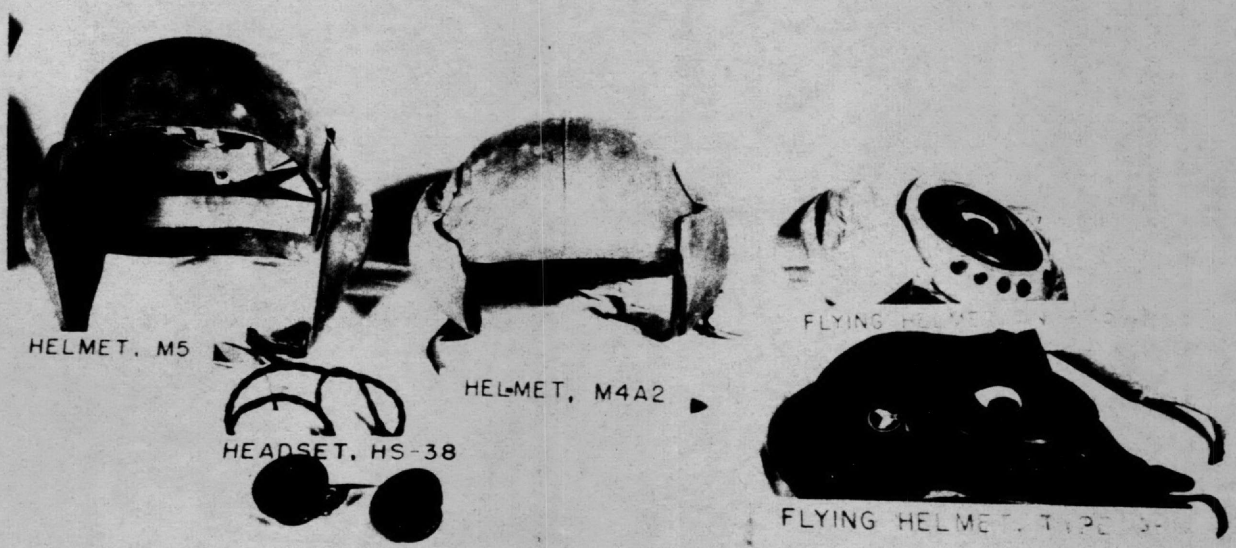
The tank helmet, T20E2, was the same as the tank helmet, T20E1, except the M-1 liner suspension was used in place of the modified M-1 liner suspension. This was also found to be unsatisfactory for use by armored units.[10]

The Doron helmet constituted the next phase of development; it is a one-piece helmet made from a material called doron. The front has a cut out which permits the wearer to use fire control instruments. It was recommended after testing that the Doron helmet be retested by Army Ground Forces Board Nr 3 after a satisfactory means of fastening the suspension to the shell had been developed. This helmet was found to be lighter, cooler, and more comfortable than the helmet, steel, M-1, and could be worn when using tank fire control equipment.[11]


T20E1

Research development efforts were not restricted to new ideas or purely ground force ideas. Existing helmets used by other branches were tested in an effort to develop a suitable tank helmet. See Appendix 1 item 5. In December of 1948 two Air Force helmets, the M-5 and the M4A2, were tested. See illustration 21. These were Air Force flak helmets intended for wear over a leather or cloth flying helmet. Headsets were attached to the leather or cloth flying helmet. After tests it was recommended that the M4A2 helmet be considered acceptable as an interim item for use by armored units. The M-5 helmet was considered unsatisfactory as an interim item either with or without the flying helmet. In further testing and discussion objections were raised to using the leather or flying helmet for wear under the tank helmet. It was finally recommended that if the M4A2 helmet combination was adopted it should be issued only to units having a critical need for a tank helmet. Limited issue was made of this helmet; however, the helmet was in the hands of the tank units first committed in Korea. Due to the general discomfort of this helmet, it was discarded by these troops in combat.

Tank helmet design from 1949 to the present has been limited by the requirements for a universal helmet which could be worn by all personnel of the Army, whether they be paratroopers, infantry, antiaircraft artillerymen, tankers, engineers, or members of any other branch. In other words, the Army is attempting to develop a panacea for its helmet troubles.



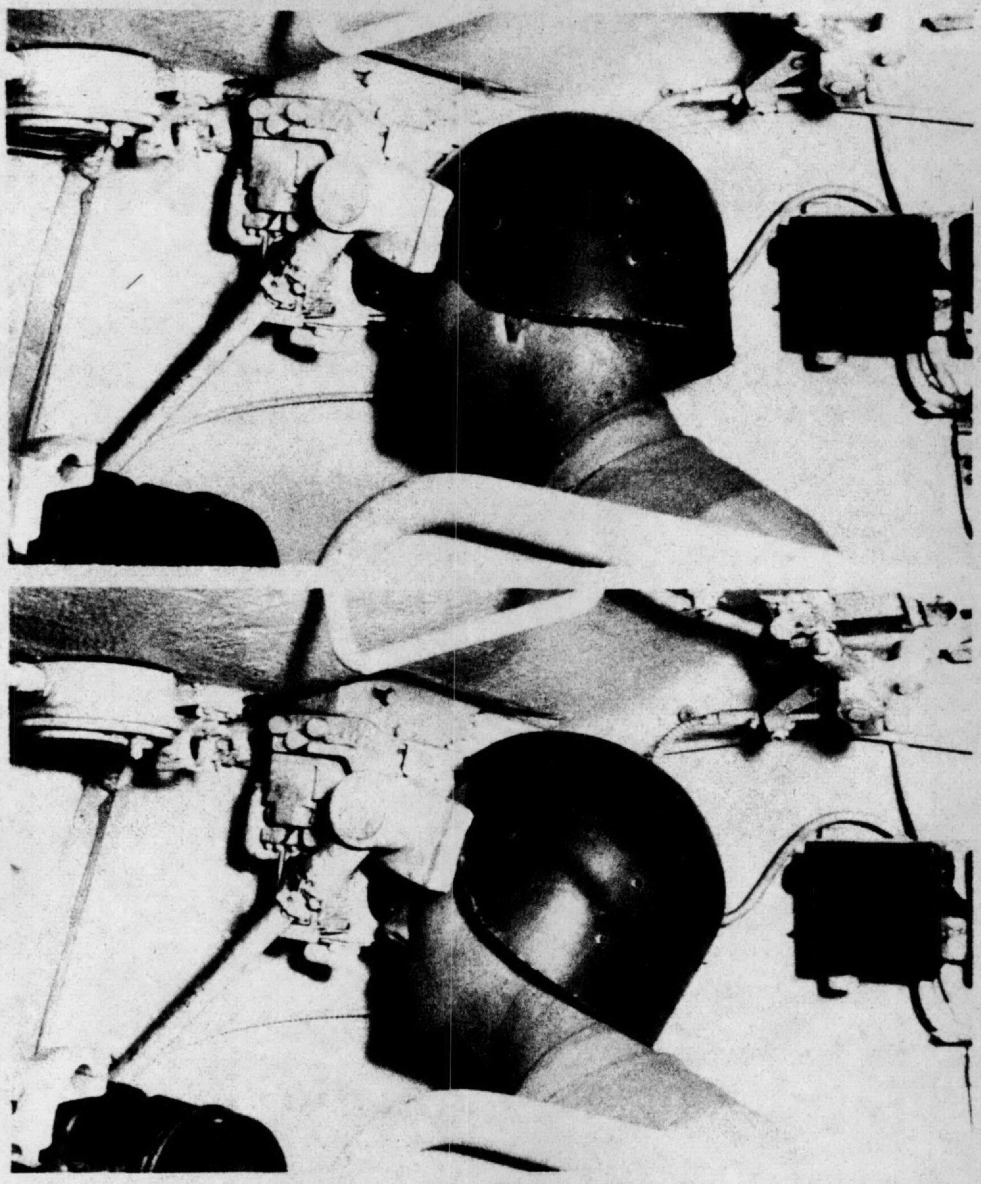
ARMY FIELD FORCES BOARD No. 2	P - 1374	# 48-2981	FORT KNOX, KENTUCKY

Air Force Helmets M5 and M4A2, with leather and cloth flying helmet and headset HS-38 (SC HS-18)

At a meeting in the Metropolitan Museum of Art in New York City in January 1949, a universal helmet design was studied in some detail and the liner, helmet, nylon, EX 49-1 evolved as a possible universal helmet. See Appendix 1 item 6. This helmet was constructed of seven-ply laminated nylon fabric. It offered considerably more coverage to the back of the head and ears than the standard M-1 helmet. It was intended for use without an external shell by crew members of armored combat vehicles. The suspension was similar to the standard M-1 suspension. After testing, it was recommended that no further consideration be given to the liner, helmet, EX 49-1 for use by armored vehicle crewmen and no further development of a universal helmet be undertaken. It was recommended that a special helmet be developed for crew members of armored combat vehicles.[12]

However, the idea of a universal helmet was not to be defeated so easily. The Metropolitan Museum of Art developed the liner, helmet, nylon, EX 49-3 (Methacrylate Prototype) in an effort to correct the deficiencies of the liner, helmet, nylon, EX 49-1. This helmet was made of methacrylate merely for testing purposes. The liner, if adopted and produced, would be made of nylon. This helmet was designed to fulfill the requirement of a one-piece helmet for armored vehicle crews. It will also serve as the liner for all other personnel requiring a two-piece helmet.

It was recommended that certain deficiencies be corrected and the modified liner be produced in quantity and submitted for



ARMY FIELD FORCES BOARD No. 2	P IP-39	# 49-1666 49-1665	FORT KNOX, KENTUCKY

Test of Liner, Helmet, Nylon Ex 49-1.
Upper: Side view of gunner with Nylon Helmet Liner, looking through the periscopic sight, M10P. Note: Interference of the rubber headrest with the front of the helmet prevents access to the sight by the gunner.
Lower: Side view of gunner with Nylon Helmet looking through periscopic sight, M10P. Note: Position of the helmet when gunner has proper access to sight.

ARMY FIELD FORCES BOARD No. 2	P - IP-39	# 50-74	FORT KNOX, KENTUCKY

TEST OF LINER, HELMET, NYLON, EX 49-3 (METHACRYLATE PROTOTYPE)

Side view of tank commander wearing liner looking through periscope sight M-15. Note the way liner fits on brow pad of periscope.

extended service tests. A test of the actual liner, helmet, nylon, EX 49-3 was made at Fort Benning, Georgia.[13]

At the present time the helmet, EX 51-1, a modification of the EX 49-3, is under test. This project has been assigned an "A" priority.[7] No results are obtainable at this writing. The EX 51-1 represents the latest development in helmets for armored vehicle crewmen. It consists of three parts; the shell, the liner, and the suspension. The shell is fabricated of heat treated aluminum alloy and is shaped to cover the head, forehead, and ears. It is cut out at the rear (nape of the neck) to allow the wearer to turn his face upward without interference from the shell. It is also cut out at the front (forehead) to allow the wearer to use optical instruments. The hinged latches on either side of the shell not only provide fastenings for the chin strap but also give a means of locking the liner to the shell. The canvas chin strap has a quick release device at one end. There are two size shells. The small size weighs 1.33 pounds; the large size weighs 1.45 pounds. The liner is designed to give protection against small arms fire and shell fragments. It is fabricated of nine-ply, 2 x 2 basket weave nylon with the same shape and configuration as the shell. The liner is made to fit snugly into the shell and is locked in by the latches on the sides of the shell. Holes are drilled into the sides of the liner to take either of two types of suspension, M-1 or M-5. There are two sizes of liners: the small size weighs 1.39 pounds, the large size weighs 1.51 pounds.

illustrations 28 and 29. Study of this helmet represents the most advanced effort in helmet development.

NOTES FOR CHAPTER 3

[1]1st Ind Hq AFF Bd Nr 3 to letter Hq The Armored School, Ft Knox, Ky, dated 20 Oct 51, Request for Research Material.

[2]Letter, Operations Research Office, Chevy Chase, Maryland, 7 Nov 51, re: "Tanker's Uniforms and Equipment."

[3]1st Ind, DA, OQMG, to letter Hq The Armored School, Ft Knox, Ky, dated 20 Oct 51, Request for Research Material.

[4]Memorandum on Employment of Steel Helmets, M-1 within Tanks, AGF, Medical Research Laboratory, Ft Knox, Ky.

[5]Test of Tank Helmets T-10, T-12, T-13, and T-16, 16 Dec 44, The Armored Board, Ft Knox, Ky.

[6]Test of Tank Helmets, T19E1, 9 Apr 45, The Armored Board, Ft Knox, Ky.

[7]Test of Helmet, T19E2, Tank Helmet, 29 Aug 45, The Armored Board, Ft Knox, Ky.

[8]Test of Helmet, T-20, Tank Helmet, 29 Aug 45, The Armored Board, Ft Knox, Ky.

[9]Test of Helmet, T20E1, Tank Helmet, 29 Aug 45, The Armored Board, Ft Knox, Ky.

[10]Test of Helmet, T20E2, Tank Helmet, 29 Aug 45, The Armored School, Ft Knox, Ky.

[11]Letter Report of Army Ground Forces Board Nr 2, Project Nr 1212, Test of Doron Type Crash Helmet, 4 Dec, 47, Army Ground Forces Board Nr 2, Ft Knox, Ky.

[12]Test of Liners, Helmet, Nylon, EX 49-1, 26 Aug 49, Army Field Forces Board Nr 2, Ft Knox, Ky.

[13]Test of Liner, Helmet, Nylon, EX 49-3, 15 Mar 50, Army Field Forces Board, Ft Knox, Ky.

CHAPTER 4

INTERVIEWS OF EXPERIENCED PERSONNEL

As was pointed out in the introductory chapter of this report, a study of this nature could not be considered complete unless the views of the personnel who must work and live in this clothing are considered. The members of this committee feel strongly on this subject, and it is our opinion that any research and development in the future along these lines should be based primarily on recommendations from personnel in the field. No one can possibly know more of the advantages and disadvantages of a piece of clothing, or any equipment for that matter, than a person who has used that equipment under the varied conditions of life in the field.

The purpose of this chapter is to briefly summarize opinions obtained from experienced personnel through interviews and questionnaries on the subject of tankers' uniforms and headgear. It is realized that this is not exclusively a problem of the United States and for that reason, a brief discussion of developments and opinions of allied officers appears also as part of this chapter.

The authors felt that at Fort Knox is found a true cross section of armored thinking and, therefore, interviews were conducted and questionnaires were distributed to various agencies located there. Included among these were the Advanced Class of The Armored School, which has provided the majority

of the data contained herein, as well as Army Field Forces Board Nr 2, and members of The Armored School Staff and Faculty.

Since the two subjects are treated separately in research channels, we will discuss uniforms in one section and headgear as a separate section in this chapter. Our first discussion will be that of uniforms exclusive of headgear.

Opinions on Uniforms

- In the way of opening remarks to this section, it should be stated that the members of this committee in our investigation and research into this subject have attempted to maintain a completely neutral frame of mind on the basic issue of whether or not there should be a special uniform for crewmen of armored vehicles. This has become an increasingly difficult thing to do since there seems to be an almost universal agreement among personnel with armor experience that the present standard uniform contains decidedly undesirable characteristics. This is pointed out so that the reader, in examining some of the comments and recommendations found in this section will realize that they are not the ideas of the authors alone but are a concensus of those interviewed.

As mentioned above, the greater part of the data contained herein came from members of the Advanced Course of The Armored School whose wide and varied experiences were felt to qualify them to comment. These officers, as well as others at Fort Knox, were either interviewed or asked to fill out a questionnaire on this subject. A copy of this questionnaire,

as well as a detailed tabulation of results appears in Appendix 2 of this report.

