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TECHNICAL OBJECTIVE DOCUMENT FOR SHELTER SYSTEMS

BY

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RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This document provides information on the Army's technical objectives for the Shelter Systems areas to the external community, both Government and nongovernment, including academic, scientific and industrial organizations. Its purpose is to stimulate the participation of such organizations in Army research and development.
Areas covered include:

Management
Technology Base Investment Strategy
Technical Objectives
Progress and Accomplishments
Planned Programs (research, technology and development)
Major Technical Barriers
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PREFACE

This report was produced during the period October 1988 to September 1989, under Program Elements 63804 and 64804.

- N O T I C E -

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POINT OF CONTACT

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I. INTRODUCTION

The U.S. Technical Objective Document is an important part of the Army's information for Industry Program. Each Army laboratory and research, development and engineering center has an opportunity annually to prepare a Technical Objective Document based upon Army requirements, scientific and technological opportunities, and the needs of present and projected systems.

We all recognize that the developments and accomplishments of the Army are the product of teamwork among Army scientists and engineers and their counterparts in industry and the academic community. This document is intended to increase this teamwork by providing you with necessary information on our research, development and acquisition program. Specific objectives are:

To provide planning information for independent research and development programs.

To improve the quality of unsolicited proposals and R&D procurements.

To encourage face-to-face discussions between Army engineers and scientists and their external counterparts.

As you read through the pages that follow, you may see an opportunity to which your organization can respond. We invite you to discuss the opportunity with the scientist or engineer identified therein. Futhermore, you may have completely new ideas not considered in this document which, if brought to the attention of the proper organization, could make a significant contribution to the Army's capabilities. The Army has a continuing interest in receiving proposals that contain new ideas, suggestions and innovative concepts for weapons, supplies, facilities, devices and equipment. In other words, your ideas, whether in response to this document or not, are always welcome.

Classified/limited distribution Technical Objective Documents are available from the Defense Technical Information Center, while unclassified/unlimited documents are available from the National Technical Information Center. These documents, as well as additional information on doing business with the Army, are also available from the Army's Technical Industrial Liaison Offices.

II. MANAGEMENT OVERVIEW

1. MISSION

The mission of the U.S. Army Natick Research, Development and Engineering Center (NATICK) is to ensure maximum survivability, supportability, sustainability and combat effectiveness of individual soldiers and crews on the battlefield under worldwide environmental extremes.

Our goal is to provide the American soldier the best equipment for the best price through research, development and engineering in the areas of Airdrop Systems, Food and Food Service Systems, Tactical Shelters, and Clothing and Individual Equipment. We are deeply committed to making our soldiers, and all Service members, the best equipped and best fed in the world.

2. ORGANIZATIONAL STRUCTURE

Natick is an element of the U.S. Army Troop Support Command (TROSCOM), a major subordinate command of the U.S. Army Materiel Command (AMC). We are currently organized with three commodity-oriented directorates - the Individual Protection Directorate (IPD), the Food Engineering Directorate (FED), and the Aero-Mechanical Engineering Directorate (AMED); three technical support directorates - the Advanced Systems Concepts Directorate (ASCD), Soldier Science Directorate (SSD), and the Engineering Programs Management Directorate (EPMD); and requisite administrative support elements.

Our commodity directorates are responsible for planning, organizing and conducting/overseeing the conduct of all required research, development and engineering in their assigned areas. AMED performs these functions for shelter systems and also coordinates all Army contributing RD&E efforts concerned with shelters.

3. PROGRAM AREAS

Natick's programs encompass the total spectrum of research, exploratory, advanced and full-scale engineering development and the operations and maintenance activities essential for standardization and production engineering in support of procurement.

Our efforts are focused primarily on three commodity areas and include several distinct fields of endeavor, all covered by the Army Material Command (AMC)/Training and Doctrine Command (TRADOC) Combat Service Support Mission Area Material Plan (CSS MAMP). They are:

AIRDROP AND COMBAT SERVICE SUPPORT

- Advanced Personnel and Cargo Airdrop Systems
- Hardened Shelter Systems
- Tentage and Organizational Equipment Systems

COMBAT CLOTHINC AND 1ND1V1DUAL EQUIPMENT	- Lightening the Soldier's Load - Ballistic Protection - NBC Protection - Countersurveillance/Flame/DEW Protection - Environmental Protective Clothing - Microclimate Conditioning Equipment
FOOD ENGINEER1NC AND FOOD SERV1CE EQUIPMENT	- Combat Feeding Systems - Operational Rations - Ration Packaging Systems

Our overall program is planned and prioritized in response to the deficiencies in the Training and Doctrine Command Battlefield Development Plan and is fully coordinated with the user. Its execution is effectively managed using a modern management control system to ensure that the individual soldier's needs are accurately identified and expeditiously addressed.

4. PROGRAM GOALS

Our program goals are to:

Ensure maximum survivability, supportability, sustainability and combat effectiveness of individual soldiers and crews at all times under all environmental conditions.

Be the Center of Excellence for research, development and engineering in combat rations and food service systems, combat clothing and individual protective equipment, tactical shelters and tentage, airdrop systems and organizational equipment.

Achieve major technological and system improvements on highest priority user-relevant programs and expedite fielding of these improvements.

Exploit the worldwide technology base to achieve mission technology superiority.

Plan and conduct technology base programs which support development of Natick's Next Generation/Future Systems (NC/FS) by addressing major technology barriers.

Optimize the use of resources to enhance productivity.

Maintain a cohesive long-range R&D plan and a corporate strategy which achieve and sustain mission superiority.

III. TECHNOLOGY BASE INVESTMENT STRATECY

Technology is the lifeblood of new and improved Army systems and equipment. However, technology can only be an effective force multiplier if the application is fielded quickly. Streamlined acquisition measures are used by Natick to shorten the time between proving a concept feasible and putting a system in the hands of the troops.

