

USAMRMC Products Portfolio



U.S. Army Medical Research and Materiel Command

Vision:

We deliver the best medical solutions—for today and tomorrow—to enhance, to protect, and to treat and heal the warfighter on point for the Nation: the backbone of the joint biomedical research and materiel community.

Missions:

- Provide medical knowledge and materiel that supports the Warfighter across the full spectrum of health care missions worldwide
- Provide medical knowledge and materiel lifecycle management and execution for the Warfighter across the full spectrum of health care missions worldwide
- Partner with other military and government agencies, academia, and private industry
- Specific functions:
 - o To advance research, development, and acquisition of knowledge and medical products.
 - o To deliver, maintain, and dispose medical equipment and supplies.
 - o To provide health facility capital investment and life cycle management expertise.
 - o To develop, deploy, operate, and sustain medical IM/IT systems.



USAMRMC Products Portfolio

U.S. Army Medical Research and Materiel Command

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Introduction



USAMRMC

The nation's military forces may be called to serve anywhere in the world during times of conflict or in peacetime. Among the threats our forces face are injury from combat operations, exposure to chemical or biological warfare agents, environmental extremes, and endemic diseases not common in the United States. To provide warfighters defenses against these hazards and sustain their health is the goal of the U.S. Army Medical Research and Materiel Command (USAMRMC).



A complex and diverse organization, the Command sustains the health and fighting ability of Soldiers, Sailors, Airmen, and Marines through its programs in medical research, medical materiel development, medical logistics and facility planning, medical information systems, and development of new technologies to improve military health care on the battlefield. The Command is engaged in a broad spectrum of activity, from basic research in the laboratory to innovative product acquisition and the fielding and life-cycle management of medical equipment and supplies for deploying units.

Six laboratories make up the Command's core science and technology capability. They are centers of excellence in specific areas of biomedical

research, staffed by highly qualified military and civilian scientists and support personnel. A large extramural contract research program and numerous cooperative research and development agreements with leading research and development organizations in the civilian sector complement the Command's in-house science and technology capabilities. For instance, the USAMRMC Office of Congressionally Directed Medical Research Programs (CDMRP) manages targeted biomedical research programs mandated by Congress. An important program within CDMRP is the Peer Reviewed Medical Research



Program, which manages projects aimed directly in support of military health and well-being. Many of the projects funded by the Peer Reviewed Medical Research Program have begun to yield combat health support technologies and products.

This portfolio provides a comprehensive listing of the products the USAMRMC provides or plans to deliver to protect and treat warfighters who serve the nation. Products the Command develops fall into the following groups in this portfolio: Military Infectious Diseases, Combat Casualty Care, Military Operational Medicine, Medical Chemical and Biological Defense, Advanced Technologies and Information Technology/Information Management, and Logistics and Facilities. An overview of each group's mission and challenges precedes the group's current product listing.

Case studies on completed projects also appear in each chapter to highlight the many ways the Command adds products to its portfolio.



For example, one product may take the Small Business Innovation Research route, another may be the result of a Cooperative Research and Development Agreement. The section that begins on page xix entitled “Work With Us” offers additional insight on how researchers and businesses can craft working relationships with the Command.

Products are described as completed, promising, or future. Completed products in the portfolio are examples of the Command’s success stories. They have made it through the advanced development process and into the procurement system and can be purchased by units. Promising products are those closest to being put in a service member’s hands. These are products that have crossed the boundary from the laboratory to advanced development. For example, vaccines and drugs in clinical trials and devices that are being evaluated and modified to fit users’ needs are considered promising. One caveat is necessary here: When a vaccine or drug moves to the different phases of clinical trials, planners expect certain fail rates. For example, half of the drugs in Phase 1 trials do not make it to Phase 2, and a third do not make it from Phase 2 to Phase 3. Future products are in basic research in the laboratories. Some are in their early stages; some are awaiting funding to make the leap into advanced development.

Three appendices also provide valuable information on the Command's products. To give the reader an appreciation of advances the Command's scientists have made over the years, Appendix A lists the patents the Command holds or held before they expired as well as a list of current licensing agreements. Appendix B provides a list of some of the commercial off-the-shelf technology the Command has fielded to support the warfighter. Appendix C lists Small Business Innovation Research projects that are in Phase II and intended to result in a dual-use technology, product, or service. Appendix D provides a list of acronyms that are used throughout the book.

Work with Us— Research Opportunities

Researchers who want to work with the Command have numerous options.

Submit a Proposal

USAMRMC funds a broad range of extramural research programs.

Awards are usually contracts, grants, or cooperative agreements. Research proposals can be submitted to the Command through the USAMRMC Broad Agency Announcement (BAA), which is continuously open, or through special USAMRMC BAAs, which are open for limited time frames.



Examples of programs with special announcements are the Breast Cancer Research Program, the Prostate Cancer Research Program, and Gulf War illness.

Additional information, the USAMRMC BAA, and open special USAMRMC BAAs can be obtained at www.usamraa.army.mil by selecting the “BAA” button.

The research funding opportunities listed below are explained on the USAMRMC web site at <https://mrmc.detrick.army.mil>.

- ◆ The Army Small Business Innovation Research program is a contract program for small businesses supporting defense and commercial applications. The Army advertises its interest in specific research topics, and small businesses offer proposals addressing topics. Successful proposals are awarded Phase I support for 6 months, and successful Phase I projects compete for 2 years of additional support in Phase II.
- ◆ The Office of the Secretary of Defense Small Business Innovation Research program is a contract program for small businesses supporting defense and commercial applications. The Office of the Secretary of Defense advertises its interest in specific research topics, and small businesses offer proposals addressing topics. Successful proposals are awarded Phase I support for 6 months, and successful Phase I projects compete for 2 years of additional support in Phase II.
- ◆ The Chemical–Biological Small Business Innovation Research program is limited to chemical and biological defense topics.
- ◆ The Small Business Technology Transfer Research program is a companion program to the Small Business Innovation Research Program. It differs only in the requirement that work must be performed by small businesses in collaboration with nonprofit research organizations.



- ◆ The Defense Experimental Program to Stimulate Competitive Research promotes defense-related research and development in states not traditionally receiving significant amounts of federal support for science and engineering.
- ◆ The Dual Use Science and Technology program is a contract program for industry under which the performing company provides at least half of a project's total cost.
- ◆ The Commercial Operations Support and Savings Initiative program inserts new commercial technologies into fielded military systems to lower support costs.
- ◆ The Warfighter Rapid Acquisition Program is used for purchasing limited quantities of prototype equipment or systems to provide initial operational capability, continue evaluation, or complete development.
- ◆ The Soldier Enhancement Program identifies and evaluates commercially available items to increase the effectiveness of individual warfighters.
- ◆ The Concept Experimentation Program evaluates new technology, materiel, or concepts either in field demonstrations or, less often, as written analyses.

For questions about these funding programs, call the USAMRMC Plans and Programs Office at 301-619-3354.



Business Opportunities

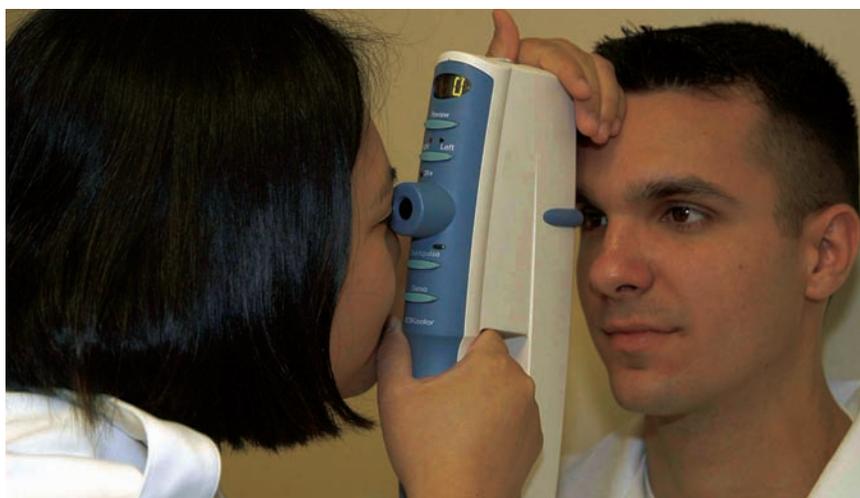
Businesses have several ways of pitching products to the USAMRMC.

New Products and Ideas Web Site

The Command recognizes that unsolicited proposals with unique and innovative products or ideas that have been developed outside of the government can help the Command accomplish its missions. To submit a new product or idea for consideration, visit www.usamraa.army.mil and click on the “Submit a New Product or Idea” button.

Small Business Programs

The Command has experienced firsthand how small businesses can deliver a required product or service on time, in the right quantity, and at a fair and reasonable price. Whether the procurement is a micro-purchase via a government credit card or a multi-million dollar contract, the Command has reaped many benefits from its formal arrangements with small businesses. The Command makes a concerted effort to forge strategic alliances with various small businesses that offer innovative products, quality services, and dynamic business solutions in support of many Department of Defense initiatives.





According to Department of the Army metrics, during the past 2 years, the Command has been successful in exceeding the mandated goal of awards made to small businesses. Visit the Office of Small Business Programs web site at www.mrmc.smallbus-ops.army.mil to learn more about how small businesses can work with the Command.