Since the principal objection to a specialized uniform at present seems to be the prohibitive cost of such a uniform as opposed to a standard uniform for all troops, the first query put to those officers interviewed was whether or not they felt that, in spite of cost and the present standardization program, there was a need for a special uniform for armored vehicle crew members. The overwhelming consensus was that there was a decided need for such a uniform. Only two officers gave a negative reply and one of these was not negative in its entirety. The reason advanced by the one officer who answered definitely no, was the cost of such a program. The other officer stated that there was a need for a new field uniform but that the need was universal and all combat arms should be provided with an improved standard type uniform for field wear.

It is interesting to note that the reasons given by those officers desiring the development of a new uniform were almost exactly the same in all cases. The two outstanding reasons mentioned by every officer were:

1. The present uniform is too bulky to permit the freedom of movement necessary to properly function in a tank and

2. The present uniform has too many exterior loops and flaps which continually snag on projections in and on a tank.

The general feeling was that the first requirement in a uniform is that it be functional. Since an armored crewman performs a special type of duty in cramped quarters, he must be given a uniform with as little bulk as possible. His freedom of movement is essential to the proper performance of his job, and both bulkiness and those features of his clothing which tend to snag, prevent or reduce this freedom. However, the crewman is not immune to heat or cold and, therefore, warmth must also be considered in the uniform design. The suggested solutions to the problem of combining the necessary warmth with lack of bulk will be discussed in a later paragraph.

One other significant reason for the adoption of a specialized uniform which was advanced by many was the factor of esprit de corps. The issuance of a well-designed tankers' uniform would contribute greatly to the esprit de corps and ultimate combat efficiency of tankers was a reason advanced by approximately 20 percent of those officers questioned. We feel that this is an important factor and should not be overlooked. All of us have been taught to look for esprit de corps as an indication of a well-trained, well-disciplined, and efficient organization, and to strive to do everything to build this feeling of pride, of distinctiveness, within a unit. The paratrooper has his boots, the cavalryman had his boots and breeches (which, incidentally, were also functional), and it is felt that some distinctiveness in a uniform for armored crewmen, provided it is a functional uniform, would contribute greatly to his efficiency.

Another officer in discussing this point stated that he felt a distinctive uniform should be provided not only for tankers, but all personnel serving with armored units such as armored infantry, reconnaissance personnel, and armored field artillerymen. Recalling his experience as an enlisted man in 1942, he pointed out how proud he and his fellow soldiers had been of their distinctive tanker suit. They considered themselves "elite troops" and were "damned proud" of it.[1]

As mentioned earlier in this chapter these three reasons -- bulkiness, snagging on projections, and esprit de corps were the most significant ones mentioned by the officers interviewed. In opposition to the adoption of a special uniform the only argument advanced was that of the additional cost introduced by such a program. Certainly this would be a factor worthy of consideration; however, many officers took issue with this on the grounds that it is fallacious reasoning and false economy. The present cost of tanks and equipment is so great comparatively speaking, and the logistical problem of tank maintenance and supply is so great that this expense would not be appreciable. The initial expenditure would be an added cost, but it is felt that, following this, the resupply of such a uniform would be no more expensive, if as expensive, as the resupply of existing uniforms. It is also felt that this initial outlay would be more than balanced by the resultant morale and esprit of the armored soldier. "Make a soldier just a little different, a bit distinct from

everyone else, and you'll make him a better soldier for it," is a statement which we frequently came across in our questioning.

It is no more correct to merely establish the fact that a need is felt for a new and distinctive uniform than it is to say that some person is no good. This is destructive criticism and serves no useful purpose. The next step must necessarily be a recommendation as to how improvement can be made. With this in mind, the next phase of our questionnaire dealt with specific questions concerning design of a new uniform and asked the person being questioned to state in his own words his general concept of what a tankers' uniform should look like. The detailed results of this questioning are shown in Appendix 2 and it is our purpose here to elaborate on the more salient recommendations advanced and to attempt to point out the majority opinion on the design of the uniform.

As a starting point in design, we felt that the basic consideration would be whether to make the suit a two-piece or a one-piece one. There were supporters of both schools of thought among those officers interviewed, but the preponderance of support was in favor of a two-piece uniform. Approximately 80 percent of the officers were in favor of a two-piece design, and 20 percent favored the one-piece design. Let us briefly look at the reasons advanced by the advocates of each type uniform since this appears to be the main basis of difference in opinion. On minor items of design such as pockets, collar, cuffs, and the like, there seems to be general agreement on both sides.

In almost every case where the one-piece uniform was proposed, reference was made to the one-piece flying suit used by the Air Force, and the desirability of using it as a basis of design. The principal reasons for this reference to the Air Force uniform were that it provided warmth, was not too bulky, contained adequate pocket space, and was easy to get in and out of, thus providing comfort, convenience and the characteristic of being functional. It was pointed out that this uniform should have a built-in lining of pile or similar material in order to eliminate the bulkiness caused by having a separate layer-type lining worn under it.

About 90 percent of the officers who recommended a one-piece suit thought it desirable to have a drop seat incorporated in it so that it would not be necessary to remove it to relieve oneself. The other ten percent felt that the drop seat would serve no purpose since men would wear another pair of trousers under the suit and, unless all clothing was provided with a similar design, the drop seat would not serve its purpose. This is a point well taken; however, in a later paragraph, it will be seen that the basic under-garment of coverall type recommended by most would contain this feature, thus providing a possible solution to the problem.

Essentially then the recommendations for the one-piece suit are that it should be functional, should not be as bulky as the existing uniform, should provide warmth if adequately lined with pile or some similar material, should provide ample

pocket space, and that it should be neat in appearance as well. As to specific design to fill these requirements, the concensus seems to be as follows:

1. Be similar to the Air Force flying suit with zippered front and zippered legs for easy entry and exit.

2. Have snug fitting cuffs on wrists and ankles.

3. Have a high knit collar.

4. Have ample pocket space -- pockets, however, to be zippered so as to prevent snagging on projections.

5. Be lined with a material such as the present pile liner; this liner is to be zipped in as part of the garment and not separate as the present liner to the M1943 field jacket.

6. Have a drop seat.

7. Possess no exterior loops or loose flaps.

Next let us examine some of the comments of those favoring the two-piece uniform. This is the larger group of the two, and it is conceivable that experience has contributed greatly to the large preponderance of support for this type uniform. Our reason for making this statement is the constantly recurring remark on the part of many who were interviewed to the effect that, "All we need is the old World War II tankers suit with a few modifications." Chief among the modifications mentioned were a darker color and a stronger outer material to resist rips, tears, and the deteriorating effect of grease and oils. It is very likely that association

with a satisfactory one-piece suit in the past might have caused more favorable comment in its behalf.

The basic requirements desired in this uniform as stated by those officers favoring it were essentially the same as those listed by the proponents of the one-piece uniform. To repeat: that the uniform be functional, have less bulk but still possess necessary warmth, have no loops or flaps that will catch on projections, provide ample pocket space, and be neat in appearance. When you note the similarity of thought as to basic requirements, it becomes apparent that the major difference of opinion between the two schools of thought appears to be either a matter of personal taste as to appearance or a preference fixed in the mind by having had the experience of wearing one or the other type of uniform.

There were, however, two other arguments advanced in behalf of the two-piece uniform which the authors feel bear great merit and are worthy of mentioning at this time. One is based on economy and the other on the difference in warmth required by the upper and lower portions of the body. In essence, the economy argument is based on the problem of salvage. It was felt that on many occasions only one part of the uniform (either upper or lower portion) would become worn to the extent that it was unserviceable. In the case of a one-piece uniform, this would necessitate salvage of the entire garment, whereas only one-half of a two-piece uniform would have to be salvaged under similar circumstances. This

certainly appears to be an argument in favor of economy, and is worthy of consideration since added expenditure is one of the points raised in opposition to the adoption of a distinctive uniform. The other point mentioned was that in many cases, and this will be particularly true of the driver, BOG, and tank commander, only the upper part of the body is exposed to the elements and would therefore require more protection than the lower portion. With a one-piece uniform, it would not be possible to provide for this difference in warmth requirements; whereas, with a two-piece uniform, the trouser portion could be removed and only the jacket worn. Here again, we have a point worthy of consideration on the basis of the uniform being made to fit the job.

As mentioned above, on most minor points of design, both those preferring the one-piece uniform and those preferring the two-piece uniform were generally in agreement. One of the points on which personnel were queried was what color this uniform should be. A breakdown by percentage as to particular colors desired appears in Appendix 2 but it was generally desired that the color be dark. Approximately one-third desired a dark green coloring, one-third an OD color, and almost one-third stated that they had no preference so long as the color was a dark one. There were a few who advocated a black uniform. Reasons in all cases were to the effect that the crewman must work continually with oils, greases, ammunition, and tools, and a light-colored uniform

such as the World War II tanker's suit showed this dirt much more quickly and obviously than would a dark-colored uniform.

There was almost universal accord (see figures in Appendix 2) that the uniform, whether it be one or two-piece, should fit snugly at the ankles and wrists and have a high, knit, zippered collar. Those desiring a two-piece uniform wished the jacket to be short so that there would be no skirt such as on the M1943 jacket, and to also fit snugly around the waist. The general design of the Armored Force combat suit in this respect was considered very satisfactory.

There was a small group who felt that there should be no pockets on this outer uniform. They felt pockets would tend to catch on projections in the tank and also that there is a tendency for the pocket to become a catchall for everything from ammunition to spare parts. The great majority felt, however, that there should be a great deal of pocket space and the concensus of opinion was that these pockets should zip closed, thereby eliminating the hazard of snagging. About 80 percent of the officers questioned were in this group. They felt that pockets should be located not only on the jacket, but that there should also be one or two large pockets on each leg similar to those on the Air Force flying suit.

Two other points of interest which were brought out were concerned with the desirability of continuing use of the present type layer system for warmth, and whether the uniform should be equipped with some distinctive type insignia.

In reference to the former, the great majority were opposed to the present type layer system of separate liners and outer garments such as the M1943 jacket or the parka. It was felt that this is one of the main causes of bulkiness in the uniform, and also that this type of clothing is uncomfortable in that it tends to twist on the body and "bind up" the wearer. About 80 percent desired a built-in lining of pile or wool OD material.

Distinctive insignia on the uniform was not given very favorable consideration by about 80 percent of those questioned. They felt that the uniform itself, worn with the regulation armor and unit insignia, would be distinctive enough and that adding more to it would serve no additional purpose.

Up to this point the questionnaire had dealt with a cold-weather uniform. The next requirement, and one on which there was not as much discussion, was for a warm-weather uniform which could also be worn under the winter uniform as a basic layer. About 70 percent of the officers desired a one-piece suit, similar to our present one-piece coverall, but with certain modifications. Chief among these modifications were a lighter, more porous material, zippered pockets on the chest and legs, adjustable cuffs, and a drop seat. In nearly all cases the recommendations for modification were similar and there was not as much dissatisfaction expressed with the present garment as there was in connection with the cold-weather uniform. Those officers desiring the two-piece

fatigue suit made recommendations as to improvement in design and material similar to those offered for the one-piece coverall. Their preference was again based on the economy angle as far as salvage is concerned and the fact that in extremely warm weather the top could be removed independently of the bottom.

We have now briefly discussed the major recommendations gleaned from a study and analysis of the questionnaires received by this committee, and it would be well to summarize the results and arrive at a uniform based on the majority opinion. This uniform would consist basically of two layers:

1. The one-piece coverall type uniform for warm weather, with the following characteristics:

a. Of a material lighter and cooler than the present HBT. As to what material in particular, comments were not specific but it was felt that this was a problem for textile engineers.

b. Ample pocket space on top and on the legs and these pockets would zip closed.

c. Adjustable cuffs.

d. A collar similar to the one on the present coveralls.

e. Equipped with a drop seat.

f. Neatly tailored and not be baggy.

2. A top layer, cold-weather uniform which would have the following characteristics:

a. Two-piece, jacket and suspender-type trousers. (General design of the World War II tanker's suit deemed suitable by about 60 percent.)

b. Snug cuffs and high, knit, zippered collar; cuffs to be elastic.

c. All fastenings to be zippered.

d. Ample pocket space on jacket and trousers. All pockets to be zippered.

e. Dark colored material such as dark green or OD.

f. Strong material to resist rips, tears and effects of grease and oil.

g. Contain a built-in lining.

h. Be easy to get in and out of by use of zippers.

i. No loops or flaps which will catch on projections.

j. Have a zippered drop seat.

k. Be as neatly tailored as possible giving first priority, however, to being functional.

The authors felt that, though about 20 percent of the officers questioned above had experience in Korea, it would be well to ascertain the results of other similar researches conducted among personnel serving in Korea. We were unable to locate any detailed questionnaires used by other agencies in such a study, but did locate several paragraphs summarizing the feeling on the suitability of present equipment for use by tank crewmen in combat. We feel it would be well to quote two of those paragraphs here.

The first was located as part of the operational research studies made by the armor section of I Corps in Korea and states:[2]

> Conclusions. The use of standard issue winter clothing by tank crews is impractical.
>
> Recommendations. The Armored Force combat suit of World War II is acknowledged by all to have been the most desirable clothing that the Army has ever issued. The new DA uniform board has adopted a new combat uniform very similar to this in principle. Tank crewmen require warm non-bulky clothing based on the layer system, free from protuberances and flaps that will catch on hatches, and with particular emphasis on keeping the legs warm.

The next quotation was taken from a report by an AFF observer team which was in Korea during the year 1951.[3]

> Tank crewmen emphasized that they need a satisfactory overall type uniform. During the past winter in Korea they were issued the parka with liner -- a very bulky and binding uniform for work within a tank. The headgear is also not satisfactory. A football type helmet with built-in headsets must be issued to tank crewmen.

Opinions on Headgear

Our interviews indicate that for the tank crewman the most important helmet characteristic is protection of the head. Most people were in agreement in regard to crash protection, but they were divided in regard to ballistic protection. We feel that the major consideration causing this divided opinion was increased weight rather than the relative need for ballistic protection. Had they the knowledge of the capabilities of modern plastics which give the protection of steel without its inherent weight, we feel that the figures on these two items would almost be identical.

Any item of equipment must be reasonably light and comfortable to the person that must carry or wear it. There are three items that contribute to comfort in the helmet, and each is a serious problem in itself that must be solved before a suitable tank helmet can be produced. They are weight, proper suspension, and firmness of adhesion. When you increase protection, you increase weight, and when you increase the comfort of the suspension, you often reduce the manner in which the helmet stays on the head during rapid position changes of the body. Most persons interviewed understood these problems and agreed that the only solution was to find that point where you get the most protection with the least weight, and the greatest amount of adhesion with the least sacrifice of comfort. Care must be taken to fit the front of the helmet close to the forehead so that sighting equipment may be fully utilized.

There are in every walk of life a few dissenters. Dissenters or no, they are entitled to their opinions, and their opinion should be considered. In our interview we find that of the number of people who were not in favor of a tank helmet (only 5 percent), 40 percent of this 5 percent favored retention of the M-1 steel helmet. These individuals evidently lacked the experience, had been misinformed, prejudiced to standardization, economy conscious or had some similar reason for declaring themselves on this idea. It is certainly reasonable to assume that they are not correct, and that the remaining 95 percent of those interviewed are right.

The other 60 percent of the dissenters favored a cloth cap of some kind. It is agreed that the cloth cap is about the most comfortable piece of headgear yet discovered, and it lends itself quite readily to earphones and optical instruments; however, most of the persons interviewed felt that these advantages should not be utilized to the complete sacrifice of protection of any kind. We feel that we could no more send the tanker into battle with his pitching vehicle without adequate head protection than we could ask the fireman, the construction worker, the football player, or the host of other groups who risk injury to their heads in their everyday work, to throw away their headgear for a more comfortable cloth counterpart.