Exploiting new technologies to field affordable systems and equipment for the Army is a challenging process, one that is becoming institutionalized at both AMC and TRADOC through comprehensive analysis and long-range planning. The Army's Long-Range Research, Development and Acquisition Plan (LRRDAP), TRADOC Mission Area Development Plan (MADP) and AMC/TRADOC Mission Area Material Plan (MAMP) provide the means for articulating a strategy for overcoming battlefield deficiencies and a rational allocation of resources based on critically of need. The link between mission area strategies and technology base planning is a set of Next Ceneration and Future Systems (NG/FS). Next Generation Systems are those immediately beyond those currently in development, and Future Systems are those in the extended time frame designed to meet Army needs in the year 2000 and beyond.

Natick's technology base investment strategy is composed of four major elements:

1. NEXT CENERATION AND FUTURE SYSTEMS

Approximately 25 percent of our technology base resources (6.1 basic research and 6.2 exploratory development) are currently allocated in support of specific Next Ceneration and Future System (NG/FS). Next Ceneration Systems are the systems that will begin full scale development in the 1990s and will provide a fielded capability into the 21st century. Future Systems are capabilities that would potentially be developed in the early 21st century. For each system, the technological barriers have been identified which could prevent achievement of the capabilities desired. Programs and proof-of-principle demonstrations of prototypes (tech demos) have been structured in a logical, time-phased manner.

2. EMERCINC TECHNOLOGIES

The potential of some emerging technologies is so great that it warrants special visibility and management attention even when its application to a specific system is unclear. About 40 percent of our technology base total resources is dedicated to maturing such high payoff technologies. In the shelters area, our key emerging technologies include new materials technology such as thermoplastics, ceramics and metal matrix composites. Other areas being investigated include a new lightweight integral design that would be adaptable to a variety of shelter sizes and that use a common fabrication process. This will provide a means of minimizing unit and life-cycle costs and provide standardization. In addition, investigations into the use of multifunction components such as an integrated ballistic, thermal, and shock isolation layer in order to reduce parts count, would further simplify fabrication.

3. CHRONIC PROBLEMS

Chronic problems face developers of shelter items, such as integrating full threat protection, power, and environmental control into a composite lightweight shelter. Also developing an affordable fabrication method adaptable to shelters for all vehicles while providing sufficient payload for a variety of users. About 20 percent of our technology base resources are allocated for these kinds of problems to make sure they get the attention they require.

4. SUPPORTING CAPABILITIES

Finally, our investment strategy allocates about 15 percent of resources in support of analytic capabilities. These include front-end analyses (analysis of combat service support in Army 21 operations), modeling and simulations, special purpose equipment, and other infrastructure items that ensure our continuing ability to execute quality R&D programs and act as smart buyers across the entire spectrum of the material life cycle.

IV. SHELTERS

1. OVERVIEW

Natick's Shelter R&D program is directed toward achievement of broad objectives that either improve product performance, improve threat protection, or create new shelter capabilities. The intent of this effort is to develop a family of highly efficient shelters that will meet the Army's needs.

Some overall objectives include:

- Reduction of shelter weight, while accommodating cost constraints, durability, and the shelter's function to provide environmental protection to reduce its carrier burden.

- Tailoring preconfigured designs to produce a standard family of generic military shelters requiring the minimum amount of internal or external user configuration.

- Threat protection--tactical shelters must provide nuclear (blast, overpressure and thermal), chemical protection, and ballistic protection in addition to providing the first line Electro Magnetic Interference (EMI)/Electro Magnetic Pulse (EMP) shield.

Emerging shelter technologies seek to achieve these objectives by applying state-of-the-art techniques, methodologies, and materials to the RDTE process. Accordingly, technical thrusts will be in the area of composite materials, synergistic structural design, test realism, manufacturing, internal/external design, integration of standard subsystem components, lightweight ballistic appliques, hybrid metal composite structures, and flexible EMI shielding materials.

Shelter development within the Army has come a long way since the early 1970's. There is still a challenge ahead, however, especially in the areas of nuclear hardening and shelter system development. With today's emphasis on mobility, threat protection, and with the realities of limited funding, future R&D and production efforts will concentrate on the following:

- Increasing mobility by use of lightweight materials and by elimination of towed generator trailers wherever possible.

- Reducing life cycle cost by having as many sheltered systems utilizing standard generic military shelters, with a standard suite of integrating components. Logistic supportability is enhanced, and individual users of Program Manager (PM) - specific integration efforts are greatly reduced or eliminated.

- Improving threat protection by developing shelters hardened against nuclear, biological, chemical and ballistic threats and which, in addition, are lightweight and easily deployed.

2. TECHNICAL OBJECTIVES

Our technical objectives in the shelters area include:

a. Near Term (current to five years):

- Development of Standard Integrated Command Post Shelter (SICPS) - Rigid Wall Shelter (RWS). This will provide a lightweight Chemically/Biological (CB) and EMI protected shelter system to fit on a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or Commercial Utility Cargo Vehicle (CUCV).

- Development of a New Family of Tents for the 1990's.

- Development of a Family of Lightweight CB Hardened Tents.

- Development of a Five Soldier Crew Tent, which will be lightweight quickly erectable/collapsible and provide environmental protection.

- Development of CB Protective Shelter Systems for highly mobile Battalion Aid Stations (BAS) to CB Hardening of Corps Hospitals.

- Development of a family of Nuclear Hardened Shelters for the HMMWV and medium or heavy wheeled and tracked vehicles. This program is developing the technology for the next generation in nuclear shelters by exploiting lightweight composites, advanced design concepts and fabrication techniques.