Vendor Days

The U.S. Army Medical Materiel Agency, along with other medical professionals at Fort Detrick, Maryland, routinely set aside dates called Vendor Days for medical equipment and supply vendors to display products to multiple organizations at one time. For more information on Vendor Days, click on the Command web site at <https://mrmc.detrick.army.mil>.

Technology Transfer

The Command's Technology Transfer Office coordinates all intellectual property licensing from the federal sector to nonfederal parties on behalf of all the Command's subordinate laboratories.

Visit the technology transfer web site at <https://technologytransfer.detrick.army.mil> to discover technology available for licensing through issued patents and published pending patents. Appendix A also provides a list of current licensing opportunities.

If you are unable to locate a technology or if you would like to find out more about a specific area, please contact us for further information:

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Military Infectious Diseases



Overview

Infectious diseases debilitate service members and can influence battle outcome. Infectious diseases in the military cause lost duty time; increase the medical logistical burden for diagnosis, treatment, and evacuation; and decrease combat effectiveness.

Many hospital admissions among U.S. service members in Vietnam were attributed to infectious diseases, including malaria, dengue, scrub typhus, and Japanese encephalitis. Dengue and malaria caused hospitalizations in Somalia, and dengue and diarrhea afflicted troops in Haiti. Diarrhea remains a major cause of illness among deployed service members supporting Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom in the Persian Gulf. Additional infectious disease threats to service members include hepatitis, leishmaniasis, meningococcal disease, human immunodeficiency virus (HIV), hantavirus infections, and other hemorrhagic fever viruses. Many environments to which service members deploy harbor specific infectious disease hazards.

The Military Infectious Diseases Research Program (MIDRP) focuses on prevention, diagnosis, and treatment of naturally occurring disease-causing microorganisms with major potential to reduce mission effectiveness. Research emphasis includes the following:

- ◆ Developing vaccines against infectious diseases important to the U.S. military,
- ◆ Discovering and developing drugs to prevent and treat militarily relevant infections,
- ◆ Creating techniques to identify disease-causing microorganisms and diagnose infections rapidly,
- ◆ Collecting and analyzing epidemiological data to optimize infectious disease control strategy, and
- ◆ Evaluating methods to control vectors (insects and arthropods that carry disease-producing microorganisms) of relevant infectious diseases.

The program is enhanced by numerous facilities, including eight infectious disease research laboratories around the world, accredited animal and biosafety level four containment laboratories, a pilot vaccine facility, and clinical trials units. Most of the associated 330 scientists employed by the military, civil service, or contracting companies have advanced degrees. The program maximizes research dollars by collaborating with industry and universities through more than 100 cooperative research and development agreements.

Vaccines

The discovery and development of vaccines to protect the warfighter are priorities for the MIDRP. Vaccines can be administered prior to deployment and provide long-term protection, thereby reducing disease incidence and the associated medical logistics burden (which includes transportation of preventive countermeasures to prevent illnesses for which no vaccines are available as well as medical equipment for ill warfighters). The U.S. military's infectious diseases program has played a significant role in the development of eight licensed vaccines:



- ◆ Rubella (1969),
- ◆ Adenovirus 4 & 7 vaccines (1980),
- ◆ Tetravalent meningococcal vaccine (1981),
- ◆ Hepatitis B vaccine (1981),
- ◆ Oral typhoid vaccine (1989),
- ◆ Japanese encephalitis vaccine (1992), and
- ◆ Hepatitis A vaccine (1995).

More than half of the vaccines routinely given to service members were co-developed by the military. Development of other vaccines was supervised by investigators who began their careers at military research centers (e.g., yellow fever vaccine by former Army Surgeon General William Gorgas; mumps, measles, and varicella vaccines by Maurice Hilleman; and oral polio vaccine by Albert Sabin). Vaccines currently in advanced development stages include new adenovirus vaccines, as well as vaccines for dengue and hepatitis E.

Drugs

The MIDRP has contributed to the development of most of the synthetic drugs licensed in the United States for the prevention and treatment of malaria, including:

- ◆ Chloroquine (1949),
- ◆ Primaquine (1952),
- ◆ Chloroquine-primaquine (combined drug, 1969),
- ◆ Sulfadoxine-pyrimethamine (1983),
- ◆ Mefloquine (1989),
- ◆ Doxycycline (1992),
- ◆ Halofantrine (1992), and
- ◆ Atovaquone-proguanil (2000).

MIDRP researchers also developed the current dosing regimen for treating cutaneous leishmaniasis with the drug pentostam.

Diagnostics and Vector Control

MIDRP products include fieldworthy devices to diagnose human infections rapidly (such as leishmaniasis and malaria) and determine if insects are carrying infectious agents transmissible to humans (such as malaria parasites and West Nile virus). Additional products include insect repellents, a camouflage face paint/insect repellent, and computer-based systems to identify insects capable of transmitting human diseases.



Other Contributions

Licensed products reflect only a small portion of the contributions of the U.S. military to infectious diseases research. Contributions range from the demonstration that yellow fever was transmitted by a virus by Major Walter Reed in 1900 to the treatment of cholera by Captain R.A. Phillips in the 1940s (which led to the development of oral rehydration solution) to the publication of the complete malaria genome in 2000. U.S. military physicians have authored and coauthored thousands of research publications elucidating the etiology, ecology, epidemiology, and pathophysiology of many infectious diseases, leading to effective treatment and control measures. Additionally, long-term deployment of military scientists to Department of Defense (DoD) laboratories in the tropics over the past 100 years has accelerated scientific discoveries and product development and assisted technology transfer of research techniques and tropical disease control measures to developing countries.



Specific MIDRP Areas

Diarrheal Diseases

Diarrhea afflicts up to 50 percent of troops deployed to high-risk areas. Currently, no guaranteed protective measures exist, and the global problem of antimicrobial-resistant, diarrhea-causing microorganisms may limit treatment options. Candidate vaccines for major causes of bacterial diarrhea, including enterotoxigenic *Escherichia coli* (ETEC), *Shigella*, and *Campylobacter*, are being developed and evaluated by the MIDRP.

Drugs to Prevent and Treat Malaria

Malaria is rated the most important infectious disease threat facing U.S. troops worldwide. Malaria may cause severe illness and death among U.S. service members sent to tropical and some subtropical regions. The malaria threat is exemplified by the experience of 225 Marines briefly deployed to Liberia in 2003. Falciparum malaria was identified in 80 Marines, and 5 persons were noted to have severe and complicated infections. The MIDRP is developing new drugs to prevent infection and accelerate recovery from severe and multidrug-resistant infections. Because malaria parasites eventually develop mechanisms to resist the effect of antimalarial drugs, each drug is only useful for approximately 10–15 years, necessitating continuous replacement drug development efforts.



Malaria Vaccines

The MIDRP is developing vaccines to protect against *Plasmodium falciparum* and *P. vivax* as a long-term solution for the most significant infectious disease threat to U.S. forces. A vaccine will improve operational capabilities by minimizing malaria casualties and potentially decreasing the need to use malaria drugs thus avoiding drug-associated side effects and compliance issues. The medical logistic burden associated with the need for administration of drug prophylaxis, and medical diagnosis, evacuation, hospitalization, and intensive treatment will be reduced.

Malaria Genome Project

MIDRP researchers, in collaboration with partners, successfully completed genome sequencing of the malaria parasites *P. falciparum*, *P. vivax*, and *P. yoelii*. Application of these results will aid in the discovery of drugs and vaccines to prevent and treat malaria.



Dengue Fever Vaccine

Dengue fever is a painful viral disease caused by a bite from an infected mosquito. Dengue is a leading cause of hospital admission in units operating in the tropics. There is currently no vaccine or drug to prevent the disease. The MIDRP manages a program focusing on pathogenesis studies, diagnostics, and vaccine development to protect against the four types of dengue virus.

Leishmaniasis

Leishmaniasis is a disease caused by protozoan parasites of the genus *Leishmania* transmitted by phlebotomine sandflies that has afflicted more than 1,500 U.S. service members stationed in Iraq. Leishmaniasis includes a wide spectrum of illnesses ranging from the self-healing cutaneous form to a life-threatening visceral disease. This program is focused on diagnostic assays to detect active *Leishmania* infection in theater, diagnostic assays to detect latent *Leishmania* infection in troops deployed in the endemic area (with concern for blood supply), and licensing a U.S. Food and Drug Administration (FDA)-approved, systemic, nonparenteral treatment for cutaneous leishmaniasis.

Scrub Typhus Vaccine

Scrub typhus is caused by a bite from an infected mite or chigger and can cause fever and rash with a long convalescence or death. The disease is prevalent in Asia, Australia, and many Pacific Islands. Outbreaks occurred in the U.S. military in 2001. The MIDRP is developing a vaccine that can protect individuals from multiple strains of scrub typhus.



Meningococcus Type B Vaccine

Meningitis is a bacterial disease transmitted by human aerosol and is potentially life threatening or permanently debilitating. The threat to service members primarily occurs during basic training but is also prevalent in sub-Saharan Africa, South America, and Asia. Even a single case can be disruptive to troops. The DoD successfully developed meningococcal vaccines for types A, C, Y, and W-135. The MIDRP effort is now focused on type B.

Lethal Virus Countermeasures

Hantaviruses are usually transmitted to humans via aerosols created by infected rodent excreta. The four distinct hantaviruses that cause hemorrhagic fever with renal syndrome (HFRS) are endemic throughout Asia and Europe. There have been thousands of occurrences of HFRS causing illness (often necessitating evacuation and extensive long-term care) and death in U.S. troops. The MIDRP is pursuing DNA vaccines to prevent HFRS as well as methods to prevent and treat other hemorrhagic viruses such as Lassa fever and Rift Valley fever.