The color of the helmet is of no great importance since it can be readily changed, and the concensus was in favor of some shade of olive-drab color.

Most interviewed personnel voted down the use of a chin strap, mainly because they felt that some risk was involved in snapping the neck in case of a severe blast. Some just didn't like having something under their chin, and felt that the helmet could be made tight enough to adhere to the head and prevent its falling off easily without chin strap. They were possibly not aware of the safety breakaway devices that can automatically release the helmet under pressure. We wonder if they were completely aware of the fact that a tight-fitting helmet keeps out all external sounds, and that it is sometimes advantageous to be able to hear the spoken voice or enemy fire, especially when directed toward the wearer of the helmet.

The wool liner is of no great consequence. If, in testing, it is found that one is desirable or necessary, it can be readily produced and issued.

The problem of communications equipment is quite serious, since, due to motor, track and firing noises, instructions cannot be transmitted in a tank by voice alone. Only by electrical transmission are we able to communicate in tanks. One of the great problems is the many items necessary to complete the receiving and transmitting circuits, and their phenominal suitability for becoming lost, strayed, or stolen, together with their delicate construction which lends itself to early destruction underfoot or in the moving parts of the turret. Most persons interviewed desire that this equipment be incorporated into the helmet in such a way that the communications hook-up procedure will be simplified, and the units will be kept together and protected by the helmet itself. The type of headsets or microphones appear to be immaterial so long as they can be incorporated into the helmet, function properly, and are comfortable.

The problem of sizes makes itself apparent in the interviews insofar as the personnel are equally divided between a universal size and several sizes. Proper fit is most important and there is considerable difference in the space between a large-size head and a small-size head and the sides of the helmet. Too much space may allow the entry of too much outside noise, too much blast from firing, and cause the helmet to be unsteady on the head. Too little space on the other hand may

cause all outside sound to be excluded, and the helmet to be snug to the point of being uncomfortable. We feel that a solution somewhere between these extremes is desirable.

The matter of what type of issue should be made of this helmet if developed is not really within the scope of this research; however, it is a problem that involves the helmet, and we will only mention it here. If issued with the tank, there is the matter of getting the right size and of possible abuse as it is passed from one crewman to the next in the event of transfer or discharge. Organizational issue seems a good system, especially in the matter of sizes; but, it is felt that if not strictly supervised the care of the item may become lax. Individual equipment has all the advantages mentioned except the individual becomes the owner, and it may find its way to units or places that may prove undesirable from the Army viewpoint. This system would, of course, necessitate issue in larger numbers than the previously discussed systems. Perhaps an individual issue that would obligate the wearer to turn in the helmet for a value as assessed according to its condition upon transer from an armored unit or discharge would be the answer.

NOTES FOR CHAPTER 4

[1] Captain C. C. Ross, Armor, Advanced Class, The Armored School.

[2] Operational Research Studies, Armor Section, I Corps (US) 1951, Pars 10, 22.

[3] Report, Army Field F orces Observer Team Nr 5, 5 January 1952 FECOM 1951.

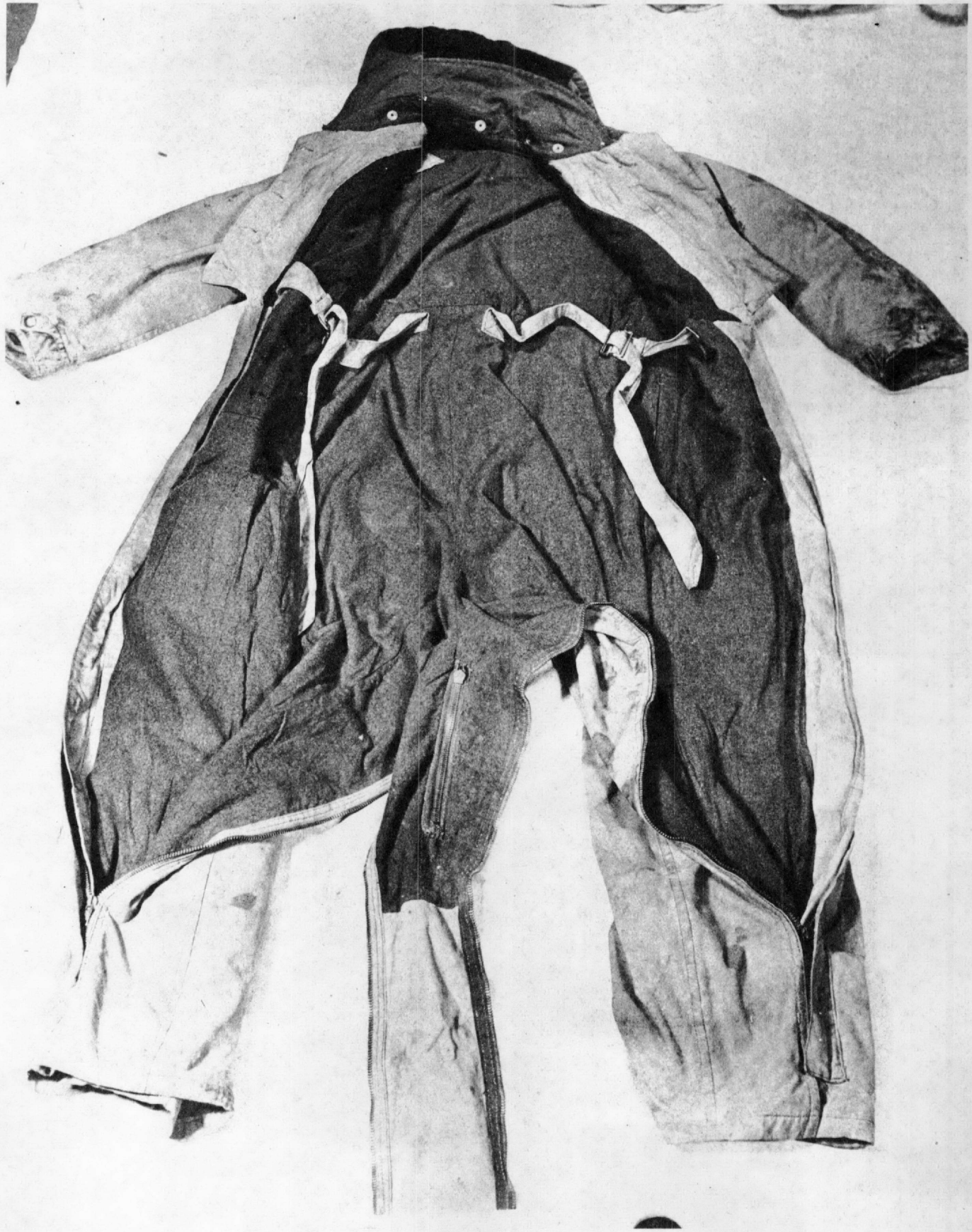
CHAPTER 5

FOREIGN UNIFORMS AND HELMETS FOR TANK CREWMEN

It is not the purpose of this chapter to deal in great detail with the uniforms of all foreign nations but rather to establish the fact that foreign armies have recognized the need for specialized uniforms for tank crewmen. The investigation disclosed that the distinctive uniforms appeared to result largely from functional requirements; however, the distinctiveness of the dress uniform was undoubtedly derived from an effort to foster pride in the armor branch. No concerted effort was made to investigate the dress uniform: suffice it to refer in passing to the black dress uniform with pink trim of the German Panzer Force and to the recently developed gold and green dress uniforms worn by Russian air and tank officers.[1] Sources of information on all foreign uniforms and related equipment were scarce. A few intelligence reports were revealing but most information was derived by studying photographs and interrogating foreign student officers at The Armored School.

Foreign Uniform Design

The basis for a good many of the existing foreign tank uniforms currently in use is the British Tank Suit. See illustrations 24 through 26. This is a one-piece suit, utilizing



both snaps and zippers for fastening. Two zippers, each beginning at the bottom of the trouser legs, are installed up the full length of the front to the collar. As an additional, novel, and practical use, this suit may be made into a sleeping bag by closing the zipper fastener of the right leg to that of the left leg. The suit has a built-in OD wool lining and a detachable hood. Pocket space on this uniform is ample and the pockets are fastened by means of snaps. A pocket with slots for pencils is provided over the left breast. Note, also, the belt installed inside the suit to allow adjustment of the waist. The uniform is light tan in color, similar in this respect to the United States Armored Force Combat Suit. Recently, some objection has been raised on the need and expense of this garment and, as a result, "The Working Party on Standardization with the USA and Canada on Clothing and General Stores" undertook an investigation. It would be interesting at this time to present some excerpts from a recent meeting of this committee, since the ideas therein are very significant to this subject. These remarks show a realization on the part of the British that there is a need for further research and development in this field, and they contain the military characteristics felt desirable by the board. The 63rd meeting of this committee took place in London on 22 November 1950. In regard to the project entitled, "Tank Suit," the chairman read the following:[2]

...a. Action by the ministry of supply on this project had been suspended until the reports on the troop trials with the new range of combat clothing had been studied, as it was hoped that these reports would show that the combat suit would be suitable for tank crews in place of the oversuit and battledress, thus making redundant an expensive garment which has only a limited specialist use.

b. Reports of the troop trials with the combat suit indicated that this garment was not acceptable as a replacement for the tank suit, and that a requirement for an improved tank suit persisted in all RAC units...

This is inserted to point out that field testing is the basis on which this committee is making their recommendations.

During the 63rd meeting, based on the finding that there was a requirement for an improved tank suit, this committee formulated a directive for further development which stated the military characteristics to be sought:

Title: Tank Suit 1

Purpose:

a. To improve the present pattern tank suit.

b. To produce a tank suit embodying all the advantages of the present garment without the disadvantages.

Military Characteristics:

1. Functional requirements,

a. The wrist fitting should be broadened or redesigned to prevent chafing.

b. A stronger and more durable material should be used, providing it neither increases the stiffness and weight of the garment, nor detracts from any of the other required properties.

c. The material must be pre-shrunk.

d. The slide fastener must be stronger.

e. The garment must be fitted with a means of closing the bottoms of the legs at the ankles.

f. A larger tag should be fitted to the slide fastener to facilitate opening and closing.

g. Malleable wire should be inserted in the front edge of the hood, as in the parka, to prevent hood from blowing off.

h. Hood should be permanently attached to the garment.

2. Proofing.

a. Garment should have wind and rain resisting qualities equal to the material of the combat suit. In any case, extra protection against water is required across the shoulders, at the seat, and at the lap, where a puddle tends to form.

b. Must be rot-proof and mildew-proof.

c. Proofing must not deteriorate after cleaning.

3. Effects on human body.

Must contain no element which would cause dermatitis or serious complications to wounds. Materials coming in contact with the body must not cause any physical irritation.

4. Other desired military characteristics.

a. The weight and stiffness of the material should be reduced to increase mobility.

b. If possible the material should be more oil-resistant and also fire-resistant than the existing garment.

These recommendations are presented herein since it is felt that they contain many sound ideas, but chiefly because they show that others feel the need for action in this field despite the fact that additional expenditure would be involved. Officers of countries using this British Tank Suit, namely England, the Netherlands, and Belgium, were asked for their recommendations in the development of a new uniform for tanker's use. They felt that the uniform should be a one-piece, coverall type, and should be of a waterproof material. The bulkiness of the existing uniform could be reduced in their poinion, but this should not be done at the expense of warmth. Research should go further in the field of textiles and produce a material which would at the same time be light, durable, and warm. Their ideas were similar to those of the American officers in regard to reduction of

bulk, and also as to elimination of flaps and loops which would snag on protuberances within a tank. Zipper fastenings, they felt, would be best to use on this uniform in order to prevent this snagging, and also for ease in putting on and taking off the uniform.

The winter uniform of the Russian Armored Force is not so distinctive as the British Tank Suit as far as can be ascertained from intelligence reports. One Russian translation dated 19 September 1947[3] states:

> For winter wear the Armored Force is issued a short fur coat painted black, and a pair of trousers quilted with cotton has proved to be very satisfactory. Leather costumes for tank crews are invaluable in autumn and spring, but are useless in winter and in the hot time of the year.

The leather uniform, probably due in most part to its durability, is not only popular with Russian tankers (illustration 27) but also as a jacket with the Italian and French tank crewmen (illustration 28). When treated properly, leather also can be made to resist oils and greases in addition to its other widely known properties.

In regard to the summer and fatigue uniform worn by Russian tank crewmen (illustrations 29 through 32) the following description is quoted:[4]

> Armored troops have been observed wearing both black and olive-drab whip cord coveralls. The black coverall, which may fade into purple or violet color, is closed by means of six concealed buttons, has a small turned-down collar, and is closed at the neck by means of a wire hook and eye. It has one pocket on the left breast with a

USSR

UNIFORMS AND HELMETS WORN BY FRENCH TANK CREWMEN.

Note leather jackets, helmet chin straps, and cutaway in helmet to receive earphones.

(6)

buttoned-down flap, a large pocket on the right thigh which has a small buttoned flap which covers only about one-half of the width of the pocket, has adjustable straps with two buttons each on the sleeve cuffs and ankle portion of the trousers, reinforced elbows and knees, and a drop seat which is closed by means of a cloth belt and buckle, both of which are an integral part of the coverall. The olive-drab coverall has two breast pockets with buttoned-down flaps, reinforced knees, and has adjustable straps and buttons at the cuffs, adjustable straps with a metal buckle at the bottom of the legs, a cloth belt with a wire buckle, buttoned side pockets -- one on either side -- and a small turned-down collar. It is closed by means of seven concealed buttons in front. The olive-drab coverall has tabs for attaching the shoulder boards (officers).

The black coverall presents only one outstanding feature with which to be concerned -- the drop seat. This feature is exactly alike that proposed by the Robinett Board in 1945. (See chapter 3.)

Little or no information was available in regard to the uniforms worn by the armored forces of other nations. Indications point to the fact that the armor branches of other armies are dependent upon the major power which supplies their armament for the type of uniform to be worn by armored personnel -- United States, Great Britain, France, or USSR.

Foreign Helmet Design

As in the case of the uniform, the design of the tank helmet in use by foreign armies is also dictated to a large extent by that adopted in the country supplying the armament. With the exception of the United States, however, the dark colored beret is the international symbol of armored

personnel when not actually within their armored vehicles. The source of information in this matter was largely through interrogation of foreign officers and interpretation of photographs. The information received was neither official, complete nor comprehensive. It did, however, give some idea of what is being used by at least some armored forces, what the present trend of procurement is pointed toward, and what the officer personally considers adequate for armor needs. Comments from many of the officers were of very little value since many had used only American tanks and the football type helmet that was evidently part of the on-vehicle materiel. See illustration 33 for view of French tank crew wearing United States crash helmet. Many countries had little or no armored history prior to World War II; this was particularly true of the South American countries. The comments of these officers have been summarized below by country with only emphasis being placed on countries that produce their own tanks.

England. The infantry steel helmet was used by armored vehicle crewmen, but it was uncomfortable in the tank, fell off easily, and interfered with the use of the optical instruments. Men inside the tank soon discarded them, but they continued to be worn occasionally by the tank commander who was in a somewhat exposed position. The steel helmet for the crew was kept in the turret or hung on the outside of the tank for use if dismounted action became necessary. The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headgear most universally used was the Beret, which was comfortable, well adapted to the various duties of a tank crewman, and was a mark of distinction for the armored soldier. The major deficiency in this headpiece was its complete lack of crash and ballistic protection features. The officer interviewed stated that he felt a helmet designed for the needs of the tank crewman was definitely a necessity. He was in favor of a football type of metal or plastic helmet that would offer crash and ballistic protection without a great deal of weight. It should be comfortable, not interfere with the use of optical instruments or aiming devices, and not fall off the individual's head easily.