- Development of Chemical Biological (CB) Electro-Magnetic Interference (EMI) Hardened Rigid Wall Shelter, which will provide 125 sq ft of EMI-shielded, CB protected, floor space.

- Development of Complexing Kits for Rigid Wall Shelters. These will be comprised of two passageways, International Standards Organization (ISO) Shelter to ISO Shelter and TEMPER Tent to ISO Shelter.

- Development of a Lightweight, Hardened S-280 Shelter, designed to withstand 7 PSI Nuclear Blast, Thermal Radiation and Ballistic Fragments.

- Development of a Chemically Hardened Expandable Rigid Wall Shelter.

- Development of Modular Extendable Rigid Wall Shelter (MERWS) to allow further expansion of usable Shelter space.

- Development of a Night Maintenance Shelter/Tent for repair of helicopters and vehicles.

- Development of an EMI Hardened Expandable Rigid Wall Shelter, which will incorporate EMI shielding into the Army standard Family of ISO RWS's.

b. Mid-Term (5 to 10 years)

- Development of a Fully Hardened Composite Heavy Force Modernization (HFM) Shelter.

- Development of a Lightweight Shelter for medium or heavy wheeled and tracked vehicles.

- Development of large area, quickly erectable, tents for maintenance of fixed wing aircraft and other large area applications.

- Development of CB/Infrared/Thermal Imaging/Radar/Camouflage resistant Tents.

c. Long-Term (10 to 20 years)

- Integrated medium wheeled vehicle Command Control Communication (C3) Shelter System.

- Nuclear Hardened Palletized Loading System (PLS) Shelter.

- Directed Energy Weapons (DEW) Hardened Shelters.

- Next Ceneration Intermodal (Container Ship/C-17 Aircraft) Expandable Shelters.

- Advanced Infrared (IR)/CB/Camouflage Soft Shelter System.

- Heavy Force Modernization (HFM) Common Shelter Module.

- Future Family of Vehicles (FFV) Shelter System.

3. PROGRESS AND ACCOMPLISHMENTS

Natick is responsible for many RDTE programs. Military relevance, quality products, mission productivity, progressive management initiatives, and technical competence are synonymous with our programs, our staff, and our achievements. Through engineering for today, development for tomorrow, and research for the future, we are truly providing the decisive edge for the American soldier. We have, for example, focused our tech base programs toward the technologies needed for Next Ceneration/Future Systems (NG/FS), while still addressing the chronic Army problems, emerging technologies, and required supporting capabilities. Examples of recent accomplishments in the Shelter Systems Area follow.

a. Research Program - During FY88-89 our research program accomplishments included:

- Analytical Modeling of Ballistic Penetration of Composite Laminates

b. Technology Program: During FY88-89, our technology program accomplishments included:

- Completed phase I design studies of Nuclear Hardened HMMWV Shelters, these studies showed that it is possible to build a hardened shelter weighing less than an unhardened shelter. This shelter was subjected to a Defense Nuclear Agency (DNA) simulated nuclear blast test in June 89.

- Completed Ballistic tests of various fiberglass materials. These tests provided a data base for future hardened shelter designs and for retrofits of ballistic armor into existing shelters.

c. Development Program: During FY 88-89 our development program accomplishments included:

- Standard Integrated Command Post System (SICPS), Tent Command Post (TENT CP) (see fig. 1).

SICPS Tent CP provides a standardized command post, which integrates separate components of the CP into a total systems package for fielding and employment. The SICPS Tent CP consists of a tent, two tables, two mapboards, a light set, a 15,000 Btu heater and a Surface Wire Ground System (SWCS).

The SICPS Tent CP was Type Classified (adopted by Army) Limited Procurement Urgent (directed by Army to purchase a limited number for an urgent need) in Feb 87, initial fielding of the SICPS Tent CP was accomplished in Aug 88. Distribution was made to the Light Infantry Divisions and the 10th Mountain Division. A Milestone I/II In-Process Review (Program Decision meeting) was held in Nov 88 at which time the SICPS Tent CP program transitioned (released) to the Full Scale Development (FSD) Phase.

- Five Soldier Crew Tent (FSCT)

The FSCT System is being developed in response to a need for a lightweight, quickly erectable/collapsible crew size tent that will provide environmental protection for combat, combat support, and combat service support units. a Market Investigation of domestic and foreign commercial and foreign military sources has been conducted from which four commercial candidates were chosen. An in-house prototype was also constructed and along with the commercial candidates was further evaluated and tested.

A Milestone I/III IPR (Program Decision meeting) was held for the FSCT resulting in a decision to review a select number of commercial tents. Following this evaluation, one of the tents will be selected for use by the Army.

- Complexing Kits for International Organization for Standardization (ISO) Shelters (see fig. 2).

The Complexing Kits are comprised of two Passageways. Both are designed to provide an environmentally sealed connection between: (1) an ISO Shelter and a Tent Modular Personal (TEMPER) Tent and (2) two adjacent ISO Shelters.

During FY88 deliveries of ISO to TEMPER and ISO to ISO Passageways were made to Deployable Medical Units (DEPMEDS) Units. A Milestone (MS) I/III IPR (Program Decision meeting) to adopt for the Army the Complexing Kit Passageways was held in 4QFY89.