Diagnostic Systems

There is an urgent demand for fieldworthy methods to rapidly diagnose infectious diseases. This is particularly relevant given concerns about biological warfare. Timely and accurate diagnosis will permit appropriate medical treatments and other protective measures. MIDRP scientists are developing scientific assay sets suitable for a variety of assay platforms.



Identification and Control of Insect Vectors

Seventy percent of deployed military personnel experience problems related to biting insects. The current military repellent is a greasy compound that dissolves plastic, is removed by abrasion or wetting, and is not popular with U.S. service members. The MIDRP is developing a new standard military insect repellent that is effective and has improved acceptability.

Military HIV Research Program

Military personnel can become infected by HIV via blood transfusions, accidental blood exposure while providing humanitarian assistance, or sexual exposure. HIV impacts troop strength of U.S. and allied forces and the political and economic stability of developing nations. Research focuses on the development of a global HIV-1 vaccine. Field sites have been established in Uganda, Kenya, Tanzania, and Thailand. Research management is shared by the MIDRP, advanced development programs of the U.S. Army Medical Research and Materiel Command, and the National Institutes of Health's National Institute of Allergy and Infectious Diseases.

Case Study

Adenovirus

Challenge

Adenovirus infections cause illness among deployed troops as well as basic training recruits and are a proven threat to military readiness. Outbreaks often cause an increased burden on medical staff and facilities. The vast majority of all adenovirus infections in basic combat training are caused by serotypes 4 and 7.

Adenovirus vaccine has been used exclusively by the military to prevent adenovirus-associated acute respiratory disease (ARD) in basic trainees. However, since termination of the Wyeth vaccine production in 1995, the incidence of disease has increased to that of the pre-vaccine era. The Wyeth vaccines were effective in preventing ARD in recruits without producing adverse effects. In 1995, Wyeth, the sole manufacturer of adenovirus vaccine,

elected to cease production when faced with the requirement for costly updates to manufacturing facilities. By 1999, DoD supplies of vaccine were depleted.

In July 2000 and September 2000, the deaths of two Navy trainees were reported, and it was suspected that both deaths were due to adenovirus infections. In 2002, it was reported that there were 11,633 cases of ARD among Army trainees. Based on 1998–2003 data, approximately 60 percent of these cases were adenovirus types 4 and 7. Due to the subsequent surge of adenovirus cases in recruits, the Army issued a request for information entitled,



"Re-establish the Manufacture of Adenovirus Vaccines, Types 4 and 7" in *Commerce Business Daily*. Immediately thereafter the U.S. Army Medical Research and Materiel Command issued a request for proposals, and the DoD contracted with Barr Laboratories, Inc. for restoration of live adenovirus vaccines using manufacturing instructions proved by Wyeth.



Contribution

In 2001, the Army awarded a \$17.4 million, 3-year baseline contract for the manufacture of vaccine types 4 and 7 and for conducting a Phase I clinical trial, followed by an additional \$18 million to support Phase II and Phase III clinical studies and filing of the license application. Barr proposed to seek licensure based on a demonstration of immunogenicity similar to that of the old vaccine. In 2002, the technology transfer from Wyeth to Barr was completed with some procedures updated and modified. In 2003, Barr completed construction of an adenovirus vaccine manufacturing facility in Forest, Virginia. In 2004, the contract with Barr was modified to allow Barr to be the sponsor and file the Investigational New Drug application. Barr submitted the Investigational New Drug application to the FDA in July 2004, and Phase I clinical trials began during fall 2004 at Fort Sam Houston, Texas, by investigators from Barr, Walter Reed Army Institute of Research (WRAIR), and Brooke Army Medical Center.

Benefit

Barr is a specialty pharmaceutical company engaged in the development, manufacture, and marketing of generic and proprietary pharmaceuticals. Following successful approval, Barr will manufacture the vaccines under contract to the government specifically for dispensing to the armed forces. FDA-licensed vaccines are expected to be available in 2008.



Adenovirus Vaccine *(Adenovirus Vaccine Live Oral Type 4 and Live Oral Type 7)*

Mission

These two adenovirus vaccine types are used to prevent the spread of respiratory disease among U.S. troops.

Description

Adenovirus vaccine types 4 and 7 are both live, viral vaccine tablets for oral administration to prevent adenovirus infection and associated diseases, such as ARD and pneumonia. Use of the vaccines leads to reduced incidence and epidemic spread of respiratory disease in military and civilian populations. Completed in 1980, production of the vaccines ceased in 1995 due to costly facility upgrade requirements.

Laboratory/Developer

WRAIR



Aerosol Generator, Ultra-Low Volume, Electric

Mission

The Aerosol Generator, Ultra-Low Volume, Electric (AGULVE) is used for dispensing pesticides in the form of fog.

Description

The AGULVE is a lightweight unit for pesticide fogging operations composed of a spray head and pump that is powered from a vehicle's electric power supply. Completed in 1993, AGULVE improves the sustainability of U.S. forces in regions of the world where disease-carrying insects reside.

Laboratory/Developer

U.S. Army Medical Materiel Development Activity (USAMMDA)

Camouflaged Bednet Shelter



Mission

The Camouflaged Bednet Shelter is used to protect service members from insects.

Description

The Camouflaged Bednet Shelter is a self-supporting, low-profile shelter that contains a collapsible support structure and is impregnated with a quick-acting insecticide for knock-down effect. Completed in 2004, it provides improved protection against biting insects and improves service member survivability and sustainability in regions of the world with insect-transmitted diseases.

Laboratory/Developer

WRAIR



Combined Camouflage Face Paint

Mission

Combined Camouflage Face Paint (CCFP) with DEET insect repellent will improve U.S. troop survivability and sustainability in regions of the world where biting insects transmit diseases.



Description

Inclusion of insect repellent protection will reduce nuisance factors by repelling insects near the face and help reduce diseases (e.g., malaria and dengue fever) transmitted by biting insects. New CCFP will be a blend of face paint with DEET insect repellent to provide a minimum of 8 hours of protection against biting insects.

New CCFP, completed in 2003, is packaged in a compact container with a mirror on top and compartments on the bottom to provide 20 applications of the loam, green, and sand colors and 10 applications of the black and white colors. A product improvement effort to reformulate and package CCFP in stick-type dispensers is projected to be complete by the end of 2007. All CCFP formulations will be used by individual service members for protection against biting insects and detection by night vision goggles (the face paint reduces a service member's near-infrared signature) and assimilation into the military theater environment.

Laboratory/ Developer

Iguana LLC
Natick Soldier Center
USAMMDA
WRAIR





Doxycycline (Vibramycin)

Mission

Doxycycline (Vibramycin) is a drug used to treat malaria.

Description

Doxycycline (Vibramycin) is a drug originally developed as an antibacterial agent with useful antimalarial properties against tissue malaria parasite forms. It is effective against chloroquine-resistant malaria parasite strains with fewer adverse effects than mefloquine; however, it requires daily administration, is slow-acting, and is associated with adverse effects that may impact daily compliance. This drug should not be administered to pregnant women or children. A new indication was completed in 1992.

Laboratory/Developer

WRAIR





Electronic Surveillance System for the Early Notification of Community-based Epidemics

Mission

The Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) is a prototype system that detects outbreaks of infectious diseases.

Description

ESSENCE is a system proposed for the early detection of infectious disease outbreaks at military treatment facilities. Data from patient symptoms are instantaneously recorded at a patient's visit and uploaded into ESSENCE, which also contains Ambulatory Data System diagnoses from 104 primary care and emergency clinics within a 50-mile radius of Washington, DC. Diagnostic codes are grouped into "syndromic clusters" consistent with emerging infections, including bioterrorism. Once an outbreak is suspected, the system dispatches an epidemic control team that may include epidemiologists, statisticians, and laboratory personnel.

Laboratory/Developer

DoD Global Emerging Infections System
WRAIR



Global Emerging Infections System

Mission

The Global Emerging Infections System (GEIS) is a communications system supporting medical surveillance activities.

Description

In the United States, GEIS units are located in California, Texas, Virginia, and Washington, DC. Overseas they are located in Peru, Egypt, Thailand, Indonesia, and Kenya. Together, these assets represent a global health care system, connected by a worldwide, state-of-the-art communication system using a relatively standardized information technology infrastructure for supporting medical surveillance activities. GEIS facilitates early recognition and control of new disease problems that threaten national security.

Laboratory/Developer

WRAIR



Hepatitis A Vaccine (HAVRIX)

Mission

The Hepatitis A vaccine is an inactivated viral vaccine for the prevention of hepatitis A infection.

Description

The Hepatitis A vaccine prevents epidemics during deployments to endemic regions and areas with suboptimal sanitation, water, and waste systems, as well as at military posts. HAVRIX replaced the use of immune serum globulin that required repeated injections, was not readily available, and was impractical to distribute during large deployments. HAVRIX was completed in 1995.

Laboratory/Developer

WRAIR



Hepatitis B Vaccine (*Hepatavax B*)

Mission

The Hepatitis B vaccine is used to prevent hepatitis B infection.

Description

The Hepatitis B vaccine was previously produced by using plasma from infected individuals and is now produced by recombinant methods in yeast cells. It prevents hepatitis B infection transmitted by blood and body fluid exposure. Completed in 1981, the Army contributed to the epidemiology and hepatitis B vaccine subtyping efforts.