France. Before World War II a steel helmet especially padded and adapted for tank crewmen was used extensively and is currently in limited use (see illustration 28). During World War II the French Army was equipped with American tanks and used the football-type helmet issued with the tanks. A new helmet is being produced at this time. It is reportedly an aluminum shell with a sponge rubber liner that will offer the same ballistic protection as the M-1 steel helmet that is used by United States forces. This piece of equipment is expected to be light, comfortable, and adapted to receive communication equipment (see illustration 34 for artist's concept of proposed helmet). Ground units of the French Army use the American steel helmet, but this is absolutely

FRANCE 1951

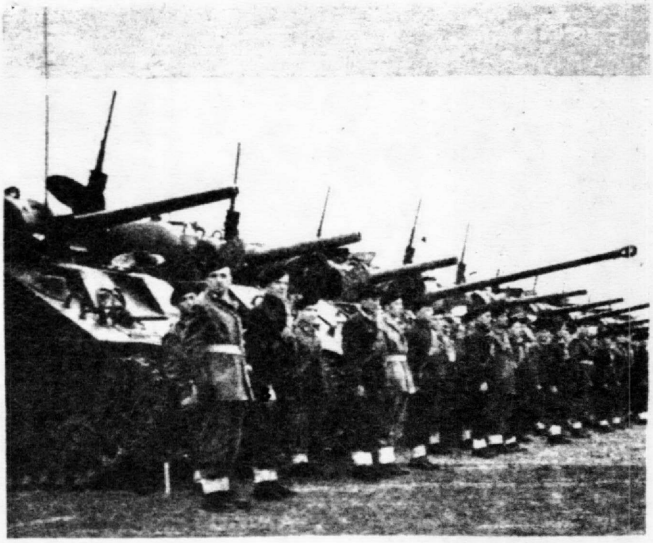
impracticable for tankers since it is heavy, uncomfortable, and it shifts or falls off whenever the body position is rapidly changed. It has proven completely unsatisfactory for use with headsets. The officer interrogated feels that the tank is a special weapon with special problems, and that a special helmet to assist the operating personnel to more efficiently perform their mission is certainly worth the time, money, and effort that may be spent in its development.

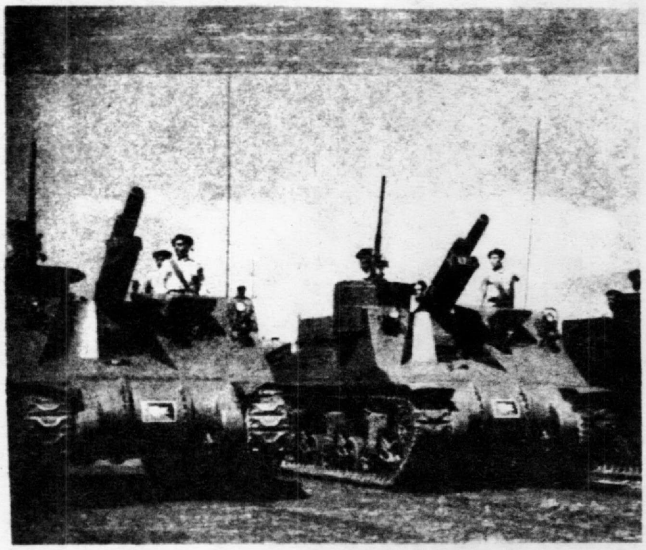
Canada. Before World War II the Canadian armored units used a rugby or football-type crash helmet. During World War II they developed a steel helmet with a rubber shock liner. This was not generally accepted by the tank crewmen because it was heavy and somewhat uncomfortable. After the war it was decided that for tank crewmen the beret was sufficient head covering and it was issued to be worn not only while operating tanks but for general duty wear as well. This officer felt that the beret was sufficient headgear for the tank crewman, except when it was necessary to dismount, and then a steel helmet which could be stored in the turret or hung outside the tank could be worn.

Belgium. This country issued a modified infantry steel helmet to its tank crewmen. The visor of the steel helmet was removed and a heavy leather pad was substituted therefore to assist in sighting through the aiming devices. Since Belgium did not participate to a great extent during

World War II, no further development was made. This helmet was discarded because it was heavy, uncomfortable, was not adaptable to communication equipment, and did not stay firmly on the wearer's head. The beret service cap with earphones is at present the only headgear used by Belgian tank crewmen. It was felt that, although the beret was quite comfortable, it offered absolutely no protection of any kind. It should be replaced with a comfortable, light-weight, well-ventilated tank helmet which features a built-in microphone and headset. Such a helmet, although not presently available, must be developed at all costs.

Other countries. Representatives from Greece, Spain, Denmark, Pakistan, and Iran stated that they had very little armored equipment, and lacked background in the field of tank helmets. Each was familiar only with the headgear that was issued with the tank which narrowed the selections down to the beret for those countries that obtained their armored equipment from Great Britain and the football helmet for those who received their equipment from the United States with a beret for dismounted duties. See illustrations 35 and 36 for Italian, Greek, and Turkish troops wearing the beret. The one exception to this was Spain, a country that had occasion to use some German armored equipment. The helmet issued with these vehicles was constructed mostly of leather, and resembled somewhat the United States football-type helmet.





TANKERS OF ITALY'S ARIETE ARMORED BRIGADE STANDBY FOR INSPECTION

Beret is used for tank helmet.

A GREEK TANK CREW RELAXES BESIDE THEIR TANK.

The beret is used extensively by armored units throughout Europe.

A TURKISH TANK CREW WITH THEIR AMERICAN M-24, FURNISHED THROUGH AID MISSION.

All of these officers expressed a desire for a one-piece tank helmet with built-in communication equipment to provide a unit that could be easily put on, plugged in, and permit the crewmen to be instantly ready for the business at hand.

USSR. The unique Russian-type helmet is becoming quite common among the Satellite countries and others that use Russian armored equipment. An intelligence report of 1943[3] states:

> ...The tanker's helmet is not rigid at all. Three heavy padded cloth strips run front and back over the top of the head. A large padded buffer runs the length of the forehead. There is a flap which may either be pulled down the neck or snapped up out of the way. Cloth or leather -- ...

For the cloth helmet, see illustration 37 while the leather helmet appears in illustration 27. The padded cloth rolls are obviously provided for the purpose of shock protection. The helmet does not offer ballistic protection nor protection against sharp objects that may strike the head between the rolls. The earphones appear to be in pockets on the ear flaps which facilitates installation. The chin strap reportedly includes the throat microphone.

There would be no purpose in studying the various foreign helmets presented herewith without deriving some ideas. Consequently, a summation of the outstanding features of the helmets discussed and of the opinions expressed by various foreign officers appear below:

RUSSIAN TYPE TANK HELMET WORN BY YUGOSLAV TANK CREWMEN.

Note shock pads in construction of helmet and pockets to receive earphones. Helmets apparently afford comfort and warmth but not ballistic protection.

[redacted]

1. A beret is a practical, distinctive headgear and is internationally recognized symbol of armored personnel.

2. A tank helmet is needed.

3. It should be light in weight and comfortable.

4. It should offer both ballistic and crash protection.

5. It should incorporate the helmet and the communication equipment into one unit.

6. It should fit snugly, be of the football type, and should not interfere with the use of optical instruments.

NOTES FOR CHAPTER 5

[1] WDGS Intelligence Report Nr R-62-49, subject: "Parade in Moscow," dated 1 May 1949. Confidential.

[2] Working Party on Standardization with USA and Canada (Clothing and General Stores), November 1950, AFF Board Nr 2, file F 421.1.

[3] "Extracts Regarding Tank Uniform -- USSR," inclosure 1 to letter, Department of the Army, subject: "Answer to Request for Information," file AICBB-E, 15 February 1952. Secret.

[4] Draft of QM Contribution to Armed Forces Handbook -- East Germany, IS 140.

CHAPTER 6

APPLICATION OF MOTION STUDY AND JOB ANALYSIS TO UNIFORM DESIGN

Having traced the development of the uniform to its present form in current issue and having established, to a certain degree, the fact that this current uniform is unsatisfactory, we feel it logical here to initiate a motion study of crewmen in performance of their duties and give due consideration to the influence of vehicle design. The man-machine team is an important phase of the human engineering field and the place of clothing design in this field becomes obvious with a consideration of the principles involved. Among these are:

1. Seating and posture are related to efficiency of work.

2. The machine and associated clothing and equipment should be designed with the man in mind.

3. Movement of the man in order to do his job should be reduced to a minimum to prevent fatigue. Movement should be necessary, natural, and unrestricted.

4. In general, the more difficult the mechanical work, the more important become the details of the associated clothing and equipment in facilitating the work to be done.

It is known that the human organism uses far less energy in mechanical work than it generates for that work. One study has shown that a normal man running at maximum speed generates about 13 horsepower, of which he applies 2.94 horsepower to useful work; the rest is wasted. This is a mechanical efficiency

of 22.6 percent, far less than some machines.[1] Since work is done in generating heat, the implications of this to clothing are obvious. Inefficient clothing, whether it be because of snagging, bulkiness, weight, generating too much heat, or too little, or affording too little protection, reduces even more the man-machine efficiency. In short, the type of clothing needed for a given task should be a function of that task. The determination of whether or not the tanker deserves specialized clothing and headgear can be justified on the basis that he must perform numerous tasks radically dissimilar to any tasks performed in the infantry, artillery, or any other branch of the service.

Motion Study and Job Analysis as it Affects the Uniform

Probably the best way to study these tasks is by a motion analysis of the individual members of a vehicle crew at crew drill. Since crew drill is designed to standardize the actions of crew members in mounting, operating, and dismounting from their vehicle by the most direct and efficient means, it covers all motions necessary for the performance of duties within the combat vehicle. Since also in a drill the motions are repeated over and over, it gives the crewman or observer a better chance to detect features in clothing and vehicle design that interfere with the smooth and efficient performance of duties.

For these reasons, it is advisable to study at least one member of the crew from the time he steps upon the vehicle until he steps back to the ground. Since most of the motions observed

were common to all members of the crew, we elected to consider the gunner who probably goes through the greatest variety of motions. Where motions of the other four members of the crew are different from those of the gunner, comments will be made to that effect. The M4 tank was used for this study, but observation will apply generally to any of our standard tanks with, of course, certain allowances for minor variation in design.

To Mount Medium Tank Crew

Gunner's Movements	Comments
1. Mount fender	1. In this position the arms are stretched upward and extended, tending to cause clothing to pull up at the waist and boot tops. In some cases, the shirttail came out (two-piece) and trouser legs came out of boots. Only extreme flexibility of clothing at arm pits and knees prevented this from happening.
2. Enter turret.	2. Here the body was fully extended in lowering itself into the turret. Again the shirttail tended to come out as did the trouser legs. The belt almost invariably hung on the turret ring. The skirt of the field jacket when worn also tended to catch on the turret ring.
3. Taking post.	3. As in 2, the belt was cumbersome and the skirt of the field jacket tended to hang on the gunner's back rest.
4. Connect breakaway plugs.	4. Twisting to get plug-sleeves snagged and belt hung on back rest.

To Close and Open Hatches
Crew Being Mounted

To Close Hatches

Gunner's Movements	Comments
5. Release turret traversing lock and insure that the turret on the cannon does not block hatches.	5. Gunner (sitting) stretches upward with one or both hands--clothing stretched at armpits. Clothing without proper looseness at armpits pulled shirttail from trousers if two-piece suit.

To Open Hatches

Gunner's Movements	Comments
6. Same as 5.	6. Same as 5.

To Dismount Medium Tank Crew

Gunner's Movements	Comments
7. Disconnect breakaway plugs.	7. None.
8. Emerge from turret.	8. Here the gunner backs up over his back rest, reaches up, grasps the sides of the hatch and pulls himself up through the hatch. While lifting himself through the hatch with hands and arms, the body from shoulders down hangs loosely. Freedom of movement of arms and shoulders required. Armpits must be flexible. Two-piece clothing tends to separate at the waist and the trousers come out of boot tops where there is insufficient slack in legs of trousers. Belt and shoulder loops snagged on projections.
9. Move to right fender.	9. None.
10. Take dismounted post.	10. None.

To Dismount Through Escape Hatch

Gunner's Movements	Comments
11. Disconnect breakaway plugs.	11. None.
12. Traverse turret to give access to forward compartment.	12. Cuffs which did not fit snugly at wrists would get caught while turning the handwheel.
13. Move to left side of turret.	13. In this operation it is necessary to crawl underneath the gun and recoil guard or go around the end of it. Either way there is barely enough room to squeeze through. Loose loops, exposed buttons, flaring pockets, belt buckles, pistol holster or canteen present real difficulty due to hanging on projections or gouging the crewman.
14. Enter bow gunner's compartment and dismount.	14. Space between fighting compartment and bow gunner's compartment very restricted. Chances for hanging clothing or equipment very good. Requires crawling, twisting, and pulling. Once in the BCGs compartment must leave through the escape hatch. Jacket skirts and web belts hang easily here.
15. Crawl out and take dismounted post.	15. None.

We do not believe it necessary to cover in detail the performance of the driver, BCG, tank commander, and loader. The first three were not required to make any types of motion peculiar to the gunner. The latter, however, the loader, might be mentioned here. Due to the manner in which tank ammunition is stowed, the loader must work stooped over or on his knees.

Actually, he must use both positions alternately. This requires that he be given the maximum freedom of movement of shoulders, arms, and torso. There must be no binding at armpits or waist, for this position is a cramped one under best conditions. It was very difficult in the case of two-piece suits to keep the shirttail in and a belt hindered twisting motions. The knees, although pads were worn, tended to wear faster than other parts of the uniform, and therefore suggested reinforcement of the uniform at that point.

Loose cuffs, loops, and straps not only impeded the loader in the performance of his duties, but were an actual hazard. There was always the possibility of getting a loose cuff caught in the breechblock, or a part of his clothing caught on the recoiling gun which might result in serious or even permanent disability.

It would be very hard, indeed, to say how many times the crew members go through all the motions outlined above over any prescribed length of time, because it would depend on the crew's mission during that period.

It is realized, of course, that we have followed the tank crewman through only a limited portion of his duties with respect to the vehicle itself. However, those duties covered are typical of normal operation and do serve to indicate some of the problems inherent to operation within an armored vehicle.

Crewmen are also responsible for the cleanliness and first echelon maintenance of their vehicle and its weapons and equipment. There is maintenance of the radios, engines, tracks (to include changing thereof), and guns, to mention a few. These duties require skills ranging from that of the highest type muscular and body coordination to a very strenuous type of manual labor. It is, therefore, a necessity (not a luxury) that these soldiers be provided with clothing that will allow them freedom from unnecessary incumberances and provide the maximum degree of safety.

As a matter of information and interest, let us consider for the moment some observations made during the recent maneuver "Snowfall" at Camp Drum, New York. The following conclusions were derived by Dr Walker of the Army Medical Research Laboratory, Fort Knox, Kentucky, through personal observations and interviews with members of units participating:

1. They found it very difficult to get in and out of tanks with the new clothing due to its great bulk.

2. The outer layers of clothing were not needed inside the tank because of the heaters in the vehicles, but there was no place to store outer garments in the tank.

3. Skirts of parkas invariably snagged on turret hatches when entering the tanks.

4. The present practice of stuffing trousers in boot tops caused painful rubbing of the legs and poor circulation in the feet. Jodphur type trousers were suggested.