- Standard Integrated Command Post System (SICPS) Rigid Wall Shelter (RWS) (see fig. 3)

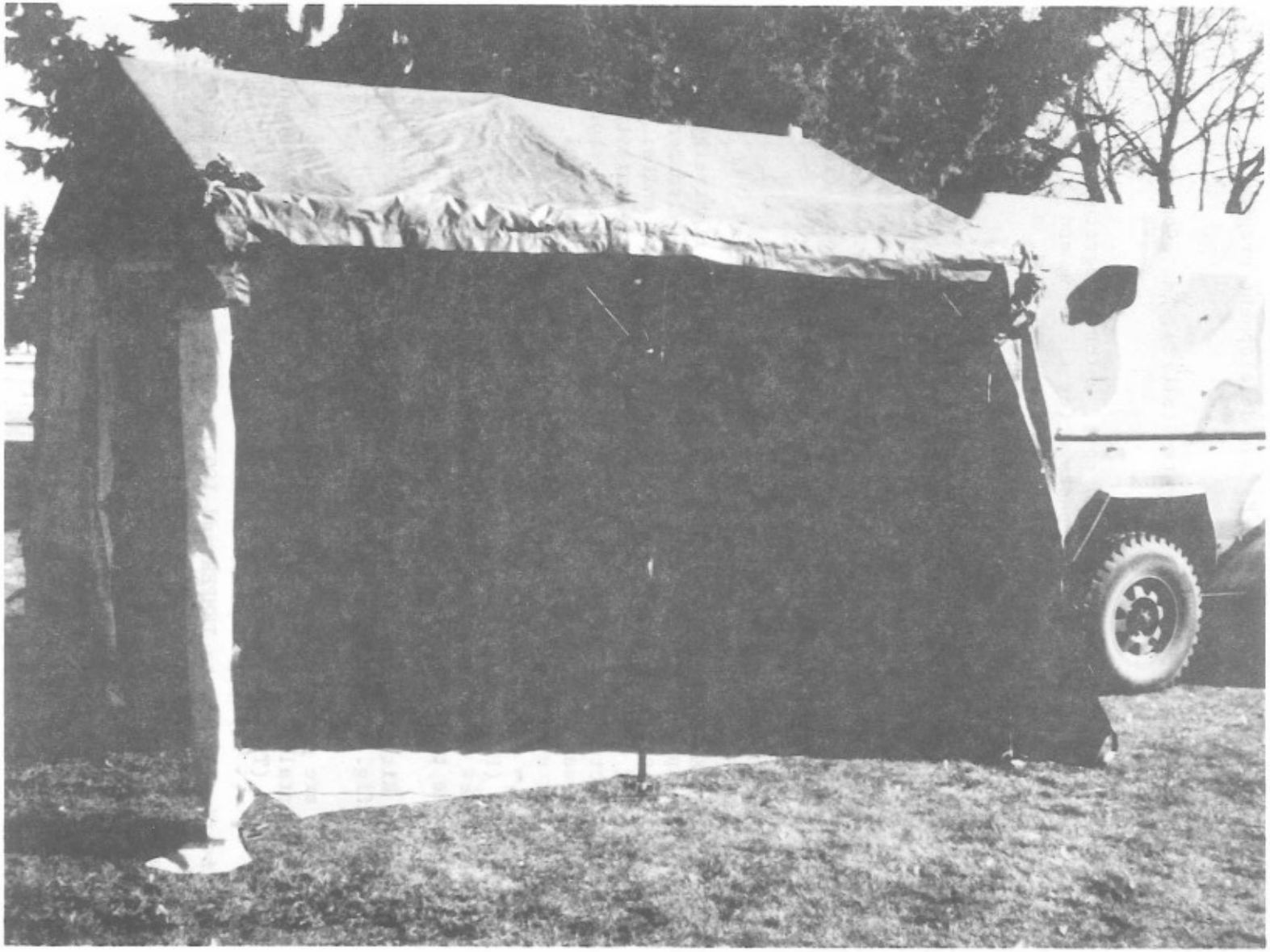

Figure 1. Standard Integrated Command Post System (SICPS)
Tent Command Post (CP)

Figure 2. Complexing Kits

Figure 3. Standard Integrated Command Post System (SICPS)

The objective of this program is to develop a lightweight, Chemical/Biological, (CB) and Electro-Magnetic Interference (EMI) protected shelter system to fit on a HMMWV or CUCV vehicle. These shelters will be fully integrated with power, air conditioning, ventilation, lights, and racks and will be utilized for command, control, communications, and intelligence (C3I) mission.

During FY88, prototype shelters were fabricated by two contractors for technical feasibility testing at Aberdeen and for contractor testing. Testing was conducted on empty and integrated versions of the shelters. One contractor was selected to continue into Phase III of the development contract. A Milestone I/II IPR (Program Decision meeting) will be held in 1QFY90 to transition (release) the SICPS RWS to the Full Scale Development Phase.

- Modular Expandable Rigid Wall Shelter System (MERWS) (see fig. 4)

The objective of this task is to develop a MERWS that will be transported in, stowed within, and readily deployed with the Army Standard Family of Shelters. Each will have sections that interlock and combine to allow further expansion of usable shelter space.

A meeting between representatives from all the agencies involved in testing this program was held in Oct 88 to discuss and evaluate test results. A Milestone 1/II IPR (Program Decision meeting) was held on 14 Mar 89 which released the MERWS into Full Scale Development.

- EMI Hardened Expandable Rigid Wall Shelter (RWS) (see fig. 5)

The objective is to incorporate Electro-Magnetic Interference (EMI) shielding into the Army Standard Family ISO Rigid Wall Shelters.

A Test meeting was held in Oct 88 to discuss and evaluate test results. A Milestone 1/II IPR (Program Decision meeting) was held on 14 Mar 89 which released the EMI Hardened Expandable RWS into Full Scale Development.

- Chemically/Biological Protected Shelter (CBPS) System

The objective of this task is to develop a highly mobile, self-contained collective protection system which can provide a contamination-free working area for medical and other selected units.

First generation prototypes have been constructed and evaluated. Efforts are underway to build second generation prototypes.