Laboratory/Developer

WRAIR



Influenza Virus Vaccine

Mission

The Influenza Virus Vaccine is used to prevent influenza infection.

Description

The U.S. military helped develop one of the first FDA-licensed vaccines for the prevention of influenza infection composed of inactivated whole influenza virus. The Influenza Virus Vaccine prevents influenza infection and its rapid epidemic spread in close quarters and contact that otherwise can significantly impact military readiness and civilian productivity and potentially lead to death in the very young and old. This vaccine was completed in 1945. The U.S. military does not currently manufacture influenza vaccines, but GEIS contributes pertinent epidemiologic data regarding current influenza vaccine preparation.

Laboratory/Developer

WRAIR



Japanese Encephalitis Vaccine

Mission

Japanese Encephalitis Vaccine is used to protect against Japanese encephalitis.

Description

Japanese Encephalitis Vaccine is a formalin-inactivated whole-virus vaccine used against the Japanese encephalitis virus, which is transmitted by mosquitoes. It prevents Japanese encephalitis infection, for which there is no treatment, and can result in fever and mild illness to brain inflammation, neurological sequelae, and sometimes death. Outbreaks occur in Asia, the Pacific Islands, northern Australia, and Russia. Japanese Encephalitis Vaccine was completed in 1992.

Laboratory/Developer

WRAIR



Meningococcal Vaccine (Menomune)

Mission

The meningococcal vaccine, Menomune, is used to prevent meningococcal infection.

Description

The meningococcal vaccine is a tetravalent vaccine, composed of purified components from the polysaccharide coating (A, C, Y, and W-135, but not B), used against the *Neisseria meningitidis* bacteria that is transmitted by respiratory droplets under close person-to-person contact. The vaccine prevents meningococcal infections that, if invasive, can lead to meningitis and sepsis with a 10–30 percent fatality rate. In addition, it reduces the risk of meningococcal disease outbreaks among military recruits and service members. Menomune was completed in 1981.

Laboratory/Developer

WRAIR

Oral Live Typhoid Vaccine (*Vivotif Berna*)



Mission

Oral Live Typhoid Vaccine (*Vivotif Berna*) is used to protect against *Salmonella typhi* bacterium infection.

Description

Vivotif Berna is a live, attenuated oral vaccine used to protect against *Salmonella typhi* bacterium infection that is caused by the ingestion of contaminated food or contact with contaminated feces and can be spread by a healthy carrier of the bacterium. This vaccine prevents typhoid fever, an acute generalized illness with fever, headache, abdominal pain, mild rash, and bowel movement and mental changes. In combination with hygiene control, the vaccine reduces the likelihood of epidemic spread of the disease, particularly in areas that lack clean water and effective sanitation systems. *Vivotif Berna* was completed in 1989.

Laboratory/Developer

Naval Medical Research Unit
Acambis



Pesticide Dispersal Unit, Multicapability, Helicopter Slung

Mission

The Pesticide Dispersal Unit, Multicapability, Helicopter Slung is a pesticide sprayer used for insect control.

Description

The Pesticide Dispersal Unit, Multicapability, Helicopter Slung is a multimode (solid/liquid) pesticide sprayer powered by a hydraulic motor and attached beneath a helicopter via a sling with a cargo hook and controlled within the helicopter. This unit will improve the sustainability of U.S. forces in disease-carrying, insect-infested regions of the world. Completed in 1993, it was used successfully after Hurricane Andrew hit southern Florida in 1992.

Laboratory/Developer

USAMMDA



Rubella Vaccine **(Meruvax, now Meruvax II)**

Mission

Rubella vaccine (Meruvax II) is a vaccine used against rubella (German measles).

Description

Meruvax II is a live, attenuated viral vaccine for the prevention of rubella (German measles), which spreads person-to-person via respiratory droplets, causes fever and rash, and can lead to serious fetal malformations in pregnant women. Completed in 1969, the introduction of the vaccine to the United States during the same year resulted in a drop from 47,745 cases (for the 3 years prior) to 345 cases in 1998. As of 2005, rubella virus infection has been eliminated in the United States.

Laboratory/Developer

WRAIR

Merck Sharp & Dohme



Chloroquine (Aralen)

Mission

Chloroquine (Aralen) is a drug that is used to treat and prevent malaria.

Description

Aralen is an antimalarial drug for both the treatment and prevention of *P. falciparum* and *P. vivax* malaria. It has rapidly controlled the clinical symptoms of susceptible malarias and is useful in prevention when taken once a week. Completed in 1949, the emergence of chloroquine-resistant malaria parasites has limited the use of this drug.

Laboratory/Developer

Winthrop

Abbott

E.R. Squibb and Sons

Eli Lilly and Company

Sharp and Dohme, Inc.

Sanofi Synthelabo



Primaquine

Mission

Primaquine is a drug used to treat and prevent malaria.

Description

Primaquine is an antimalarial drug used for the treatment and prevention of relapsing malaria following *P. vivax* and *P. ovale* infections. It attacks the liver stage of malaria parasites and reduces recurrent malaria caused by latent forms of the malaria parasites present in the liver after cessation of a prior preventive such as chloroquine. It also prevents malaria infection. Primaquine was completed in 1952.

Laboratory/Developer

Winthrop-Stearns, Inc.

WRAIR

University of Chicago



Sulfadoxine-Pyrimethamine (Fansidar)

Mission

Sulfadoxine-Pyrimethamine (Fansidar) is a drug used to treat and prevent malaria.

Description

Sulfadoxine-Pyrimethamine (Fansidar) is a drug used for the treatment and prevention of malaria, particularly chloroquine–primaquine-resistant types, which acts by blocking folic acid to prevent replication of the malaria parasites. The occurrence of infrequent, but serious, adverse allergic reactions limits its use except in countries where chloroquine-resistant malaria is widespread and other drugs are not available. Sulfadoxine-Pyrimethamine (Fansidar) was completed in 1983.

Laboratory/Developer

WRAIR





Atovaquone-Proguanil (Malarone)

Mission

Atovaquone-Proguanil (Malarone) is a combined drug used to treat *P. falciparum* malaria.

Description

Atovaquone-Proguanil (Malarone) is a combination of two existing drugs for the treatment of *P. falciparum* malaria that acts on the malaria parasite by inhibiting essential synthesis pathways. The combination of drugs has an enhanced effectiveness over single-drug treatments for malaria and reduced side effects compared to other antimalarial drugs. Atovaquone-Proguanil (Malarone) was completed in 2000.

Laboratory/Developer

WRAIR
GlaxoSmithKline (GSK)



Chloroquine-Primaquine

Mission

Chloroquine-Primaquine is a combined drug used to treat *P. vivax* malaria infection.

Description

Chloroquine-Primaquine is a combination of two antimalarial drugs used in the treatment of *P. vivax* infection (see also Chloroquine and Primaquine). Combining the two drugs into a single treatment yields improved compliance with the two-drug treatment for relapsing malaria. Chloroquine-Primaquine was completed in 1969.

Laboratory/Developer

WRAIR
Sanofi Synthelabo



Halofantrine (Halfan)

Mission

Halofantrine (Halfan) is a drug used to treat chloroquine-resistant malaria.

Description

Halofantrine (Halfan) is an antimalarial drug used in the treatment of chloroquine-resistant *P. falciparum* malaria. It is no longer licensed in the United States due to its potential for cardiac toxicity. Halofantrine (Halfan) was completed in 1992.

Laboratory/Developer

WRAIR
World Health Organization
SmithKline Beecham



Quinidine/Quinine

Mission

Quinidine is a drug that is used to treat chloroquine-resistant malaria.

Description

Quinidine is a drug given intravenously for treating chloroquine-resistant *P. falciparum* malaria, a parasitic disease transmitted by mosquitoes. Inadequate personal protection (e.g., bed nets and repellents) and preventive drug regimens necessitate treatment measures for malaria infections that can lead to serious or fatal complications such as brain infection. Quinidine and quinine are natural components of cinchona bark, originally found in cinchona trees at high altitudes in South America, and used to stop shaking chills. U.S. military physicians demonstrated the efficacy of large doses of oral quinine to treat remittent fevers in the 1830's that led to improved results with quinine as a malaria treatment around the world. Quinidine was approved for malaria treatment by the U.S. FDA in 1991 (labeling revision).

Laboratory/Developer

Lilly

Adenovirus Vaccine, Types 4 and 7

Mission

Adenovirus vaccine will prevent acute respiratory disease (ARD) caused by adenovirus (types 4 and 7) that frequently occurs in Soldiers, Sailors, Airmen, and Marines living in barrack-type environments during basic training. Prevention of adenovirus-related ARD will result in decreased recycling of recruits and considerable cost savings.

Description

The symptoms of ARD are pharyngitis, rhinitis, and pneumonia, and the illness often leads to lost training time. In the absence of vaccine, about 60 percent of ARD cases are due to adenovirus infection. A vaccine was developed by scientists at the National Institutes of Health and WRAIR, and used for more than two decades. It was taken as oral tablets containing live virus, types 4 and 7. Millions of recruits received the vaccine; it was shown to be both safe and effective. Failure to upgrade the production facility led to the termination of vaccine production in the 1996. A project to restore the vaccine is currently under way. A new tableting facility has been built, and types 4 and 7 vaccine are being produced in compliance with current FDA standards. Test and evaluation of the new vaccine is being done at Army and Navy training bases. Licensure of the restored vaccine is projected for 2009.