The foregoing discussion and study has brought out the following points:

1. Uniform must allow maximum use of arms without binding.

2. Uniform should not bind at the waist.

3. Articles worn around the waist are hindrances to entering and leaving the vehicle.

4. There must be sufficient slack in the trouser legs to prevent trouser bottoms from pulling out of boot tops when knees are bent.

5. Cuffs should fit snuggly.

6. The uniform should be reinforced at points where wear is heaviest -- seat, elbows, and knees.

7. Buckles, uncovered buttons, loose loops and straps should be eliminated.

8. Uniform should not be bulky.

9. Coats or jackets should not have skirts on them.

10. Tucking trousers in boots is a poor practice.

Review of Studies by Medical Research Laboratory

Several points of interest in this work were brought to light by a study of reports on studies made by the Armored

Medical Research Board during 1943-44. Discussion of the more applicable information is included below:

1. Armored Medical Research Board Report, Project Nrs 1-1, 1-4, 1-5, 1-6, 18 January 1943, "Adequacy of Armored Force Winter Clothing." The uniform was tested between +10° F. and -30° F. It was determined that the uniform would keep resting men warm for one hour at an average temperature of +5° F. Ventilation was inadequate, especially on the lower part of the body. The knees were poorly protected because the clothing was too tight in fit. The greatest limiting factor was protection of hands and feet.

2. Project Nr 14, "Methods of Protection Against Flash Burns," 13 November 1943. It was found here that the majority of burns suffered by tank crews (90 percent) are from burning propellants set fire by hot fragments of shell or armor which tear shell cases. The period of escape is brief -- from 3 to 5 seconds. It was found that for this period (3 to 5 seconds) the clothing worn was in most cases adequate except for exposed parts -- hands, face, and neck. A cream was recommended for use on exposed parts. The difficulty after the initial flash was that sometimes the clothing was ignited and continued to burn after the crew dismounted from the tank. Discussion was made of the use of water insoluble salts either impregnated into or precipitated on

the fabric. It was found, however, that these treated fabrics would either fail to stand up under laundering or restrict normal ventilation required by the body.

3. Project Nr 27 "Test of Compounds, Fire Resisting, for Field Treatment of Clothing (OQMG-253)," 13 March 1944. Two compounds were tested in this case, "Flame-Out" (Treasdale) and "Fire Retardent-CM" (Dupont). The first compound stopped burning after a small hole was burned into the herringbone twill. The Dupont compound was recommended, however, since it stopped burning as soon as the source of heat was removed from the material. In other words, once the crew had dismounted from the burning tank or vehicle the fire went out. This compound furnished protection against the flash burns, and at the same time prevented burning after evacuation from the vehicle. It was capable of withstanding repeated laundering and made no particular difference in other characteristics of the uniform. It was recommended for use in impregnating all clothing worn by tank crews and personnel handling gasoline or other inflammables.

Motion Study and Job Analysis as it Affects the Helmet

Although no studies of helmets by the Medical Research Laboratory were available for review, the helmet certainly must be considered in a motion study of this type.

Unlike the uniform, the helmet plays its major role during periods in which the vehicle is moving. During this period the helmet should provide the crewman with crash protection to accommodate for sudden halts, violent rolls of the vehicle, or any other shock loads which may be transmitted from the vehicle to the crew members. During operation of the vehicle over bumpy roads with hatches closed, the crew member's head is subjected to severe jolts on the hatch just above it. There are any number of sharply edged and pointed metal fixtures in the vicinity of each crewman's position that would cause serious head wounds in the event they were struck by the unprotected head. Further investigation reveals that the position of these metal fixtures does not limit the part of the head subject to being struck. Hence, maximum coverage of the head is a requirement.

In mounting of, dismounting from, and moving in the vehicle, the same metal fixtures present a similar hazard. Moreover, during these motions, there is a normal tendency for the helmet to slip off of the head. This dictates the requirement for a means of securing the helmet on the wearer, either by chin strap or snug fit.

While operating within the vehicle, the crew must frequently use the periscopes provided for observation. In addition to the periscopes, the gunner and tank commander

must use optical sighting equipment. These duties require that the helmet be cut away high enough on the forehead to allow use of these instruments. Unless the individual can get his head close to the eyepiece of the instrument he is using and in the same relative position each time, there will be a resultant inability to line up the target and to adjust his fire accurately due to the parallax created. The helmet must also be readily adapted to the brow pad provided above the optical sights; however, some consideration to minor alterations of the brow pad to accommodate the helmet. These observations point up the need for a fit close to the forehead and, under optimum conditions, against the forehead.

Most of these requirements based on motion study to this point are definitely essential characteristics. Some concern must be expressed here for the overall weight of this helmet and features of general comfort since it has already been determined that these factors influence the human efficiency. Those who have worn the steel helmet, M1, complete, (3.3 pounds) know that its weight is in excess of optimum, whereas the liner alone (0.5 pound) is less than the weight which can be utilized without impairing movement of the head. So we see that an optimum weight occurs between 0.5 and 3.3 pounds, or approximately 1.5 to 2.0 pounds. Tests of various helmets by AFF Board Nr 2 indicate the desirability of three point suspension to provide maximum comfort.

Lastly, but not least, we must consider this helmet in the light of the radio equipment to be used with it. Earphones must be worn with the helmet; this is an absolute requirement, whether or not the earphones are integral to the helmet. Here again, the matter of comfort and functional requirement must be compromised. A pressure sufficient to allow operation of the earphones must be exerted and yet not so great as to cause undue discomfort for the ears. In the job analysis we must also consider the means whereby the crewman, without removing the helmet from his head, is able to listen to the spoken voice and, hence, the means whereby the crewman may readily remove one earphone from contact with the ear. This may be accomplished either by moving the earphone alone or the earphone and the attached ear piece of the helmet. It is believed the latter method would be the more feasible.

Due to the extent of duties required of the vehicle crewman outside of his vehicle in all types of situations and of the vulnerability of the head, ballistic protection must be incorporated in the helmet. This protection may be secured without sacrifice of any previously discussed characteristic. This is possible now with the recent development of a numerously nylon material. This material was tested as it occurs in the EX 51-1 helmet for ballistic limit; tests disclosed a

ballistic limit of 1165 feet per second, or nearly 10 percent more effective than the M1 steel helmet.[2]

NOTES FOR CHAPTER 6

[1] W. O. Fenn, "Mechanical Energy in Sprint Running as Measured by Moving Pictures," Amer J. Physiol, 1929, 90, p583.

CHAPTER 7

SPECIFIC MILITARY CHARACTERISTICS AND RECOMMENDED UNIFORM

Warm Weather Combat Suit and Fatigue Uniform

1. Military purpose: To provide adequate protection for the crews of combat vehicles while performing normal duties under warm weather conditions.

2. General design features:

a. Shall be a one-piece coverall type garment.

b. Shall be of a light-weight, durable, porous material providing adequate ventilation to the body.

c. The exterior shall be free from any loops, flaps, patch-type pockets, or any other design features which might catch or bind on projections within or upon an armored vehicle.

d. Shall be designed to minimize any other interference to entering, leaving, and fighting in combat vehicles.

e. Shall be tailored to provide a snug fit at ankles, wrists, and waist.

f. Shall have a shirt-type collar designed to be worn either open or closed.

g. Shall be provided with a heavy-duty zipper-type front closure from neck to crotch.

h. Shall be capable of being washed (and starched) without impairing other military characteristics.

i. Shall provide five pockets, two on the chest, one on the right thigh, one on the left leg below the knee, and one on the right hip. All pockets shall be of a slash type and be provided with a zipper closure.

j. Shall include small pocket on upper left sleeve for carrying pencils.

k. Shall provide a flap-type drop seat.

l. Shall be a dark green color, similar to M1943 field jacket.

m. Shall be reinforced at elbows, knees, and seat.

n. Shall be provided in three sizes -- small, medium, and large.

3. Climatic conditions: Shall furnish adequate protection at temperatures above 60° F.

4. Proofing: Shall be shrink proof, water repellent, and fireproof, and provide flash protection, consistent with other military characteristics.

5. Discussion. It is felt that a uniform designed to fit these military characteristics will provide the armored vehicle crewman with a garment superior to any now issued and one which will be at the same time practical and comfortable. It is to be noted that in recommending this uniform no specification has been made as to exactly what material is to be used; this omission has been intentional. We feel that the study of textiles is beyond the scope of this report and that

this phase of development should be handled by textile engineers. Our purpose is to present the qualities desired of the material and to require that they be fulfilled as nearly as possible in the finished product.

As noted throughout this report a common recommendation of all sources and agencies examined has been the removal of as many exterior loops and flaps from the uniform as possible. It is felt that this is an important consideration from the standpoint of safety of the crewman as well as his ability to efficiently perform his duties and for these reasons have included this recommendation in our military characteristics.

With reference to the desire for a snug fit at ankles, wrist, and waist a little elaboration will bring out more clearly what we desire. By this is not meant a knit, elastic cuff, but rather a tapered sleeve similar to those on a conventional type shirt. It is desirous to eliminate a wide, flapping cuff which tends to get in a man's way and to catch and shag on projections. Trouser legs should be similarly tapered since we do not visualize wearing this uniform without boots.

In place of the present system of buttons as a method of fastening the uniform, a zipper type closure running from the neck to the crotch is recommended. This is done primarily to eliminate another source of snagging on projections as well as to provide ease of entry and exit to this garment. We also

feel that this system will add to the neatness of the garment and provide easier collar adjustment.

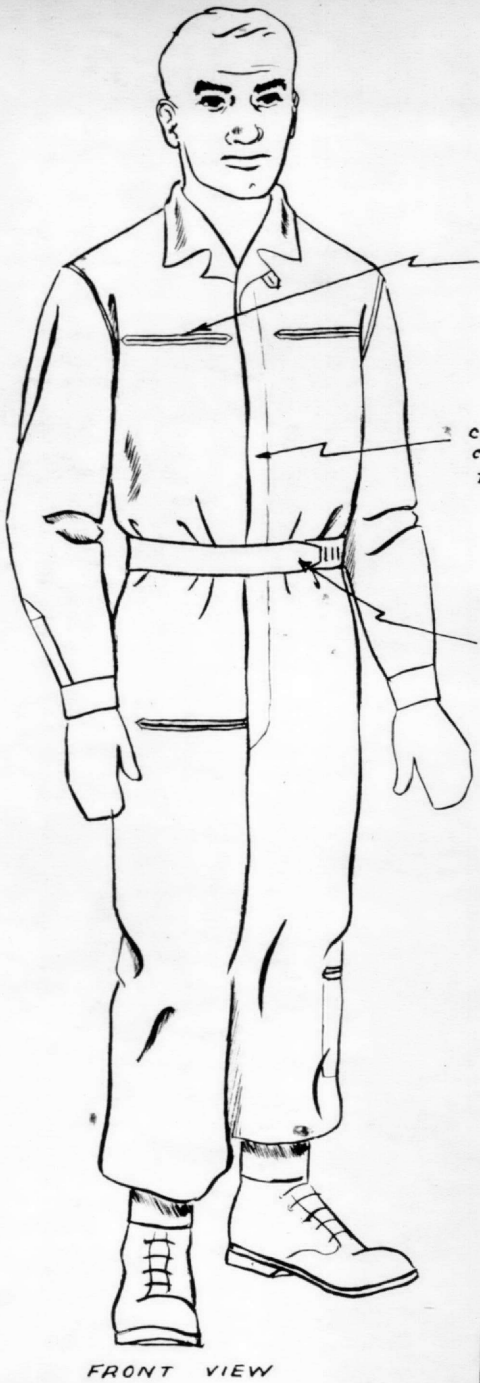
The question of pockets has been the subject of wide discussion not only on this garment but on all others considered in our research. Patch-type pockets with their accompanying flaps have been a particular target of those desiring to eliminate characteristics which catch and snag on the projections of armored vehicles. At the same time, the almost unanimous opinion has been that pocket space in itself is a definite requirement for a combat uniform. For these reasons it is felt that the recommended pattern will provide the required pocket space and at the same time will afford no feature which will snag. The best solution is a slash-type pocket which will have, in addition, the capability of being closed and thus prevent items from falling from the pocket. In accordance with the majority opinion on this subject the zipper provides the best method of closure. The chest pockets and hip pocket are in a conventional location, but, some explanation is required on the location of the pockets on the legs of the uniform. Crew members will spend a great deal of their time seated in rather cramped quarters and for this reason we have located one pocket below the knee so that it will be readily accessible when in this position. Some may contend that this is a feature bordering on luxury rather than necessity, but the need is great enough and the design modification minor enough to

warrant it. The small pockets, or actually slits, on the left sleeve will be similar to those on the Air Force flying jacket and will provide for convenience in carrying pencils.

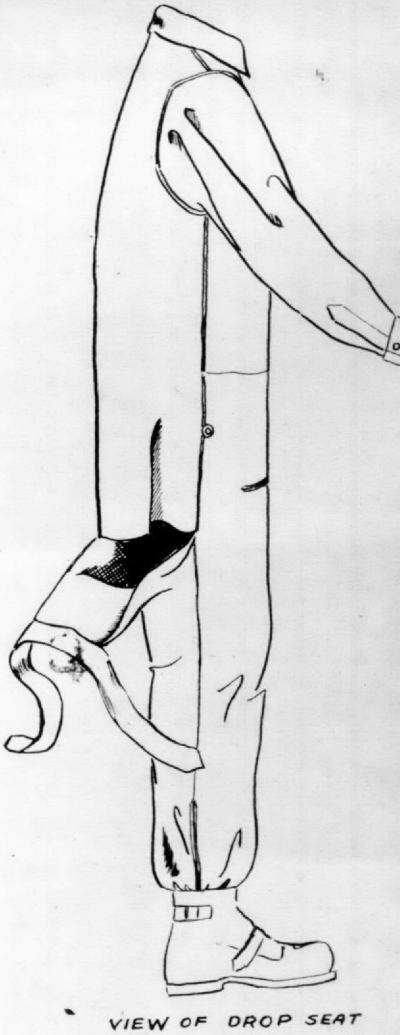
The feature of the drop seat is one which has been proposed in the past and one which is practical and will not affect the appearance of the uniform if adopted as we propose. Since this uniform will be the basic layer of clothing and nothing except underwear will be worn under it, this feature becomes more important. Without it the man must strip to his underwear to relieve himself, which is an inconvenience as well as, at times, a physical hazard, particularly in tropic climates.

In the recommendations as to color of uniforms, a dark color of some sort is essential. The present shade of the field jacket, M1943, appears to be very satisfactory and meets with the approval of most people interested in or questioned on this subject, and for that reason, all field uniforms for armored vehicle crewmen should be standardized in this color. This standardization also permits this coverall to be worn with the proposed cold-weather combat jacket with a look of neatness, since they will be of matching color.

The preceding paragraphs contain in brief the major factors considered in arriving at a recommended Warm Weather Combat Suit and Fatigue Uniform. The authors feel that this uniform will provide the armored vehicle crewman with a garment which is at the same time comfortable, functional, and neat

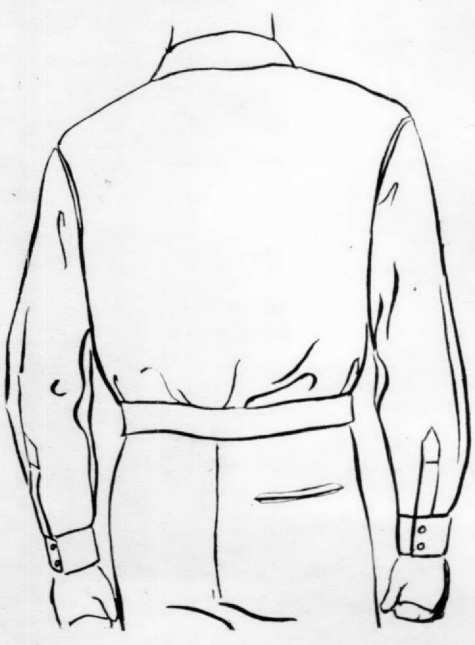


FRONT VIEW



VIEW OF DROP SEAT

REAR VIEW



PROPOSED WARM WEATHER COMBAT AND FATIGUE UNIFORM

in appearance. In order that there be no misunderstanding on the part of the reader as to what this uniform will look like, see illustration 38 for an artist's conception of this proposed uniform incorporating all of these military characteristics.