- CB/EMI Hardened Non-Expandable Rigid Wall (RWS) ISO Shelter (see fig. 5)

The objective of this task is to provide a capability for the Non-Expandable RWS of the Army Standard Family to the extent required to protect sophisticated communications and computer systems from electromagnetic interference (EMI) and provide a shirt-sleeve environment for equipment operators during chemical/biological (CB) warfare.

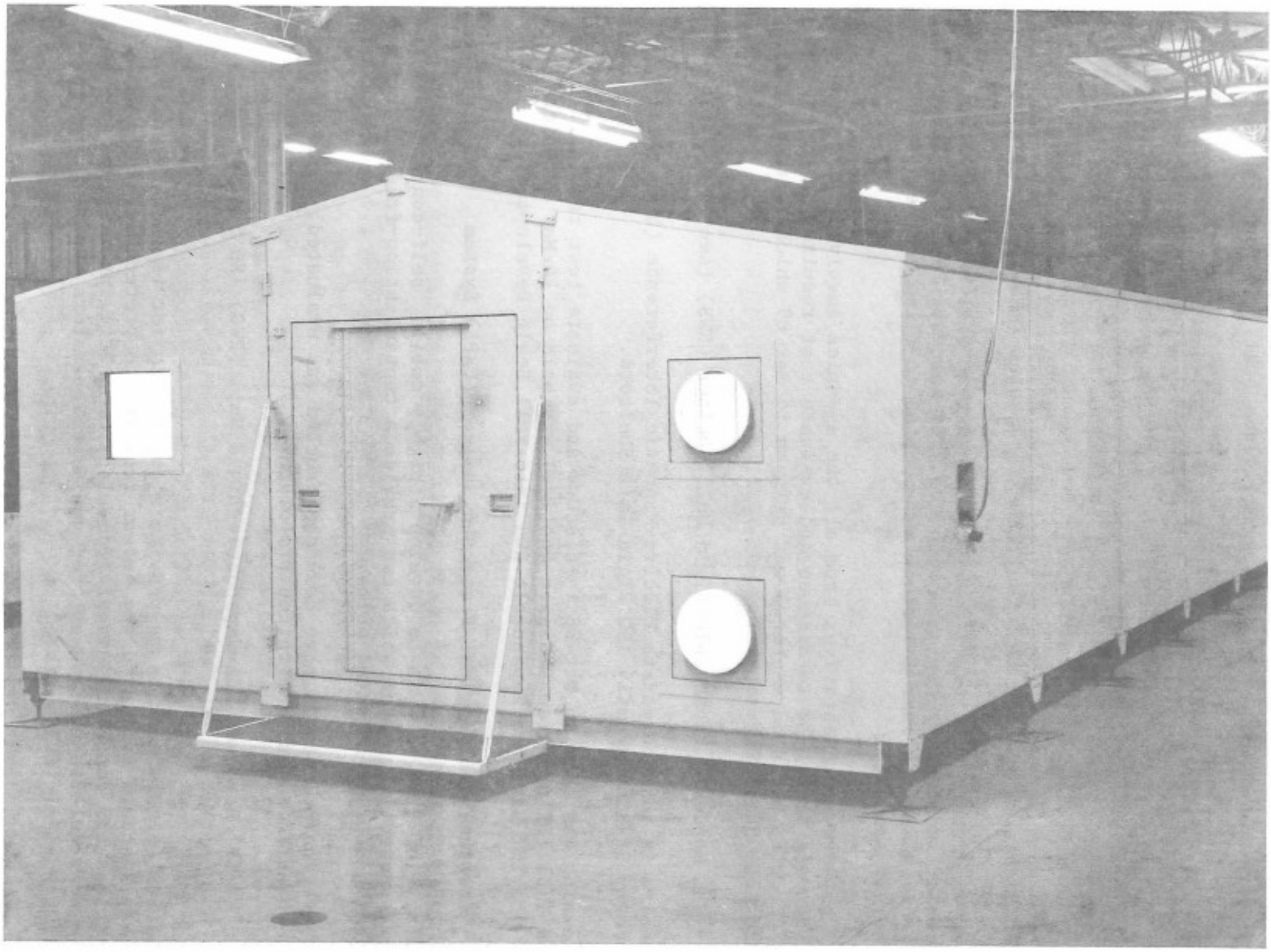

Figure 4. Modular Extendable Rigid Wall Shelter (MERWS)

Completed noise test for Human Factors Engineering (HFE) information and received preliminary test reports from Command Support Test Activity (CSTA). Prepared and staffed to Test Group members updated Program Documents.

- Lightweight Hardened S-280 Shelter

The objective of this task is to develop a shelter with size functional characteristics of the S-280 shelter and the capability to survive 7 psi nuclear overpressure with the attendant thermal pulse.

A redesign was completed to solve some technical problems associated with electrical continuity across the shelter door opening. With these problems resolved, fabrication of the remaining two prototypes has been completed; contractor and technical testing has been initiated.

- Chemical/Biological (CB) Hardened Expandable Rigid Wall Shelter (see fig. 5)

The objective of this task is to provide protection for the one-side expandable and two-side expandable tactical shelter to the extent required to preserve tenant personnel and systems from biological and chemical agents.

First prototype fabrication has been completed. After completion of contractor testing the design was finalized. Final prototype fabrication has been completed and technical tests (user troops) have been initiated.

4. Planned Program

With fiscal restraints, it is imperative that our research, technology, and development program efforts be prioritized to maximize our gains for the individual soldier. To that end, therefore, our planned programs for fiscal year 1990 will be focused on priority areas, and our major objectives include:

a. Research Program

- FY90 Planned Program:

Continue to develop an analytical technique capable of predicting the level of ballistic protection provided by nonmetallic, fiber-reinforced composite laminates used in Tactical Shelters.