Adenovirus vaccine is an orally administered, enteric-coated tablet containing live adenovirus serotypes 4 or 7 and is used almost exclusively by the military.

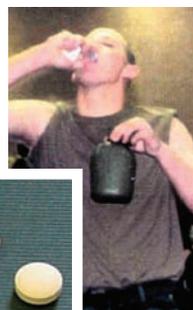
Laboratory/Developer

Duramed Research (A subsidiary of Barr
Pharmaceuticals, Inc.)

USAMMDA

WRAIR

Naval Health Research Center



Diarrheal Disease Supplement

Mission

Rehydration and antimicrobial treatment are the cornerstones of disease management, but even with early institution of appropriate therapy, diarrheal diseases exact a cost in terms of lost duty and effectiveness. An effective supplement that will aid in the treatment of diarrheal disease will enhance the sustainability of troops in regions of the world where diarrheal illnesses and dysentery are endemic.

Description

There is no licensed drug or biologic that provides a safe, effective mode of prevention against diarrheal diseases, leaving an important deficiency in military and travel medicine. This project is developing bovine milk immunoglobulins as a supplement with activity against ETEC, the predominant cause of traveler's diarrhea. The first of two clinical trials was completed in 2006. The trial showed that anti-adhesin BlgG antibodies afford significant protection against ETEC. Three additional clinical trials to be conducted during 2007–2008 are expected to solidify the foundation for future development of a product suitable for field testing.

Laboratory/Developer

Congressionally Directed Medical Research Programs
Naval Medical Research Center (NMRC)



Intravenous Artesunate for Treatment of Severe Malaria

Mission

Malaria constitutes a serious infectious disease threat to U.S. forces in times of war and peace in most tropical and some subtropical regions of the world. Even with the most sophisticated preventive drugs and strategies, there will still be cases of malaria, and because of this, our troops will be at risk of dying from severe malaria when a patient is comatose or cannot take oral drugs.

Description

Quinidine gluconate has been the only parenteral drug available in the United States to treat U.S. military and civilian personnel who may get severe malaria. Unfortunately, quinidine has significant cardiotoxic activity and can induce heart failure; therefore, the use of quinidine requires constant monitoring in an intensive care setting. A safer treatment of severe malaria is needed.

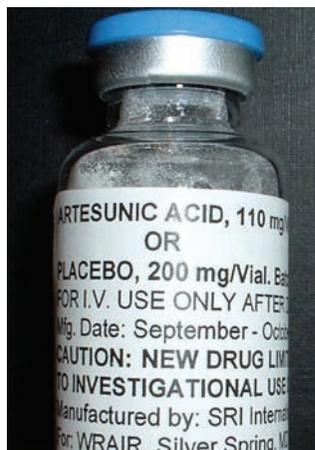
Artesunate in an intravenous form is being developed as a replacement for quinidine. The safety profile of artesunate is well established because it is used as a non-GMP (good manufacturing practice) drug in many parts of the world. The MIDRP is developing an FDA, GMP version of the drug for use in the United States and by U.S. troops.

Laboratory/Developer

WRAIR

Sigma-Tau Pharmaceuticals (tentative manufacturer)

USAMMDA



Malaria Rapid Diagnostic Device

Mission

Malaria constitutes a serious infectious disease threat to U.S. forces in times of war and peace in most tropical and some subtropical regions of the world. The Malaria Rapid Diagnostic Device (MRDD) permits field diagnosis of malaria infection and early intervention.



Description

Malaria is a potentially fatal illness with the ability to quickly incapacitate large numbers of personnel. Diagnosis must be rapid to initiate proper therapy in infected persons and prevent infection in others.

MRDD is a field-deployable, handheld, disposable, point-of-care test to detect the presence of malaria parasites in blood samples of persons with symptoms compatible with malaria. The MRDD test follows a simple procedure where a whole blood finger-stick sample is added to a sample pad. After just 15 minutes, the result can be read. This speed and simplicity allows diagnosis and targeted treatment to occur in the same patient visit, allowing for improved patient outcomes. MRDD kits (not yet approved by the FDA) are marketed worldwide except for in the United States.

Laboratory/Developer

Binax, Inc.

USAMMDA

WRAIR

Dengue Fever Vaccine (Dengue Tetravalent Vaccine)

Mission

Dengue Tetravalent Vaccine (DTV) will prevent mission-degrading, potentially lethal occurrences of dengue fever and dengue hemorrhagic fever in service members who are deployed to tropical and subtropical regions of the world, increasing the survivability and sustainability of U.S. forces.



Description

Dengue virus infection causes an acute, incapacitating illness characterized by severe head, muscle, joint, and eye pain, with fever lasting 4 to 7 days. Subsequent infection with a different dengue virus can occur and may result in the more severe hemorrhagic form of the disease. Dengue fever is a leading cause of hospital admissions in units operating in the tropics. There are currently no licensed vaccines or drugs to prevent dengue fever or the often fatal dengue hemorrhagic fever.

The product to be developed is a live, attenuated virus vaccine containing all four monovalent dengue virus serotypes, produced from purified, inactivated organisms. Dengue Tetravalent Vaccine must simultaneously provide long-term protection against all four known dengue viruses because cross-immunity among the four dengue viruses lasts only a few weeks. Co-infection with more than one dengue virus type can lead to the often fatal dengue hemorrhagic fever. Other tetravalent vaccine products in development include a purified inactivated vaccine, a DNA vaccine, and a protein subunit vaccine.

Laboratory/Developer

GSK

USAMMDA

WRAIR

Armed Forces Research Institute of Medical Sciences (AFRIMS)

Diarrheal Disease Vaccines

- ◆ *Campylobacter* Vaccine
- ◆ ETEC Vaccine
- ◆ *Shigella* Vaccine



Mission

Vaccines against *Campylobacter*, ETEC, and *Shigella* will enhance the sustainability of U.S. forces.

Description

Diarrheal diseases affect up to 50 percent of U.S. service members early and continuously in deployments to disease-endemic areas. Currently, there are no totally effective preventive medicine measures or vaccines to protect troops against these threats.

***Campylobacter* Vaccine:** *Campylobacter* infections are sometimes complicated by a usually temporary but potentially serious inflammatory neurological disorder called Guillain-Barre Syndrome. The association of an oral whole-cell-killed *Campylobacter* vaccine approach with Guillain-Barre Syndrome has precluded any additional whole-cell-killed or attenuated vaccine efforts. A second-generation, potentially improved, recombinant protein-based vaccine is nearing the clinical testing phase. Results of a new vaccine approach using capsule conjugates will be compared with the protein subunit results.

ETEC Vaccine: ETEC is a common etiologic agent of diarrhea in the Middle East irrespective of combat phase or operational tempo. Current research is focused on developing a purified protein subunit vaccine against ETEC. The target antigens in this vaccine strategy are the major ETEC colonization factor antigens and nontoxic derivatives of heat-labile enterotoxin.

***Shigella* Vaccine:** *Shigella* is the most common pathogen during combat phases in U.S. operations in the Middle East. Vaccines against *Shigella flexneri*, *S. sonnei*, and *S. dysenteriae* are under development. Two promising approaches are being evaluated: Invaplex extracts of *Shigella* bacteria that induce immunity when sprayed into the nose and live *Shigella* vaccines that are genetically modified and safely induce immunity following ingestion.

Laboratory/Developer

NMRC
WRAIR

Hepatitis E Virus Vaccine

Mission

Hepatitis E Virus (HEV) vaccine will enhance the survivability and sustainability of U.S. forces in regions of the world where HEV is endemic. Nonimmune service members deployed to endemic regions are at risk.

Description

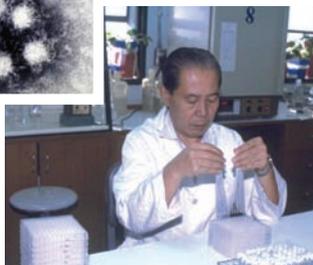
Hepatitis E is most often transmitted through the fecal-oral route; drinking fecally contaminated water is the most common mode of transmission. The illness often occurs 2 to 6 weeks after infection and results in protracted convalescence lasting several weeks to months. In some cases, infection results in severe, rapidly progressing disease that ends in death due to liver failure. The case-fatality rate is approximately 2 percent in men and nonpregnant women and up to 20 percent in pregnant women during the third trimester of pregnancy. The highest incidence of HEV infection occurs in young adults (of military age), making approximately 97 percent of American adults susceptible to HEV infection.

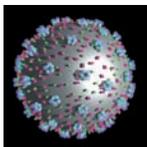
The HEV vaccine is a recombinant vaccine that consists of a purified polypeptide produced in insect cells infected with recombinant baculoviruses and formulated with an aluminum salt adjuvant.



Laboratory/Developer

- GSK
- USAMMDA
- WRAIR
- AFRIMS





HIV

- ◆ HIV Vaccine
- ◆ HIV Research Program

Mission

An HIV vaccine will enhance survivability and sustainability of U.S. forces worldwide. Furthermore, an HIV vaccine will promote political, social, and economic stability, thereby deterring conflict and the need for U.S. intervention in areas where HIV is causing significant morbidity and mortality.