Cold Weather Combat Suit

1. Military purpose: To provide adequate protection for the combat vehicle crewmen while performing normal duties under cold weather conditions.

2. General design features:

a. Shall be a two-piece suit capable of being converted into a one-piece garment by the individual.

b. Shall be of a heavyweight, durable material capable of withstanding rips, tears, and the effects of grease and oil.

c. Shall be of a dark green color similar to that of the present field jacket.

d. Shall contain a built-in liner which will provide adequate protection for cold weather.

e. The exterior shall be free from any loops, flaps, patch-type pockets or any other design features, which might catch or bind on projections within or upon an armored vehicle.

f. Shall be designed to minimize interference in entering, leaving, and fighting in armored vehicles.

g. Shall be tailored to provide a snug fit around wrists, neck, boots, and waist.

h. Shall be provided with a heavy duty zipper -- see drawing.

i. Shall be capable of being dry-cleaned without impairing other military characteristics.

j. Shall provide five pockets, two on the chest, one on the right thigh, one on the left leg below the knee, and one on the right hip. All pockets shall be of a slash-type and be provided with a zipper closure.

k. Shall include small pocket on upper left sleeve for carrying pencils and cigarettes.

l. Shall be reinforced at elbows, knees and seat.

m. Shall permit carrying out of biological functions of body without removing the upper part of the suit.

n. Shall be constructed in three sizes -- small, medium, and large.

3. Climatic conditions: Shall furnish adequate protection for wear in temperate climates (0 to 60° F).

4. Proofing: Shall be shrink proof, water repellent, fireproof, and provide flash protection consistent with other military characteristics.

5. Discussion: There seems to be considerable controversy over whether this uniform should be a one-piece or a two-piece suit. Consequently, the design of this uniform will

embody most of the desirable features of both suits. In recognition of the fact that the two-piece suit affords the opportunity to salvage half of it at a time instead of the whole suit, and that there would be times when it would be desirable to wear it one piece at a time, a two-piece feature has been included in this uniform. However, the desirability of having a one-piece suit under many conditions as pointed out in preceding chapters has been given consideration, too, and this feature has been incorporated into our uniform. It is to be accomplished as follows:

Basically the suit is to be two-piece, having a jacket and trousers.

The jacket is to have two deep slash-type pockets on the chest, and one patch-type pocket for pencils and cigarettes on the left upper sleeve. The collar will be designed to fit snuggly or to be worn open. Cuffs will fit closely from the wrist to about half-way up to the elbow where they will be permitted to blouse out loosely to prevent restriction of movement or binding at the elbow. Armpits must be loose to allow stretching upward with the arms without bind. The back will be pleated to allow stooping and twisting of the torso. Shoulder epaulets will be wide and sewn down halfway up from the point of the shoulder to the button.

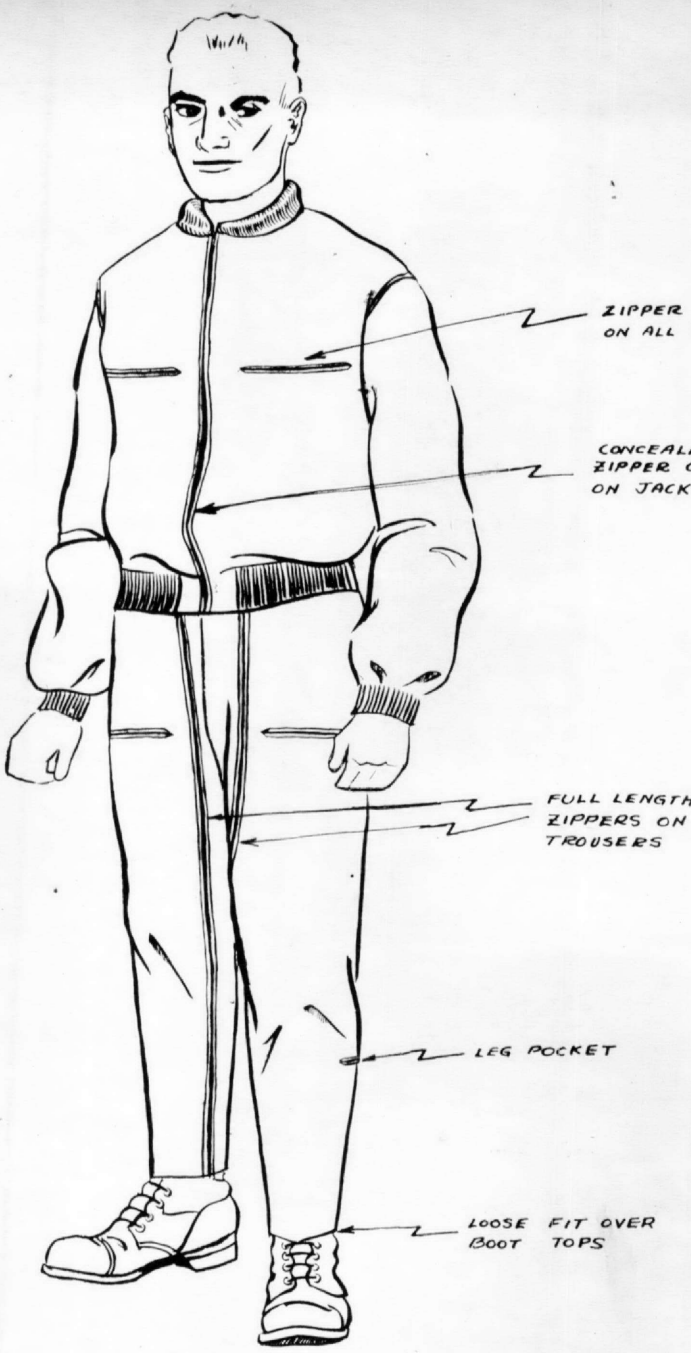
The jacket will extend down to the midsection. A covered zipper will be used down the front, and a zipper

arrangement around the waist will be for the purpose of attaching the trousers to it and converting the uniform into a one-piece suit. An elastic strip across the front will be for the purpose of allowing flexibility at the waist not afforded by the zipper and giving a snug fit (see sketch).

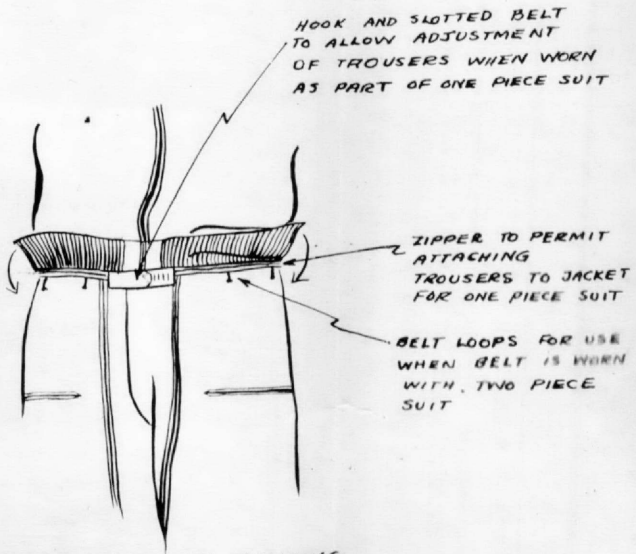
The trousers are to be provided with three slash-type pockets -- one on the right hip, one on the right front thigh, and one on the left front shin. A small patch pocket will be on the outer seam of the right leg for the first aid packet and a rule pocket at the corresponding position on the left leg.

The bottoms of the trouser legs will fit closely from the ankles to the boot tops where they will be permitted to blouse fully, eliminating any restriction to movement of the knees. The snug fit may be obtained by use of laces or elastic. The reason for this is to prevent pressure and rubbing caused by gathering trouser legs in boot tops and to enhance circulation in the toes, feet, ankles, and legs. It is felt that this would materially reduce the hazards of trench foot and frostbite.

The trousers will extend upward to join with the jacket above the point of the hips, as do the conventional-type trousers. They must be capable of being joined to the jacket by a concealed zipper arrangement which runs around the waist. A piece of elastic across the front will permit flexibility at the waist not afforded by the zipper, and give a snug, comfortable fit



FRONT VIEW
UNIFORM COMPLETE



DETAIL OF WAIST SHOWING ZIPPER PROVIDED FOR ATTACHMENT OF TROUSERS TO JACKET

PROPOSED COLD WEATHER COMBAT UNIFORM

without binding at the waist. There will be a zipper opening from the waist to the crotch. The trousers must be capable of removal without removing the jacket, and belt loops must be provided for wear without the jacket.

We visualize using some type of heavyweight material such as that used in the field jacket or trousers that is a dark green in color, durable, capable of withstanding hard wear and the effects of oil and grease. It should contain a built-in liner similar to the blanket lining used in the old type tanker's suit to provide adequate protection for cold weather. Both jacket and trousers are to be lined in this manner.

The exterior as designed would afford minimum possibility of interference in entering, leaving, or fighting in armored vehicles, due to flaps, pockets, or loops which might catch on projections while working with the vehicle.

For proposed uniform complete, see illustration 39.

Tank Helmet

1. Military purpose: To provide adequate protection the crews of combat vehicles while performing normal duties.

2. General design features:

a. Shall be sufficiently comfortable to permit continuous wear without causing adverse effect.

b. Shall be designed to be easily removed from and replaced on the head.

c. Shall be stable when worn.

d. Shall provide adequate crash protection to the wearer when riding in armored vehicles.

e. Shall be designed so that noise resulting from helmet contact with metallic surfaces on the interior of a combat vehicle is damped.

f. Shall be reasonably durable under hard wear and rough usage.

g. Shall be adequately ventilated.

h. Shall be capable of being worn with the standard gas mask.

i. Shall not interfere with the performance of crew duties within or without the vehicle.

j. Shall be easily adjusted to the head.

k. Shall fit snugly as possible, commensurate with other characteristics herein specified.

l. Shall provide ballistic protection.

m. Shall be of a color similar to that of the M1943 field jacket.

n. Shall be equipped with a quick release chin strap.

o. Shall be provided in two sizes with an overlap of the medium size.

p. Shall be of one-piece construction and shaped similar to the modern-type football helmet.

q. Shall be minimum weight, consistent with other characteristics, and not in excess of 2 pounds complete.

r. Shall have built-in suspension which may be easily adjusted.

s. Shall have clean and simple lines.

t. Shall have a snap-in arrangement for earphones with the earphones easily removable for repair and replacement.

u. Shall utilize a built-in microphone system.

v. Shall have hinged earflaps that will offer the same ballistic protection as the rest of the helmet and be capable of receiving and securing earphones.

3. Climatic conditions: Shall furnish adequate protection at temperatures from 0 to 100° F.

4. Proofing: Shall be water repellent, fungus proof, and fireproof.

5. Discussion: It is envisioned that a modern football-type helmet be constructed that will not be uncomfortable in hot weather. The matter of arctic protection is another subject, but this item could be reinforced with a heavy pile liner that would most likely make it acceptable. A wool, knit liner could be issued for wear under this helmet in cold weather if it was deemed necessary. This helmet must be comfortable so that the person to whom it is issued will wear it. Nothing is more worthless than an item of equipment that is not used. We recommend a suspension similar to the one

found in the Air Force jet pilot's helmet. It is felt that this suspension system will allow the helmet to be worn continuously without adverse effect. The recommended helmet should offer the very minimum of difficulty in placement on and removal from the head. The recommended suspension system, and especially the arrangement of the neck band, plus the use of a chin strap, should be condusive to complete stabilization.

This helmet, if constructed of one of the new plastic materials and the recommended suspension system utilized, should afford maximum crash protection. The problem of the noise that may be produced by the helmet striking metal is greatly reduced by the discovery of new plastic materials that allow the elimination of steel as the outer surface. Durability is of major concern and it is felt that any material that will turn small arms fire and shell fragments is certainly durable; however, much attention must be paid to straps and harness and their connections. Ventilation should present no great problem since some space will exist all around the helmet, and especially the rear portion. If more ventilation is desired, holes could be bored into the side of the helmet, but this will weaken the ballistic protection. The holes should be bored on a 45-degree angle with the low end of the hole to the outside surface. This would tend to reduce the ballistic weakness and prevent water from dripping through to the interior of the helmet.

The use of the gas mask requires the removal of any headgear in order to properly fit the mask to the face. This helmet should present no problem whatsoever to the wearing of the gas mask since once the gas mask was fitted to the head, the helmet could be replaced without difficulty. The recommended helmet, if properly constructed will be light, not bulky, comfortable, and well-secured to the head. It should not interfere with the crewman's duties. The material recommended is waterproof, and can easily be made fungus proof. Unless large holes are bored into the helmet for ventilation, it should offer adequate protection from rain. The recommended suspension system allows an adjustable headband and, coupled with the two sizes of helmets desired, no difficulty should be experienced when adjusting the headband to the individual. Proper engineering of the helmet recommended should make the problem of assuring a snug fit hardly worth comment. As mentioned before, we are fortunate to be in possession of plastics that give the protection of steel without its accompanying weight. The helmet recommended will provide the same protection as the M1 steel helmet and will be greatly reduced in weight.

The color of the helmet is a debatable question, but it is felt that this can be controlled by local commanders since the material of which this helmet is constructed makes it possible for the same helmet to be several colors in a

single day. A shade of color similar to the M1943 field jacket was recommended because the headgear would then correspond to the field uniform. The color could be changed easily to conform with snow, sand, the color of the vehicle, or other uniforms or backgrounds.

There are many quick release devices that could be used on the chin strap of this helmet. No emphasis is placed, therefore, on this item so long as the device used functions properly and will release when the predetermined pressure has been applied.

Sizes of the helmet are very important. We recommend two sizes to overlap in the vicinity of size 7 so that men possessing the average head size can wear either of these helmets with the difference being taken up by adjustment of the head band. The construction is to be one-piece; however, the ear flaps are to be cut and hinged. The angle of cut should be about 45 degrees to retain as much ballistic protection as is possible. It will resemble to a great extent the modern football helmet.

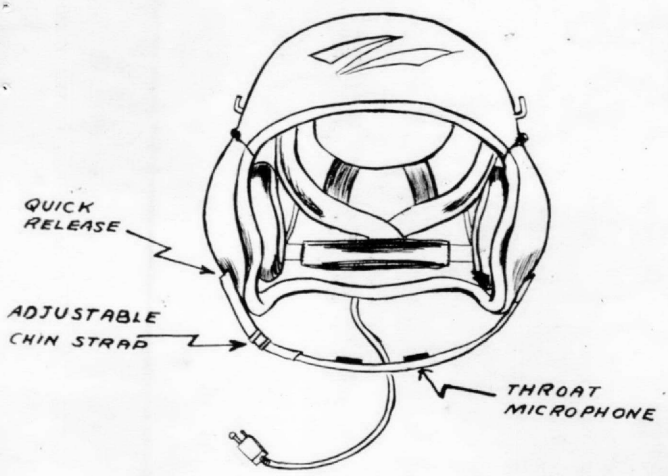
With careful engineering, the weight of this item should not become much greater than that of the shell of the present M-1 helmet. Every effort should be made to keep the weight well under 2 pounds and still retain the other characteristics. The suspension system recommended is the type found in the Air Force jet pilot's helmet. It is felt that improvement could be made on the ease of adjustment and the manner

in which the suspension system is fastened to the helmet. The helmet should appear similar to the Air Force jet pilot's helmet, and, if this is done, the resultant headgear will have extremely clean and simple lines.