Focal Point for Research Program: John M. Calligeros, Telephone (508) 651-4267.

b. Technology Programs

- FY90 Planned Programs:

Continue to develop a set of standard reference measurements for predicting shelter performance of electromagnetic shielding from sample data.

Continue to develop novel composite material design and manufacturing methodologies capable of providing integrated protection against all components of Nuclear Biological Chemical (NBC)/Ballistic threats.

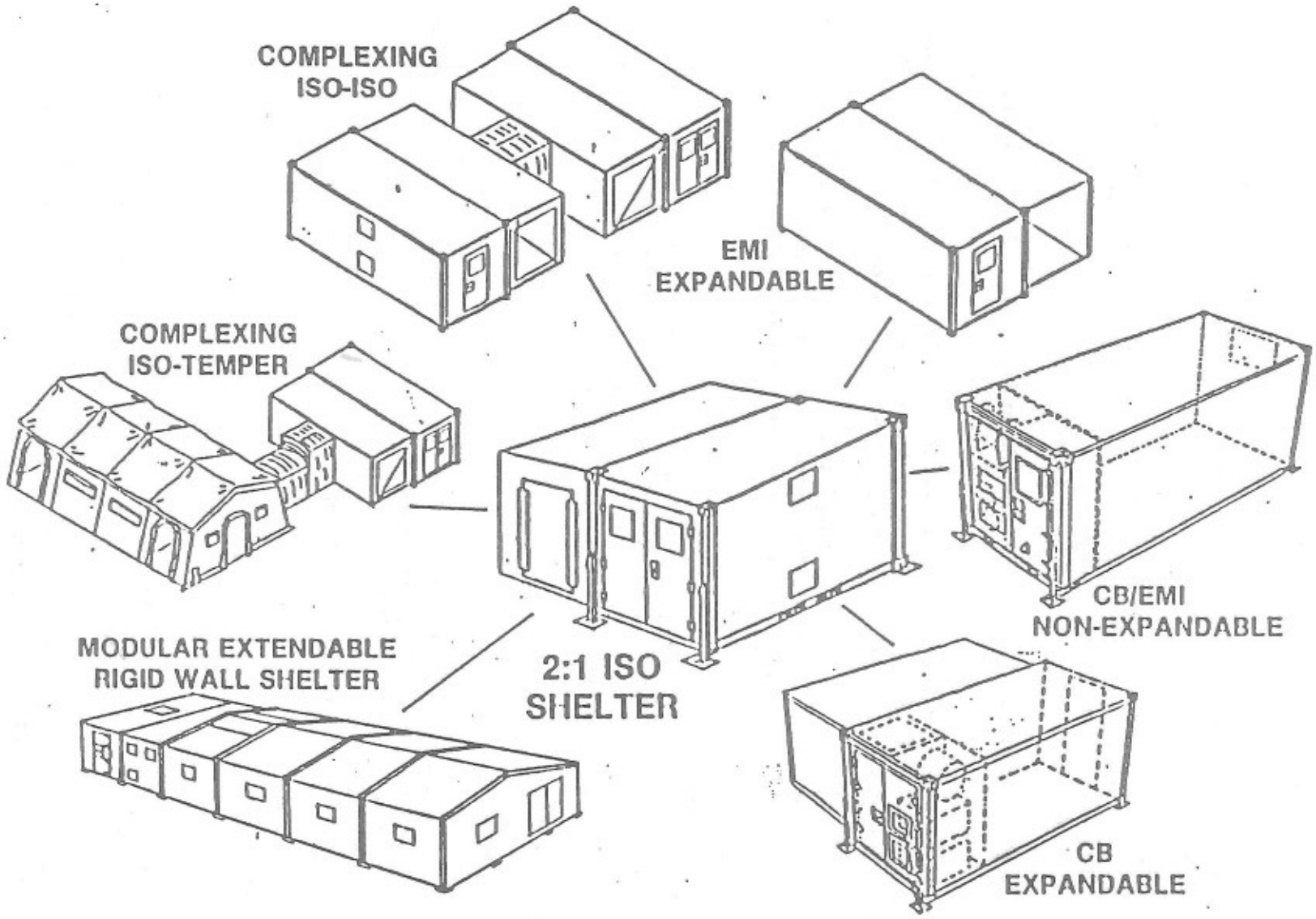

Figure 5. International Organization for Standardization (ISO) Shelters

Continue to develop a program to solve the heat/fluid equations which govern temporal and special distribution of heat, moisture and chemical agent inside a tent as a function of exterior environment and chemical threat.

Complete phase I of ongoing work to identify candidate chemically resistant materials to be used as the outer skin on Chemically and Biologically Protected Shelter (CBPS).

Continue to investigate, design and test various gasket concepts for providing EMI/Radio Frequency Interference (RFI) protection of Tactical Shelter Door joints.

- FY91 Planned Programs:

Investigate concepts for improving pressurized beam designs.

Continue to investigate various gasket concepts for EMI/RFI protection of Tactical Shelter Door joints.

Focal Point for Technology Program: Mr. John M. Calligeros, Telephone (508) 651-4267.

c. Development Program

- FY90 Planned Programs:

Begin the Full Scale Development Phase of the SICP RWS program. Have test prototypes fabricated for testing.

Complete testing of five candidate Five Soldier Crew Tents. Select the final model for TC Standard. Prepare the detailed spec to complete the Technical Data Package (TDP) and forward it to the Defense Logistics Agency (DLA) for procurement.

Complete developmental tests for the Lightweight Hardened S280 Shelter. Review test reports and coordinate preparation of Independent Assessment/Evaluation Reports, and conduct a Milestone (MS) III 1PR (Program Decision meeting) to adopt the item.

Complete the Technical Tests with User Troops for the Chemically Hardened Expandable RWS. Update the program documentation, the Acquisition Strategy (AS) and Test and Evaluation Master Plan (TEMP) for MS III 1PR (Program Decision meeting to adopt this item).