Description

HIV poses a threat to U.S. military forces and is a national and global security issue. The magnitude of this disease is so great that it could destabilize foreign governments and slow economic growth worldwide. A few new cases of HIV occur annually among U.S. Army personnel, and it is estimated that 30 percent of these HIV infections are acquired during overseas deployments, predominantly from the less developed countries of sub-Saharan Africa, Asia, and South America. According to the Central Intelligence Agency, HIV/AIDS will probably cause more deaths than any other single infectious disease and account for at least half of infectious disease deaths worldwide by 2020.

HIV Vaccine: Currently, there is no effective vaccine to prevent HIV infections. A potential HIV vaccine candidate is currently being evaluated in HIV-naïve volunteers. The HIV prime-boost vaccine consists of a prime with a recombinant canarypox virus expressing the products of three HIV-1 genes and a boost with a recombinant vaccine containing the envelope proteins for HIV types E and B. The prime-boost vaccine approach is being used to induce both cellular and humoral immunity to HIV.

HIV Research Program: The HIV vaccine research and development program is mandated to develop a safe and effective HIV-1 vaccine against all HIV-1 subtypes (A, B, C, D, and E). The plan is to engage regional overseas laboratories in this effort.

Laboratory/Developer

WRAIR (Technology Base R&D)

Sanofi-aventis; VaxGen; National Institute of Allergy and Infectious Diseases (Prime-Boost)

USAMMDA; WRAIR; AFRIMS (Prime-Boost)

Improved Insect Repellent

Mission

This new repellent will offer the greatest tactical flexibility of any arthropod-borne disease prevention strategy.

Description

Repellents can be applied effectively to prevent most arthropod-borne disease even if surveillance has not identified the pathogen. Repellents are often the only means of protection from arthropod-borne diseases in combat environments when vector control measures are not possible, when no vaccines exist for diseases in the deployment area of operations, or when the speed of military developments prevents the use of chemoprophylaxis or vaccines.

The current military insect repellent is ineffective against some disease vectors and has a very low service member acceptance rate. Because no commercially available repellents meet Army requirements, new effective repellent compounds and leading-edge formulation technologies are being explored and prioritized. A new military insect repellent that is completely acceptable to the user and maintains effectiveness under combat conditions is desired.

Laboratory/Developer

WRAIR



Malaria Vaccines

- ◆ **Recombinant Vaccine (RTS,S + Adjuvant)**
- ◆ **Malaria DNA Vaccine and Prime-Boost Approaches**
- ◆ **Adenovirus Vaccine against *P. falciparum***

Mission

A safe, well-tolerated malaria vaccine will provide protection against disease and prevent blood-stage infection.

Description

P. falciparum is the most immediately life-threatening type of malaria, causing massive destruction of the body's red blood cells. Currently, there are no licensed vaccines, and the malaria parasite continues to develop resistance to new drugs used for treatment or prevention. Initially, *P. falciparum* malaria vaccines were being developed, but a combined vaccine to protect against all types of malaria is the long-term goal.

Recombinant Vaccine (RTS,S + Adjuvant). One *P. falciparum* malaria vaccine candidate consists of the RTS,S recombinant malaria protein antigen combined with a proprietary adjuvant from industry partner GSK.

***P. falciparum* RTS,S + MSP-1.** This vaccine consists of the RTS,S recombinant protein antigen combined with an additional malaria antigen component.

Malaria DNA Vaccine and Prime-Boost Approaches. Investigators have demonstrated substantial protection using a combination of malaria DNA and pox virus. Another approach has been to combine RTS,S with adenovirus 35 (an uncommon adenovirus serotype against which little natural immunity exists). The prime-boost combination will consist of RTS,S/ Adjuvant + Adeno35CS vaccines.

Adenovirus Vaccine against *P. falciparum*. A multicomponent adenovirus vaccine containing five promising antigens of *P. falciparum* will be used as a boost in combination with a DNA priming vaccine.

Laboratory/Developer

U.S. Army Medical Research Institute of Infectious Diseases (Lethal Viruses)	Congressionally Directed Medical Research Programs (Adenovirus) Army and Navy OCONUS Laboratories; WRAIR; NMRC (Technology Base R&D)
GSK (RTS,S+ Adjuvant)	
USAMMDA (Prime-Boost: RTS,S/ Adjuvant + Adeno35CS)	



Meningococcal Type B Vaccine

Mission

Meningococcal meningitis is fortunately uncommon but causes a devastating illness, and a single case of meningitis can result in major disruptions of military operations and training because of the need for preventive and assessment measures. Five types of meningococcus (A, C, Y, W-135, and B) cause 80 percent of meningococcal meningitis. DoD researchers have contributed to the development of a licensed tetravalent vaccine protecting against types A, C, Y, and W-135. Development of a vaccine protective against type B meningococcus is under way; the ultimate goal is a pentavalent vaccine. Candidate monovalent meningococcal Group B vaccines have been shown to provide protection against strains of the same subtype in 50 to 80 percent of vaccinated subjects, and work is continuing to develop a polyvalent vaccine to provide wider protection against Group B meningococcus.

Description

Meningococcal meningitis is an acute bacterial disease that occurs commonly in young adults, in males more than females, and particularly in newly aggregated adults under crowded living conditions such as barracks. It is a threat to service members in basic and advanced training, especially during major military mobilizations. The disease is prevalent in sub-Saharan Africa and South America and is potentially life threatening or permanently debilitating. New, virulent Group B clones have caused prolonged epidemics in at least five countries during the past 20 years.

Monovalent Group B vaccines are effective in protecting against disease only if they are made from the specific strain of the organism causing the outbreak. A polyvalent vaccine derived from three different strains is being developed to provide broad coverage against Group B organisms. Both intranasal and intramuscular routes of administration are being examined.

Laboratory/Developer

WRAIR



Scrub Typhus Vaccine

Mission

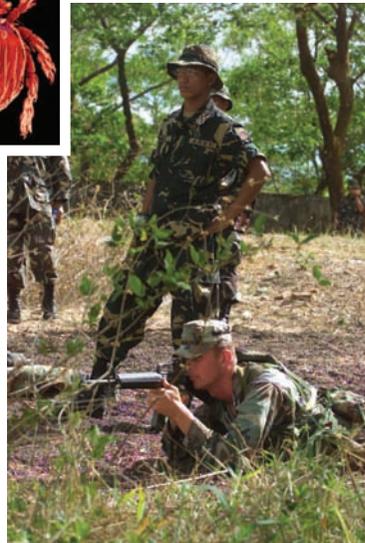
Scrub typhus vaccine will prevent mission-degrading, potentially lethal occurrences of scrub typhus in service members who are deployed to highly endemic areas, increasing the survivability and sustainability of U.S. forces.

Description

Scrub typhus, caused by *Orientia tsutsugamushi*, was problematic to U.S. forces during World War II and the Vietnam War and still poses a threat for deployments to some areas of Asia and the Asia-Australia-Pacific Islands. Recent concern about antimicrobial-resistant strains of scrub typhus has prompted efforts to create a vaccine to prevent *O. tsutsugamushi* infection. Current efforts are focused on using recombinant protein vaccine technology to produce a stable, standardized vaccine that will protect the warfighter from multiple strains of scrub typhus.

Laboratory/Developer

NMRC



Vaccines to Prevent Hemorrhagic Fever with Renal Syndrome

Mission

Vaccine products are designed to provide protection against all four hantaviruses and enhance the sustainability of U.S. forces in regions of the world where hantaviruses are endemic.



Description

Hemorrhagic Fever with Renal Syndrome (HFRS) is a problem throughout Asia and Europe that has caused life-threatening illness in thousands of service members. The virus is usually transmitted to humans via exposure to aerosols created when infected rodents' urine, feces, or saliva is released onto environmental surfaces. After an incubation period of approximately 1–4 weeks, a patient may develop fever, kidney dysfunction, alterations of blood pressure, accumulation of fluid in the lungs, and blood-clotting problems.

Two vaccine approaches are under evaluation. The first is a DNA vaccine expressing Hantaan virus M segment expected to protect humans from HFRS caused by Hantaan virus, Seoul virus, and Dobrava virus but not Puumala virus. The second is a Puumala virus DNA vaccine expected to protect humans from HFRS caused by Puumala virus.

Laboratory/Developer

U.S. Army Medical Research Institute of Infectious Diseases



Antimalarial Drugs

◆ Tafenoquine

Mission

New drug prophylactics and therapies used for the treatment of malaria will increase the survivability and sustainability of U.S. forces deployed in highly endemic areas.

Description

The malaria parasite, transmitted by infected mosquitoes, is developing resistance to current antimalarial prophylactic drugs, and resistance is now widespread in Africa and Asia. Symptoms can be fever and flu-like including shaking, chills, headache, muscle aches, and tiredness. If not treated promptly, one type of malaria, *P. falciparum*, may cause kidney failure, seizures, mental confusion, coma, and death. Two other types, *P. vivax* and *P. ovale*, concentrate in the liver cells, eventually emerging into the blood and causing disease. The most dangerous species, *P. falciparum*, moves out of the liver and into the blood in just a few days.

Studies suggest that Tafenoquine suppresses both the liver and blood stages of the malaria parasite and their effects and may also block transmission from already infected individuals. Currently, Tafenoquine is under development as a radical cure and potential postexposure prophylaxis against *P. vivax* malaria as a replacement for Primaquine. Future studies will focus on Tafenoquine for prophylaxis against *P. falciparum*.