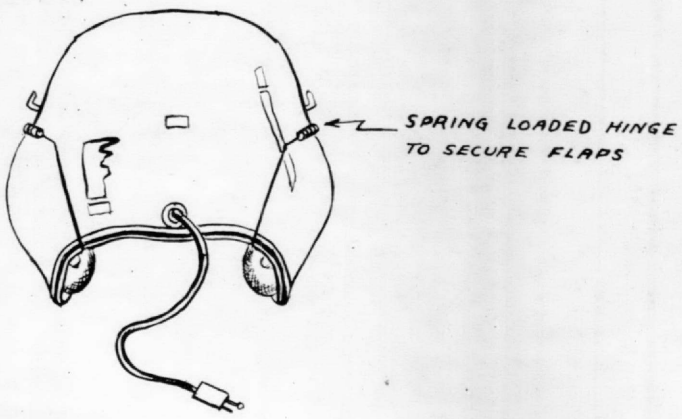
The earphones and the lead wire to the electrical connection will be placed in a soft leather or rubber pocket which will be located on the ear flaps. These pockets will be perforated at the proper place and will zipper or snap closed so that, regardless of the position of the helmet, the earphones will not fall out. The lead wire will be fastened to the interior of the helmet with snap catches. This feature will favor quick change for repair or replacement of earphones, and will eliminate the spring steel band that is usually employed with earphones which has proven so uncomfortable.

Only 20 percent of the persons interviewed were in favor of a throat microphone; however, 70 percent were in favor of a built-in microphone. It is believed that a throat microphone incorporated into the chin strap would be the best method to build the microphone into the helmet. This feature will allow some looseness of the ear flaps when released so the spoken voice can readily be heard and understood. It should also keep the throat microphone well placed against the throat and hold the helmet firmly on the head. The boom-type microphone was considered but not recommended because it was felt that the boom would easily become damaged

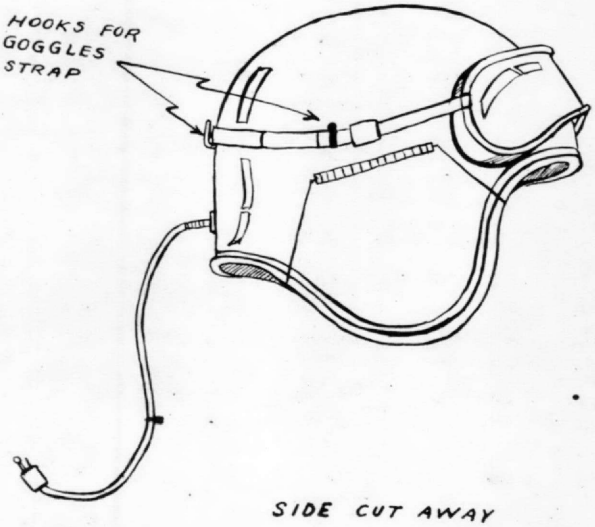
FRONT VIEW



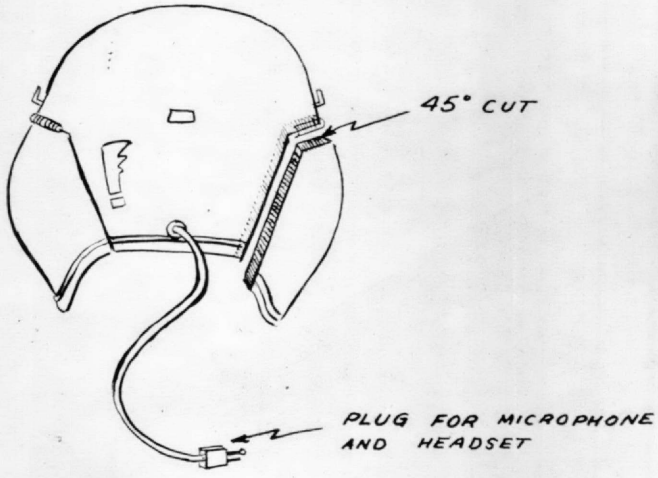
REAR VIEW



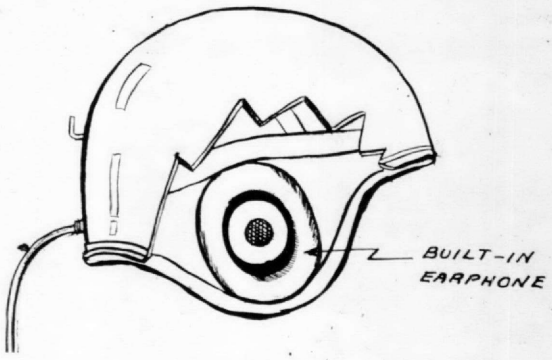
SIDE VIEW



REAR. DETAIL OF FLAP



SIDE CUT AWAY



PROPOSED TANK HELMET

by catching on projections or as a result of being bumped or dropped. The lip microphone was not recommended since it results in an unsanitary condition in cold weather and irritates not only the upper lip but also the ears which must support it in position. The hand microphone was excluded so the crewman could better utilize his hands. The helmet should have ear flaps that swing freely to allow for the spoken word to be clearly heard. Outside sound must be allowed to enter the helmet when desirable. Most orders and coordination with supporting troops are carried on by means of spoken voice. It is imperative that the tank crewman be able to hear when dismounted. Especially true is the case of incoming enemy artillery and mortar fire. Pockets should hold the earphones directly in line with the ears and only with the pressure as indicated by the adjustment of the chin strap by the individual.

The dust mask can be worn with the helmet, but a possible additional feature would be to provide snaps on the helmet so the mask could be attached there instead of to the head by a harness as is now used. Goggles can be worn, and it is felt that the use of small guides to prevent the goggle elastic band from slipping would be beneficial. For details of proposed helmet see illustration 40.

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APPENDIX I

CORRESPONDENCE AND DOCUMENTS

ITEM	SUBJECT
1	Armored Force Board Project, "Substitution of Helmet, Steel M1, for Tank Helmet," 4 January 1943
2	Letter, Headquarters, The Armored School, "Request for Research Material," and 1st Ind Army Field Forces Board Nr 3, Fort Benning, Georgia
3	Letter, Operations Research Office, 7 November 1951
4	Letter, Headquarters, The Armored School, "Request for Research Material," and 1st Ind Dept of Army, OQMG, Washington, D. C. 28 November 1951
5	Letter, OCAFF, "Helmet for Armored Vehicle Crew Members," 9 November 1948
6	Minutes of Meeting at Metropolitan Museum of Art, 12 January 1949

THE ARMORED FORCE BOARD
Fort Knox, Kentucky EWH/lk

AFB P-304 January 4, 1943

SUBSTITUTION OF HELMET, STEEL, M1, FOR TANK HELMET

1. PROJECT. Substitution of Helmet, Steel, M1, for Tank Helmet.

a. Authority.--Letter, War Department, TEO, September 10, 1942, TEO 451.25/6.911, and 5th Wrapper Indorsement, Headquarters Armored Force, Fort Knox, Kentucky, September 29, 1942, file 421.52 (9-10-42) GNOHD.

b. Purpose.--This test was for the purpose of determining whether it is practicable to eliminate the tank helmet and substitute for it either the Helmet, steel, M1, complete, or the plastic liner, M1.

2. DISCUSSION. Tests were conducted by the 36th Armored Regiment, the Tank Department of the Armored Force School, and the Armored Force Board. Some firing was done while wearing the steel helmet. See Appendix "B" of this report for a more detailed discussion and a summary on the results of the tests.

3. CONCLUSIONS. The Armored Force Board concludes that:

a. The helmet, steel, M1, when worn by tank crews, presents no serious difficulties in the use of sights and visual devices in the current models of tanks.

b. The helmet, steel, M1, is slightly less convenient than the tank helmet as a headgear for gunners. In certain cases both types of headgear interfere. Gunners frequently remove their headgear when firing. The steel helmet has a somewhat greater tendency to catch on various projections within the tank.

c. The complete steel helmet, or the plastic liner alone, will, with the exception of the area around the ear, provide protection equal to or greater than that provided by the tank helmet against blows that may be encountered within the tank.

d. The headphones which are being used in tanks at the present time are not satisfactory for use with the steel helmet. The new insert type headphones, HS-30, which have veen recommended for adoption by the Armored Force are satisfactory for use with the steel helmet.

e. The ease of adjustment of the size of the steel helmet eliminates the problems of stocking various sizes, and permits the helmet to be worn over warmer headgear such as a toque or the combat helmet.

f. Tank crews almost unanimously preferred the tank helmet to the steel helmet or liner for training purposes; however, the majority stated that they would prefer the steel helmet while in an active theater of operations.

g. The steel helmet is highly desirable for tank commanders, and it provides far greater protection to the heads of the tank crews when they are outside the tank than is provided by the tank helmet.

h. The advantages of the steel helmet over the tank helmet outweigh its disadvantages as a headgear for tank crews.

4. RECOMMENDATIONS: The Armored Force Board recommends that:

a. The helmet, steel, M1, be substituted for the tank helmets now authorized in the Armored Force.

b. The plastic inner liner of the helmet, steel, M1, be considered as a satisfactory headgear for tank crews during the training period.

c. The present supply of tank helmets continue to be used until exhausted.

d. The substitution of the helmet, steel, M1, be coordinated with the substitution of the new insert type headphones, HS-30, for the present type headphones, due to the fact that the present type headphones are not satisfactory for use with the steel helmet.

w Incls
#1 - Appendix "A" - Authority for Project
#2 - Appendix "B" - Discussion and Results of Test

G. B. DEVORE
Colonel, Armored Force
President

ITEM 1

GNBCG 461 (20 Oct 51) 1st Ind
Subject: Request for Research Material

ARMY FIELD FORCES BOARD NO. 3, Fort Benning, Georgia, 29 Nov 51

TO: Commanding General, The Armored Center, Fort Knox, Kentucky,
ATTN: Commandant, The Armored School

1. Army Field Forces Board No. 3 Project No. 2422, Military Characteristics for Jacket, Field, for Combat Vehicle Crewmen is the only study relating to development in tanker's uniforms and equipment available.

2. The Tentative Report of this project was forwarded to the Commandant of the Armored School on 18 September 1951 for comment. An additional copy is inclosed for your information.

FOR THE PRESIDENT:

1 Incl
As stated

W. B. MOORE
Colonel, Infantry
Executive

HEADQUARTERS
THE ARMORED SCHOOL
Fort Knox, Kentucky

AICBB-E 461 20 Oct 1951

SUBJECT: Request for Research Material

TO: President
Army Field Forces Board Nr 3
Fort Benning, Georgia
ATTN: Librarian

This headquarters would appreciate for permanent file, if possible, copies of studies or documents relating to the past and present development in tankers' uniforms and equipment, or any information as to where such material might be available.

FOR THE COMMANDANT:

RALPH F. CHILDS
Captain AGC
Asst Adj Gen

ARMY FIELD FORCES BOARD NO. 3
Fort Benning, Georgia

REPORT OF STUDY OF PROJECT NO. 2422 MILITARY CHARACTERISTICS FOR FIELD JACKET FOR COMBAT VEHICLE CREWMEN

1. Authority:

a. Directive: Letter, OCAFF, ATDEV-11 421, 7 July 1951, subject: "Military Characteristics for Field Jacket for Combat Vehicle Crewmen. (Appendix A.)

b. Purpose: To prepare military characteristics for a field jacket that will be suitable for combat vehicle crewmen.

2. References:

a. Report of Army Field Forces Board No. 3, Project 2326, "Jacket, Field, M-1943, Modified; Liner, Jacket, Field, M-1943, EX-50-10; Liner, Jacket, Field, M-1943, EX-50-11; Liner, Jacket, Field, M-1943, EX-50-12; Shirt-Coat, EX-50-5," dated 18 October 1950.

b. Letter, OCAFF, ATDEV-11 421, 16 July 1951, subject: "Combat Jacket for Crewmen of Combat Vehicles," to Assistant Chief of Staff, G4, Logistics, Department of the Army.

c. "Military Characteristics for Field Jacket for Combat Vehicle Crewmen" recommended by The Armored School (Appendix J, Annex 2).

3. Background:

a. In September 1950, the purpose of one of the tests made by Army Field Forces Board No. 3, Project No. 2326 (ref 2a) was to determine whether the Jacket, Field, M-1943, Modified, with button-in Liner was suitable for use by members of crews of armored vehicles. Three non-commissioned officers of Co. C, ISD, Fort Benning, Georgia, all experienced members of a tank crew, were fitted with the jacket with liner, entered an M-46 tank and went through all operations required of the various members of the crew. All three test subjects were of the opinion that the jacket with the button-in liner was entirely satisfactory, did not bind or restrict movement and was well liked, except for the flared skirt of the jacket which tended to catch on projections when

entering the vehicle through hatches. Test subjects advised that the same defect was present in the standard Jacket, Field, M-1943, but was not considered serious.

b. Reports of Army Field Forces Observer Team No. 4 indicate that the standard combat jacket is not suitable for use by armored vehicle crewmen for they are too bulky and incorporate pockets, loops and cuffs that catch on mechanisms within tanks (ref 2b).

4. Discussion:

a. A conference was held to discuss the essential and desired characteristics for the combat jacket. Officers and noncommissioned officers, all experienced tank crewmen who are members of the 550th Tank Company stationed at Fort Benning, contributed many excellent suggestions that have been helpful in the preparation of the military characteristics. (Annex 2, Appendix B).

b. Tentative Report of Project No. 2422, "Military Characteristics for Field Jacket for Combat Vehicle Crewmen," was forwarded to Army Field Forces Board No. 2 and The Armored Center for their comments (Annex 1).

5. Recommendations:

a. Recommend that a field jacket for combat vehicle crewmen be developed incorporating the military characteristics outlined in Appendix B, Annex 2.

b. Further recommend that one hundred (100) jackets be shipped to this Board for check test before standardization of the jacket.

Annexes: 1 - Coordination
2 - Appendixes Index
A - Copy of Directive
B - Military Characteristics
J - Military Characteristics Prepared by The Armored Center

The Johns Hopkins University
OPERATIONS RESEARCH OFFICE
6410 Connecticut Avenue
Chevy Chase, Maryland
Operating under Contract
with the
Department of the Army

Telephone
Oliver 4200

7 November 1951

Captain Ralph F. Childs, AGC
Asst Adjutant General
Headquarters, The Armored School
Fort Knox, Kentucky

Dear Sir:

Reference your letter of 30 October 1951, AICBB-E 461, the subject "Tankers' Uniforms and Equipment."

Your attention is called to three publications which are listed below with information as to content, and relationship to subject of your study.

1. ORO-R-1 (FEC) -- This document contains the conclusion that the clothing issued to tank crewmen was too bulky and uncomfortable. It could not be worn with ease and because the tank heaters were inadequate the crewmen were provided with inadequate protection. The clothing issued in Korea was similar to that provided for infantrymen. Recommendation was made that we should resume the use of the type of clothing worn in World War II. (armored) The foregoing information was based on interrogation of the crews rather than upon any extensive investigation.

This document is under review by the D/A prior to official distribution. The Armored School is on the official distribution list.

2. ORO-T-9 (FEC) -- This document contains information about clothing and equipment for infantrymen only. However, it is a rather complete investigation and may contain data of interest to you in your studies.