Procure prototypes for the Full Scale Development (FDS) phase of the Modular Expandable RWS (MERWS). Begin Technical Tests with User Troops.

Complete Preproduction Test (PPT) for the EMI Hardened Expandable RWS. Receive and review test reports and the lndependent Evaluation Report (lER)/lndependent Assesment Report (IAR).

Complete Fabrication of the second generation CBPS prototypes.

Continue with the development of the SICPS Tent CP. Prepare the program documentation and complete testing in preparation for a MS III IPR (Program Decision meeting) scheduled for 30 Sep 90.

- FY91 Planned Program:

Continue on with the Full Scale Development (FSD) Phase of the SICP-RWS with an estimated MS III IPR (Program Decision meeting) for 1QFY91.

Complete IPR package documentation for the Chemically Hardened Expandable RWS. Conduct the MS III IPR (Program Decision meeting) to adopt the Chemically Hardened Expandable RWS in the 1QFY91.

Continue with the FSD Phase of the Modular Extendable RWS (MERWS). Conduct Technical Test with User Troops and review Test Reports.

Update program documentation (AS, TEMP) for the EMI Hardened Expandable RWS. Prepare Technical Data Package and conduct the Milestone III IPR (Program Decision meeting) in the 2QFY91.

Focal Point for Development Program:

a. Mr. Arthur Murphy, Telephone (508) 651-5246, For Tactical Shelters Systems, Generally.

b. Mr. Frank Barca, Telephone (508) 651-5306, For Tentage & Organizational Equipment, Generally.

V. MAJOR TECHNOLOGICAL BARRIERS

The major technological barriers that must be overcome to achieve near-to mid-term Shelter Program objectives include:

a. Integrated Full Treat Protection:

Achievement of a novel, lightweight Shelter (design and materials) that will provide protection against nuclear blast, nuclear thermal pulse electromagnetic pulse (EMP), electromagnetic interference (EMI), NBC and ballistic threats, including synergistic effects. Primary structure, not appliques, must provide total threat protection.

b. Minimum Weight Shelter Design:

Achievement of a shelter (design and materials) that provides full threat protection while minimizing weight in order to offer the maximum available payload for the systems transported in the shelter. The HMMWV has a very limited payload. The design must also provide protection against severe life-cycle field environment and handling requirements while achieving minimum weight.

c. Affordable Integrated Design and Fabrication Techniques:

Development of techniques to minimize shelter system cost in order to achieve a full threat protection and mobility at a price acceptable to C3I and other system project managers.

VI. PROGRAM RELATIONSHIPS AND INTERACTIONS

Natick interacts with other Services and Government agencies to meet technology needs. Examples of these are listed below.

- U.S. Army Armament RD&E Center, NJ, provides film for adhesive R&D and aluminum skin preparation for hot bonding panels.

- National Institute of Standards & Technology, MD, provides paint coating nondestruction test development.

- U.S. Army Belvior RD&E Center, VA, (BRDEC) provides paint Research and Development and camouflage pattern definition. It also provides advice on Environment Control Units (ECU's) & Ancillary Power Units (APU's) and power requirements.

- U.S. Army Tropic Test Center, Republic of Panama, performs special studies on five-year tropic exposure test of standard shelter panels.

- Wright-Patterson AFB, OH, provides shelter materials research.

- U.S. Army Chemical RD&E Center (AMCCOM), MD, provides CB agent decontamination equipment/procedure definition for shelter and airfiltration equipment development.

- U.S. Army Materials Technology Laboratory, MA, provides Ballistic R&D

- U.S. Army Harry Diamond Lab (HDL), MD, provides Nuclear Effects R&D.

- Shelter Repair and Integration Work is performed by:

  a. Tobyhanna, PA, Army Depot

  b. Sacramento, CA, Army Depot

  c. McClellan AFB, CA, Shelter Repair Facility

  d. Naval Air Station, Norfolk, VA, Shelter Integration Facility

- Shelter Testing is performed at:

  a. Combat Systems Test Activity, Aberdeen Proving Grounds,MD, Ground Mobility/Environmental

  b. HDL, MD, EMI/EMP Shelter testing and Evaluation simulator

  c. White Sands, NM, for Nuclear Blast/Thermal Pulse Testing

  d. U.S. Army Corp of Engineers, Waterways Experiment Station, NY, supplies instrumentation for simulated Nuclear Blast Test

e. Ballistics Research Laboratory (BRL), MD, Shock Tube test for Nuclear Shelter Components

f. Yuma Proving Ground, AZ, for hot-dry testing

- U.S. Army Combined Arms Combat Development Activity, KA, is the proponent for the Standardized Integrated Command Post System (SICPS).

- U.S. Army Test and Evaluation Command, MD, provides technical testing for shelter programs.

- U.S. Army ATCCS Experiment Station, WA, provides test bed activity to test equipment to go in the SICPS.

- U.S. Army Communication and Electronics Command, NJ, develops systems that will be used in the SICPS.

- U.S. Army Cold Region Test Center,AK, provides cold weather tests for Development Test (DT) I and DT II and customer tests.

- U.S. Army Tropic Test Center, Panama, conducts hot humid test for production prove out and customer testing.

- U.S. Army Human Engineering Lab, MD.

- Defense Personnel Support Center (DPSC), PA, performs all the major buys for tentage items.

- Defense Technical Information Center, VA, provides reports, data etc., on technical information.

- U.S. Army Foreign Science and Technology Center, VA, provides information and items from foreign countries for evaluation.

- Army Shelter User Representatives:

a. U.S. Army Quartermaster School, VA

b. U.S. Army Chemical School, AL

c. Office of The Surgeon General, MD

Our interactions with industry and market surveillance are ongoing processes, which are enhanced by the active participation of our official Natick representatives to many nongovernmental technical committees, and the active membership of Natick employees in national scientific and technical associations/societies.