Laboratory/Developer

GSK

USAMMDA

WRAIR



Topical Antileishmanial Drugs (Paromomycin)

Mission

Topical antileishmanial ointment will enhance the survivability and sustainability of U.S. forces in endemic regions by allowing for local early lesion treatment. It will also prevent morale and personnel problems in a unit due to the loss of affected personnel for treatment that requires evacuation out of the theater of operations for daily intravenous injections with highly toxic investigational pentavalent antimony drugs.

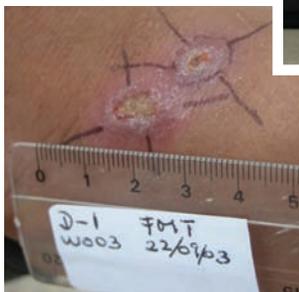
Description

Cutaneous leishmaniasis is a potentially disfiguring and serious parasitic disease. Leishmaniasis is one of several names for various tropical diseases that are caused by protozoa of the genus *Leishmania*. The parasites are transmitted by sandflies in tropical and subtropical zones. The manifestations of this disease may be visceral, mucocutaneous, or cutaneous. This illness is predominantly found in tropical and subtropical areas in the Middle East, southwest Asia, the Mediterranean coast, sub-Saharan Africa, Mexico, and Central and South America. In addition, there have been confirmed reports of canine leishmaniasis cases in 21 states across the United States. Current therapy for cutaneous leishmaniasis requires intravenous administration of toxic, metal-based drugs (antimonials) that have undesirable side effects and toxicities including vomiting, diarrhea, pancreatitis, elevated liver enzymes, and at higher doses, pulmonary edema.

Paromomycin, a topical cream made from two aminoglycoside antibiotics (15 percent paromomycin and .5 percent gentamicin) formulated in an aquaphilic base, will allow for local early lesion treatment.

Laboratory/Developer

- Teva Pharmaceuticals USA
- Pasteur Institute (Tunisia)
- USAMMDA
- WRAIR



Dengue Diagnostic Systems

Mission

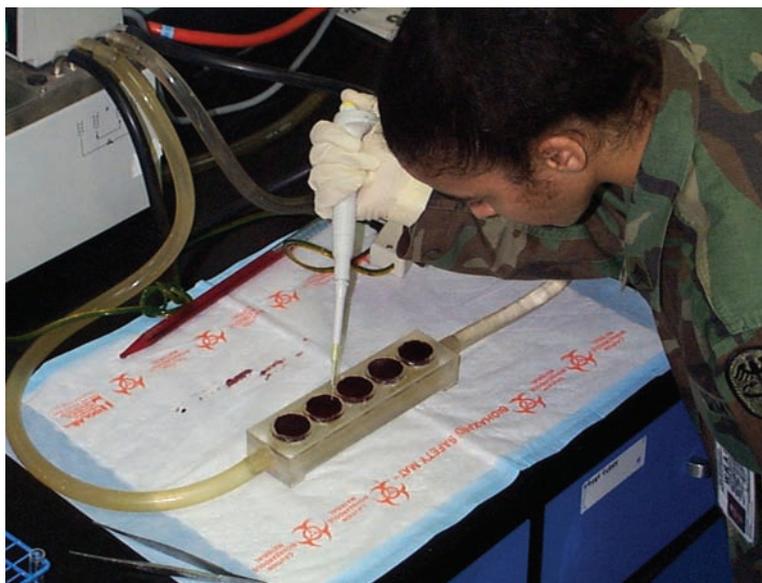
A Dengue Diagnostic System will allow for real-time diagnostics development and validation in an attempt to limit transmission of the disease.

Description

WRAIR and other collaborators are using real-time reverse transcriptase polymerase chain reaction to evaluate dengue viral loads from natural dengue infections and systematically infected samples from human volunteers, laboratory animals, and tissue cultures. Collaborative efforts involve anti-dengue drug screening, dengue vaccine development, and dengue epidemiological surveys.

Laboratory/Developer

WRAIR





Combat Casualty Care

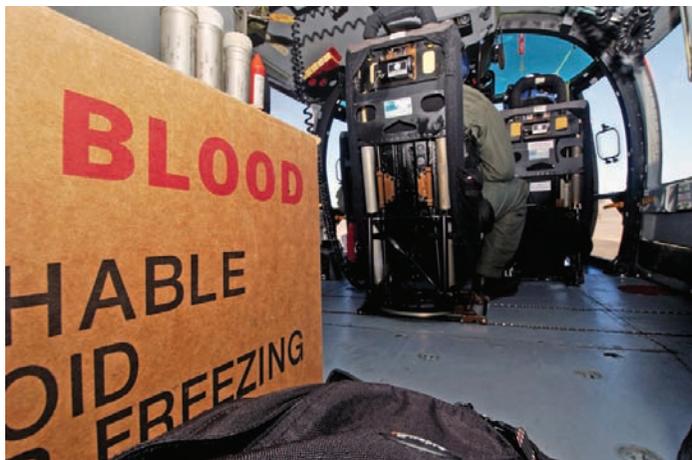


Overview

Caring for combat casualties is constrained by logistics, manpower, and the hostile operational environment. Eighty-six percent of all battlefield deaths occur within the first 30 minutes after wounding, making the ability to rapidly locate, diagnose, and treat injuries vital to reversing the historical outcomes of battlefield injuries. The Combat Casualty Care Research Program's goals are to reduce the killed-in-action rate of American troops by 25 percent, reduce the morbidity of combat injuries, and reduce the medical footprint on the battlefield.

Several factors complicate providing combat casualty care. Military casualties may wait for hours before definitive health care can be provided. Initial treatment and subsequent evacuation occur in austere environments characterized by limited supplies and limited diagnostic and life-support equipment. Further, providing acute and critical care is labor intensive and must frequently be provided by non-physician medical personnel. The primary challenge for combat casualty care research is overcoming these limitations by providing biologics, pharmaceuticals, and devices that enhance the capability of first responders to effectively treat casualties as close as possible to the location and time of injury.





Minimizing Blood Loss and Optimizing Fluid Resuscitation

Since mid-World War II, nearly 50 percent of combat deaths have been due to exsanguinating hemorrhage. Of those, about half could have been saved if timely, appropriate care had been available. Postmortem study of casualties in Operation Iraqi Freedom suggests that up to 18 percent of all battlefield deaths can be prevented with improved measures to stop and treat severe hemorrhage associated with combat injury. The Army and Department of Defense (DoD) seek new technologies and products that can reduce morbidity and mortality of severe battlefield hemorrhage. The Army's research and product development efforts focus on discovery and development of technologies and products that enhance far-forward capabilities for control, resuscitation, and stabilization of casualties with severe hemorrhage and technologies that enhance capabilities for the preservation of vital tissues and reduction of morbidity and mortality as a consequence of severe hemorrhage.

Current technologies and products under investigation or in development include:

- ◆ Lyophilized plasma and platelets
- ◆ Cryopreserved (frozen) platelets
- ◆ Extended shelf-life (8 weeks) red blood cells
- ◆ Recombinant, activated factor VII and other blood clotting factors for treatment of clotting abnormalities associated with severe hemorrhage



- ◆ New bandages and other agents that may be applied to stop external bleeding
- ◆ Simple fluid warming and administration devices
- ◆ Treatments to enhance blood flow and oxygen delivery to vital tissues that can:
 - ❖ Prevent cell death or organ failure
 - ❖ Reduce or eliminate oxygen starvation and tissue injury associated with resupply of fluids during resuscitation
 - ❖ Prevent secondary brain or spinal cord injury
 - ❖ Prevent reduction of immune system protection and serious infection associated with shock and resuscitation
 - ❖ Reduce injury to vital tissues by reducing demand for oxygen and other vital nutrients during shock
 - ❖ Prevent bacteria from crossing the bowel wall into the blood stream as a consequence of shock
- ◆ Fieldable rapid test kits for testing walking blood donors for blood-borne pathogens and for blood typing
- ◆ Fundamental investigations of vascular and tissue responses to fluid resuscitation

Treatments for Battle and Non-Battle Injuries

This science and technology effort includes:

- ◆ Refining of closed-loop control algorithms for automated delivery of oxygen, ventilation, and fluids
- ◆ Development of noninvasive sensors to determine tissue viability and perfusion
- ◆ Identification and testing of techniques, drugs, and treatments to enhance vascular repair
- ◆ Techniques and assessments for commercial materiel developments applicable to surgical management of primary ballistics and thermal burn injuries
- ◆ Techniques for management of primary blast, crush, and chemical burn injuries
- ◆ Defining predictive vital signs for use in tools that assist in deciding to implement life-saving interventions
- ◆ Development of simulators for use in training caregivers on trauma treatment techniques





Examples of specific products or efforts that might be addressed include materiel for the pharmacological or surgical management of high-velocity ballistics, fragment, and blast injuries. Materiel of interest also includes agents, including autologous stem cells, which promote neuronal regeneration, bone repair and regeneration, and vascular healing and regeneration; treatment of chemical burns; and equipment and procedures for emergency airway management and mechanical ventilation of severely injured casualties.