This document is currently in editorial process and will receive standard distribution, including the Armored School.

3. ORO-R-5 -- This is a final report of project AICLAD dealing primarily with an intensive investigation of all means which can be provided for the protection of military

personnel, including all types of clothing. It can be assumed that you may find items of interest in this study. This document is in editorial process.

As indicated above, we have made no studies specifically directed at your investigation, but have in the offing, documents which may be of general interest. It is at present impossible to tell you when these documents will become available for general distribution. If the subject matter indicated is of interest in the immediate future, you are welcome to visit ORO and discuss the problem with myself, Mr. Best or Dr. Gardner.

Very truly yours,

JWJ:ap

J. W. Johnson, Chairman
Project ARMOR

HEADQUARTERS
THE ARMORED SCHOOL
Fort Knox, Kentucky

AICBB-E 461

20 Oct 1951

SUBJECT: Request for Research Material

TO: Chief, Research & Development Branch
Military Planning Division
Office of the Quartermaster General
Washington 25, D. C.

This headquarters would appreciate an interlibrary loan of studies or documents relating to recent developments in tankers' uniforms and equipment, or information as to where it is believed such material is obtainable.

FOR THE COMMANDANT:

RALPH F. CHILDS
Captain AGC
Asst Adj Gen

QMGRV 461
Fort Knox

1st Ind

Department of the Army, OQMG, Washington 25, D. C., 28 Nov 51

TO: Commandant, The Armored School, Fort Knox, Ky.
ATTN: Captain Ralph F. Childs

1. This office has made a search of its files and can locate no studies or documents relating to recent developments in tankers' uniforms as such. Since World War II when the Army found it to be logistically impossible to supply distinctive uniforms to specialized troops, all the functional requirements of the various arms and services have been incorporated to the best possible degree into a general uniform for wear by all field forces.

2. The Army has recently standardized new combat uniforms for Cold-Wet and Cold-Dry climates. The functional requirements of tank personnel were responsible, in part, for the incorporation of special design features into the new garments. These design features include concealed buttons on the front closures of jackets and parkas, concealed buttons on all pocket flaps, drawstrings on the waist and skirt of jackets and parkas, drawstrings on the cuffs of trousers, and the elimination of buckles on combat boots. The purpose of these design features is to minimize the possiblity of clothing catching on mechanisms or equipment. In addition, there is presently under development a new helmet consisting of a ballistic liner and aluminum shell. The helmet liner, worn alone, was designed to meet the functional requirements of tank forces while the combination liner and shell was designed to answer the needs of all other forces.

3. In the absence in this Office of the information which you requested, it is suggested that you write to Headquarters, Army Field Forces, Fort Monroe, Virginia.

FOR THE ACTING THE QUARTERMASTER GENERAL:

T. R. J. HICKEY
Colonel, QMC
Chief, Research and Development
Division

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OFFICE, CHIEF, ARMY FIELD FORCES
Fort Monroe, Virginia

ATDEV-11 421.2

9 Nov 1948

SUBJECT: Helmet for Armored Vehicle Crew Members

TO: President
Army Field Forces Board No. 2
Fort Knox, Kentucky

1. Requests are being received from many sources for a helmet for armored vehicle crew members. There is at present no standard helmet designed for this purpose. Though development of such a helmet is proceeding under a priority of 1C, there is little doubt that it will be some time before standardization action is taken.

2. This Office has requested the Office of the Quartermaster General to send ten of each of two types of Air Force helmets, the M4A2 and M5, to your Board for examination.

3. It is directed that your Board:

a. Determine the extent to which these helmets meet the requirements of armored vehicle crew members.

b. Make recommendations as to the acceptability of these helmets for standardization as an interim item.

4. Report may be made by indorsement hereon.

5. This project is assigned an A priority.

FOR THE CHIEF, ARMY FIELD FORCES:

/s/ S. W. Roth
S. W. ROTH
Lt. Col. A.G.D.
Asst. Adj. Gen.

CYS FURNISHED:
AFF Board No. 3
CG, Third Army

COPY COPY

P-1374 (9 Nov 48) AKCW 1st Ind

Army Field Forces Board No. 2, Fort Knox, Kentucky, 21 Dec 48

TO: Chief, Army Field Forces, Fort Monroe, Virginia
ATTN: Assistant Chief for Developments

1. Reference. Ltr, AFF Bd. No. 2, P-1212, 4 Dec 47, subject: "Letter Report of Army Ground Forces Board No. 2 Project No. 1212, Test of Doron Type Crash Helmet."

2. Description of Materiel. No descriptive information was available at this board concerning the subject helmets. Informal discussion with Air Force personnel at Godman Field disclosed that the helmets M5 and M4A2 were developed as "flak helmets" and are intended for wear over the leather or cloth flying helmet, types A-11 and AN-H-15.

3. Summary of Tests.

a. Army Field Forces Board No. 2 conducted a test of the helmets referred to in paragraph 2, basic letter, using two tank crews from the 70th Tank Battalion. The helmets (with both leather and cloth flying helmet type A-11 and AN-H-15) were worn by the crew members during two consecutive 1-day field exercises for a total of 16 hours. The helmets were also inspected by officers and enlisted men of the board with tank experience. A ballistics test was not feasible in the limited time available for the test.

b. It was the concensus of those using or inspecting the helmets that:

(1) A leather or cloth inner helmet is required for both the M4A2 and M5 helmet. Both helmets when worn alone lack a satisfactory means of mounting any of the commonly used communications head sets. The M4A2 helmet has no means of adjustment for head size.

(2) When worn with the leather or cloth flying helmet type A-11 and AN-H-15, the M4A2 helmet is acceptable as an interim item. The flying helmet provides a means of mounting the headset HS18 (Air Force HS-38) and provides necessary stability and clinging ability to the helmet.

COPY

(3) The M5 helmet is unsatisfactory as an interim item either with or without the flying helmet.

(4) A cup type chin strap should be provided.

c. While the M4A2 helmet can be used as an interim crash helmet it is far from the ideal solution to the overall problem. The type of inner helmet to be issued would probably vary with the climate. The necessity for the inner helmet may seriously effect crew comfort during hot weather.

d. Before a helmet is adopted for interim use other types should be investigated. The doron type crash helmet tested under project No. 1212 (see report referenced in paragraph 1) has several good features.

4. Recommendations. Army Field Forces Board No. 2 recommends that:

a. A combination of the M4A2 helmet with the leather or cloth flying helmet type A-11 or AN-H-15 (leather in cold weather, cloth in warm weather) with headset HS18 (Air Force HS-38) and extension cord CD307 be considered acceptable as an interim item for use by armored vehicle crew members.

b. The present chin strap on the M4A2 helmet be replaced with a cup type chin strap if adopted for armored vehicle crew members.

c. The ballistic protection provided by helmet M4A2 be determined by contacting the appropriate Air Force agency.

FOR THE PRESIDENT:

1 Incl:
Photo of Air Force
Helmets M5 and M4A2, with
leather and cloth flying helmet
and headset HS-38 (SC HS-18)

S. G. BROWN, JR.
Lt. Col, Cav
Secretary

COPY

MINUTES OF MEETING AT METROPOLITAN MUSEUM

12 January 1949

I. Tank Helmets.

A. Helmet design.

Helmet models with one piece and hinged ear protection based on the designs of the M-5, T21E1 and Doron Crash helmets were examined and criticized. Special emphasis was placed on their suitability for use with sighting equipment and headsets of current and proposed designs including the microphone boom attachment. As the models were discussed, it became evident that the 7-ply laminated nylon liner made in the Doron Crash helmet mold (hereafter referred to as Liner, Helmet, Nylon, EX 49-1) fitted the requirements more closely than the others.

In the course of the discussion it was pointed out that Liner, EX-49-1

1. Affords suitable protection to the ears and back of neck.

2. Is adaptable for use with headsets and sighting equipment.

3. Is ballistically equal or better than Helmet M-1.

4. Weighs (with the M-5 suspension) approximately 24 oz.

5. Combined with a suitably designed Al shell would meet the AFF requirements for a 2 piece helmet.

B. Suspension design.

The helmet must be fitted with a suspension equal or better than the M1. Limitations imposed by the use of sighting equipment and impact distortion of the laminate necessitate a suspension which will provide adequate spacing between helmet and forehead.

Parachutists' chin straps were suggested for use with the tank helmet with quick release design incorporated when necessary.

A universal suspension combining comfort and improved adjustability was generally favored. It should be designed to prevent shifting of the helmet on the wearers head under all conditions.

C. Helmet Size.

This subject has always been highly controversial. Liner, EX-49-1 molded in the existing mold fits headsizes to 7½ with the present H16U headset. Until a further study of head sizes has been made, this mold will be used for samples.

3. A study of helmet size will be made to determine

a. If two helmet sizes are adequate.
b. Headsizes covered by each helmet size.
c. Percentage of headsizes fit by each helmet size.

4. The suspension and method of attachment will be improved.

5. Consideration is to be given to the development of a method of incorporating X-Ray opaqueness in nylon.

6. Upon approval of the sample a sufficient number of helmets will be fabricated, submitted to Ordnance for ballistic data and to other agencies for service tests.

G. Interim Tank Helmets for Armored Forces.

The hinged cheek piece of an M-5 helmet is to be modified by a simple stamping operation to relieve pressure on the headsets. The parachutists' chin strap is to replace the standard M-5 strap. When remodeled the sample will be forwarded to Board No. 2 for approval.

II. Eye Protection for Mine Clearance Personnel

Visors fitted with plastic windows and attached to helmets of various designs were approved as to angle of vision but criticized as to methods of attachment, especially in regard to effects of weight on the wearer.

Further development was recommended to investigate the feasibility of (1) supporting the face protection on the shoulders (2) attaching it to the armor, neck or armor, vest.

III. Armor, Nylon, Laminated for Overall Protection.

Laminated nylon armor received favorable comments chiefly because of the flexibility, comfort and ballistic properties attainable at weights 30% less than the aluminum-nylon combination. The "spot" laminated development was of interest due to maintenance of shock resistance and ballistic properties with extreme flexibility.

It is suggested that further development should be directed toward

a. Determination of the ratio of rigid to flexible areas and of the optimum size and shape of these areas.

b. Incorporation of X-Ray opaqueness.

c. Improvement of flame resistance.

APPENDIX II

QUESTIONNAIRE ANALYSIS

This appendix contains a summary of the major findings of questionnaires distributed to members of the 1951-1952 Advanced Class at The Armored School, the Staff and Faculty of The Armored School, the Army Field Forces Board Nr 2, and to various enlisted personnel with experience as armored vehicle crewmen. The figures shown herein represent a compilation of opinions expressed by personnel with an average of five to eight years experience in armored units.

QUESTION 1 a. Yes - 95%; No - 5%.

Discussion: 100% were in favor of a new uniform because the present uniform is too bulky or catches on projections. 10% favored a new uniform because the present uniform causes postural fatigue. 20% agreed that a new uniform would increase the esprit de corps of troops involved. Reasons against were based mostly on the excessive cost of special uniforms for minorities. One answer indicated a desire for a new uniform to be standardized for all troops.

QUESTION 1 b.

Discussion:

Two-piece	Yes	80%
One-piece	Yes	20%
Drop seat	Yes	60%
Layer principle for warmth	Yes	20%
Distinctive insignia	Yes	20%
Cuffs fit snugly	Yes	95%

Fasteners:
- Buttons..... 4%
- Zippers.....90%
- Clasps..... 4%
- Snaps..... 2%

Color:
- Dark green.....30%
- OD.....32%
- Black..... 8%
- Any dark color.....30%

Collar:
- High knit.....90%
- Turtle neck..... 7%
- Mouton type..... 3%

60% of the questionnaires indicated that the best solution would be the combat suit (Armored Force) of World War II with the following modifications: darker color, stronger material, and larger, zippered pockets.

QUESTION 1 c.

Discussion: The results of this question are quite thoroughly discussed in Chapter 3 of the report.

QUESTION 1 d. Yes - 95%; No - 5%.

Discussion: 100% agreed that the present helmet is unsatisfactory because it is uncomfortable, too heavy, falls off easily, does not adapt to headsets or optical sights. 95% agreed that a new helmet is needed whereas 5% indicated their satisfaction with the present M1 steel helmet.

QUESTION 1 e.

Discussion:
- One-piece.....Yes 70%
- Two-piece.....Yes 30%
- Football type.....Yes 80%
- Chin strap.....Yes 20%

Wool knit liner.....Yes 30%
Color:
Black..... 3%
OD.....97%
Built-in headset.....Yes 90%
Built-in microphone.....Yes 70%
Type headset:
Now in use.....Yes 10%
Other type.....Yes 90%
Type of microphone:
Hand..... 5%
Lip..... 5%
Throat.....20%
Furnish crash protection..Yes 95%
Furnish ballistic protection.....Yes 50%
Lightweight important.....Yes 100%
Earphones removable from helmet.....Yes 90%
Universal size.....Yes 50%
Several sizes.....Yes 50%

QUESTION 1 f.

Discussion:
OVM.....Yes 30%
Organizational.....Yes 40%
Individual.....Yes 30%

RESEARCH COMMITTEE NR 32
ARMORED OFFICERS ADVANCED CLASS
THE ARMORED SCHOOL
Fort Knox, Kentucky

1 February 1952

SUBJECT: Uniforms for Tank Crewmen

TO:

1. Committee Nr 32 of the Advanced Class has undertaken a study of combat uniforms for tank crewmen with the objective of deriving the most practical uniform. The Committee would greatly appreciate your answers to the questions hereon in the light of your experience so that your ideas may be incorporated in the research report.

a. In view of the magnitude of the logistics problem introduced by the numerous specialized uniforms then in use, in 1945 the War Department adopted one group of standard uniforms to be worn by all arms. In the light of this policy, do you believe the functional requirements of tank crewmen justify a special uniform (exclusive of headgear)? Yes _____ No _____

Please explain your answer briefly.

b. If you believe a special uniform is needed, what type of winter (not arctic) combat uniform would you want? Do not let convention influence your ideas. Questions below are furnished to assist in preparation of your answer:

(1) Two-piece or one-piece?
(2) Drop seat in one-piece uniform?
(3) Where are pockets desirable and what type?
(4) What color?
(5) What materials?
(6) What type fasteners--zippers, buttons, etc?
(7) Layer principle for warmth?
(8) Distinctive insignia?
(9) Cuffs on jacket and trousers to fit snugly?
(10) What type collar?
(11) General description of uniform or sketch and any other ideas you may advance.

SUBJECT: Uniforms for Tank Crewmen 1 February 1952

c. Using the preceding points as a guide, what type fatigue or summer combat uniform would you want?

d. Also in consideration of the logistics problems involved, the War Department in 1943 eliminated the tank helmet as an item of issue and substituted therefor the steel helmet and plastic liner which were deemed satisfactory for use in tanks then standard. Again, in the light of this policy and the tanker's functional requirements today, do you believe a special tank helmet is justified? Yes _____ No _____

Please explain your answer briefly.

e. If you believe a special tank helmet is necessary, what would you want? Questions below are furnished to assist in preparation of your answer:

(1) A liner for shock protection and an outer shell for ballistic protection?
(2) One-piece helmet to provide both shock and ballistic protection?
(3) Fit snugly like football helmet?
(4) Chin strap? If so, what type?
(5) Built-in headset?
(6) Built-in microphone?
(7) What color?
(8) What provisions, if any, for warmth?
(9) What type headset and microphone?

f. Should this tank helmet be included in the OVM of each tank?

Your name _____ Rank _____

Years armor experience _____

ROBERT E. DRAKE
Captain, Armor
Chairman

[redacted]