In addition, we formally interact with industry during several key events in the R&D life cycle, e.g., at the time of formulation of the requirement document, when conducting a market analysis, during the preparation of specifications and standards, and the preparation of standardization program analyses/plans.

We are also active participants in the Independent R&D Program, the Army Information for Industry Program (including the Army Potential Contractor Program, the use of Broad Agency Announcements and Advanced Planning Briefings for Industry), the Unsolicited Proposals Program, and the Small Business Innovative Research Program.

APPENDIX

NEXT GENERATION AND FUTURE SYSTEMS

It is planned that in the future approximately 50 percent of our technology base resources (6.1 basic research, and 6.2 exploratory development) will be allocated in support of specific Next Generation and Future Systems. Next Generation Systems are the systems that will begin full-scale development in the 1990's and will provide a fielded capability into the 21st century. Future Systems are capabilities that would potentially be developed in the early 21st century. For each system, the technological barriers have been identified that could prevent achievement of the capabilities desired. Programs and proof-of-principle demonstrations of prototypes (tech demos) have been structured in a logical, time-phased manner.

NEXT GENERATION SYSTEM

Survivable Command Post (CP) System

a. Command Control Communications Intelligence (C3I) Shelter Module Heavy Force Modernization (HFM).

b. High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) Shelter CP.

TITLE: C3I Shelter Module - HFM

SYSTEM DESCRIPTION: A lightweight full threat protection system for the medium variant of HFM will be developed for C3I and other functions, such as CP, medical, and IEW. This highly mobile modular system will be designed to accommodate additional ballistic applique protection, as required, for specific functions. This add-on armor will provide protection for anti-armor, small arms and fragmentation. The common module design will allow for maximum protection/ identical signature for various mission modules.

OPERATIONAL USE AND BENEFITS: This common module design will meet a variety of system applications without requiring special module shapes or internal configurations. The common module configuration will provide maximum protection/identical signature for each function. The applique concept for ballistic protection will allow for tailoring the level of protection for the specific threat to be addressed.

IMPROVEMENT TO CURRENT WARFIGHTING CAPABILITY: The system will be designed to be part of the HFM medium variant. It will increase survivability through use of composites with applique armor adjusted to the threat and commonality of appearance. lt will be adaptable to various mission configurations without significant modification.

TECHNOLOGY BARRIERS:

- Integrated full threat protection.

- Affordable integrated design and fabrication techniques.

Technical Barrier Descriptions for C3I Shelter Module - HFM

TECH BARRIER TITLE: Affordable Integrated Design and Fabrication Techniques

DESCRIPTION: Development of techniques to minimize shelter system cost in order to achieve a full threat protection and mobility at a price acceptable to C3I and other system project managers.

TECH BARRIER TITLE: Integrated Full Threat Protection

DESCRIPTION: Achievement of a novel, lightweight shelter (design and materials) that will provide protection against nuclear blast, nuclear thermal pulse electomagnetic pulse (EMP), electromagnetic interference (EMI), NBC and ballistic threats, including synergistic effects. Primary structure, not appliques, must provide total threat protection.

POINTS OF CONTACT:

- Mr. Arthur Murphy, STRNC-US, AV 256-5246, Commercial (508) 651-5246.

TITLE: HMMWV Shelter CP.

SYSTEM DESCRIPTION: A lightweight shelter system resistant to nuclear blast, thermal pulse, EMP/EMI, chemical agents and fragmentation will be developed utilizing composite design and manufacturing. Outriggers will prevent overturning. The CP will include integrated racks, ECU, power generation, collective protection and Local Area Network for communication and data transmission.

OPERATIONAL USE AND BENEFITS: The shelter will be designed for 10 PSI overpressure and will weigh less than 50% of current prototype hardened small shelters. With outriggers, the fully hardened shelter will weigh no more than unhardened integrated command posts currently under development. An engine/generator/ECU synergistically designed system will weigh less than 50% of current available power generation/ECU systems.

IMPROVEMENT TO CURRENT WARFIGHTING CAPABILITY: The system will provide a highly mobile, versatile, low profile CP for tactical operations and will provide increased survivability due to enhanced mobility, collective protection capability and commonality of appearance.

TECHNOLOGY BARRIERS:

- Integrate full threat protection in a lightweight composite shelter.

- Develop an affordable fabrication method adaptable to shelters for other vehicles.

- Develop a survivable shelter for the HMMWV that provides sufficient payload for a variety of users.

Technical Barrier Descriptions for HMMWV Shelter CP

TECH BARRIER TITLE: Integrated Full Threat Protection

DESCRIPTION: Achievement of a novel, lightweight shelter (design and materials) that will provide protection against nuclear blast, nuclear thermal pulse electromagnetic pulse (EMP), electromagnetic interference (EMI), NBC and ballistic threats, including synergistic effects. Primary structure, not appliques, must provide total threat protection.

TECH BARRIER TITLE: Affordable Integrated Design and Fabrication Techniques

DESCRIPTION: Development of techniques to minimize shelter system cost in order to achieve a full threat protection and mobility at a price acceptable to C3I and other system project managers.

TECH BARRIER TITLE: Survivable HMMWV Shelter with Sufficient Payload

DESCRIPTION: Achievement of a shelter (design and materials) that provides full threat protection while minimizing weight in order to offer the maximum available payload for the systems transported in the shelter. The HMMWV has a very limited payload. The design must also provide protection against severe life-cycle field environment and handling requirements while achieving minimum weight.

POINT OF CONTACT:

- Mr. Arthur Murphy, STRNC-US, AV 256-5246, commercial (508) 651-5246.

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