Meeting Program Goals

Battlefield conditions impose severe constraints on available manpower, equipment, and medical supplies for casualty care. A premium is placed on medical interventions that can be used on the battlefield or as close to it as possible, before or during medical evacuation, preferably by medical corpsmen. Medical materiel must be easily transportable (i.e., small, lightweight, and durable); devices must be easy to use, low maintenance, with self-contained power sources as necessary; and drugs and biologics, ideally, should not require refrigeration or other special handling. More specifically, the program's efforts address:

- ◆ Products and methods that reduce the number of battlefield deaths due to hemorrhage
- ◆ Pathogen inactivation in blood products to reduce transfusion-induced morbidity and mortality

- ◆ Techniques and technologies that improve the acquisition and availability of blood products and reduce the medical and logistical requirements to care for battlefield casualties
- ◆ The best fluids and strategies for resuscitation to improve survival when evacuation is delayed and resources are limited
- ◆ Advanced, noninvasive physiologic sensors and diagnostics for detecting penetrating or blunt trauma wounding events and remote triage of visible wounds and traumatic brain injury
- ◆ Automated critical care life support
- ◆ Tissue regeneration
- ◆ Prevention and treatment of dental disease
- ◆ Neuroprotective treatment strategies that significantly improve the prognosis for a service member's functional recovery from brain and spinal cord injuries
- ◆ Technology and training aids to render self-aid and buddy aid



The resulting Combat Casualty Care products listed in this section are divided into the following subcategories:

- ◆ Hemorrhage Control/Resuscitation Strategies
- ◆ Hard and Soft Tissue Injury
- ◆ Neuroprotective Treatment Strategies
- ◆ Trauma Management Systems
- ◆ Dental



Training

Two compelling needs underpin the Command's simulation and training technology research portfolio: (1) DoD's requirement to train 100,000 military health care personnel annually and (2) increasing national interest in reducing medical errors. This spans from point of wounding, to combat casualty care, to surgical care given in fully equipped fixed medical facilities. An integrated research team, convened in February 2000, developed an integrated strategic plan. Research is being conducted in four general categories: (1) Personal Computer (PC)-based Interactive

Multimedia, (2) Digitally Enhanced Mannequins, (3) Part-Task Trainers, and (4) Total Immersion Virtual Reality. Several funding sources are being



invested: Congressionally sponsored, Small Business Innovation Research (SBIR), innovation, and dual-use funds. More than 150 separate projects—some small, some large—have been conducted with a cumulative investment of more than \$60 million since 1999, making it the DoD's largest investor in science and technology research. The strategy is to identify enabling technologies, mature them into components, integrate those components into simulation-based training systems, and validate them to determine the degree to which they transfer skills learned via simulation to the practice of actual patient care. The future plan is to (1) continue identifying and developing enabling technologies; (2) continue training transfer studies; (3) support open source and architecture standards; (4) facilitate convergences between science and technology research areas and surgical robotics, education and entertainment, and virtual reality applied to behavioral health; and (5) emphasize transition of products to relevant military and private sector end-user communities.

Case Studies

Combat Application Tourniquet

Challenge

Prior to 2005, the tourniquets available to the military included a cravat-and-stick tourniquet that service members used along with the strap-and-buckle tourniquet that dated back to the American Civil War. The latter item was largely believed to be ineffective and was removed from the military supply inventory. A third tourniquet, called the one-handed tourniquet, was also available; however, it worked on arms but failed to work on legs. As a result, many deploying service members were purchasing tourniquets from the Internet, but the military had not determined the effectiveness of these tourniquets. Based on this emergent need identified from theater in Iraq and Afghanistan, the U.S. Army Institute of Surgical Research (USAISR), in summer 2004, evaluated several tourniquets that were commercially available. Eighteen volunteers helped evaluate nine tourniquets' ability to cut off blood flow. Results showed that the Combat Application Tourniquet (CAT), as well as two other tourniquets, were effective. The CAT had a smaller learning curve than the others, and based on the overall favorability of this product, researchers recommended it as the best option to the Army Surgeon General. By fall 2004, the Army policy became that each service member would have one in his or her Improved First Aid Kit. The CAT was provided by North American Rescue Products.

Contribution

The testing conducted at USAISR led to the findings of the CAT's efficacy over the other tourniquets and allowed for the rapid fielding to deployed troops to stop otherwise lethal blood loss. Making the tourniquet available to the troops was only half of the work accomplished by USAISR. The research team also changed Army doctrine. Historical experience with tourniquet use had led doctors treating evacuated patients to dislike all tourniquets. Because of long evacuation times, by the time a doctor saw a service



member wearing a tourniquet, the tourniquet had been on for an extensive period of time and usually resulted in the limb being amputated. Two studies helped improve attitudes about tourniquets when both arrived at the same conclusion: 7 percent to 10 percent of battlefield deaths in Vietnam and Somalia were caused by profusely bleeding arm or leg wounds, and if tourniquets had been used, the service members would have most likely survived. This finding, coupled with USAISR's recommendation, helped change the bias against tourniquets and led to one of the Soldiers from USAISR teaching Special Operations Forces on proper use of the CAT. USAISR also helped to write tourniquet doctrine for the common task manual.

Benefit

Hundreds of thousands of the CATs are now carried by personnel deployed to Iraq. They are used on almost every extremity injury, and they continue to save lives. Reports from the theater indicate that there is no pre-hospital device deployed in the current conflict that has saved more lives than the tourniquet. The CAT is a small and lightweight item, making it a seamless addition to the components of the Improved First Aid Kit. Each individual who carries an Improved First Aid Kit now carries a CAT, providing ready access to the capability to provide self-aid and buddy care to control severe hemorrhage from a limb. The CAT was honored as one of the Army's 10 Greatest Inventions for 2005.

Case Study

HemCon Bandage



Challenge

On the battlefield, (hemorrhage) or excessive bleeding is the primary cause of death. The use of cotton gauze and bandages is the common approach to control bleeding; however, severe bleeding cannot be controlled with gauze or even with the use of tourniquets. Although tourniquets are effective at stopping blood loss, they are not appropriate for neck or large abdominal wounds. The military required a better bandage to achieve rapid control of severe, life-threatening bleeding.

Contribution

Scientists at the Oregon Medical Laser Center, based at Providence St. Vincent Medical Center in Portland, Oregon, performed extensive research on bleeding and bandages with a research grant from the U.S. Army Medical Research and Materiel Command (USAMRMC). Researchers found that chitosan, a carbohydrate found in shrimp shells, helps stop severe bleeding. Further, they found that a bandage based on chitosan carrying a negative surface charge, put in contact with blood, which carries a surface positive charge, created a powerful electrostatic bond between the bandage and the wound, quickly stopping severe bleeding. Scientists at the Oregon Medical Laser Center created a bandage using chitosan for external applications. The chitosan bandage allows a wound to quickly form a strong, adherent clot, enabling a patient to be transported. It also offers rapid, strong adhesion to the injury site to seal the wound, criteria specifically mandated by the military.

The chitosan bandage technology was licensed from Providence Health System to HemCon, Inc., for manufacturing. HemCon was founded by Dr. Kenton Gregory and Dr. Bill Weissmann in 2001 specifically for this product. HemCon, Inc., secured a contract with the Army in April 2002 and received U.S. Food and Drug Administration approval for the HemCon bandage through the 510(k) application process in November 2002. Advanced development and procurement funding for the bandage was made available by congressional appropriations in fiscal year 2003. HemCon, Inc., shipped the first production dressings to the Army in March 2004.

Benefit

The bandage is durable and flexible making it “Soldier proof”—capable of withstanding blunt force and extreme field conditions, including inclement weather, severe temperatures, and rugged terrain. Additionally, the bandage is easily portable and can be self-administered in combat, if necessary, or easily used by a medic, who generally is the first responder to an injured service member. The bandage poses no threat to individuals who are allergic to shrimp, and chitosan is found to be antimicrobial. In addition, tests at USAISR have shown that the HemCon dressing dramatically increased survival and reduced blood loss from internal trauma and during surgery.



Blood Products Bag



Mission

The Blood Products Bag is a system for the collection, lyophilization, and storage of lyophilized (freeze-dried) blood products.

Description

Completed in 2003, the Blood Products Bag provides the packaging necessary to fully use advances in the preservation of whole blood and blood products.

Laboratory/Developer

Walter Reed Army Institute of Research (WRAIR)

Chitosan Hemorrhage Control Dressing (HemCon Bandage)



Mission

The Chitosan Hemorrhage Control Dressing adheres to an injury site to form a clot and stop severe bleeding.

Description

This dressing is manufactured from chitosan, a natural biomaterial obtained from shellfish. Once applied, the chitosan hemorrhage control dressing tightly adheres to an injury site forming a durable clot. The dressing will stop severe external arterial and venous bleeding. It is being supplied to all service members deployed in the U.S. Central Command area of responsibility, and it has been extensively used in Operations Enduring Freedom and Iraqi Freedom. The U.S. Food and Drug Administration cleared the dressing for external use in November 2002 and later expanded the dressing's indication to include use as an antibacterial barrier in June 2005. Named one of the Army's 10 Greatest Inventions for 2004, the development of an implantable chitosan dressing for surgical use is currently under way.

Laboratory/Developer

HemCon, Inc.
USAISR



Combat Application Tourniquet

Mission

The Combat Application Tourniquet (CAT) is a lightweight, easy-to-use tourniquet for hemorrhage control in severely bleeding extremities.

Description

The lightweight CAT is a strap-type tourniquet with a built-in stick or windlass for tightening. It allows rapid, effective control of extremity hemorrhage for self, buddy, or medic application in far-forward locations and is included as a component of the improved first aid kit. The CAT was named one of the Army's 10 Greatest Inventions for 2005.

Laboratory/Developer

USAISR



Demand Oxygen Controller

Mission

The Demand Oxygen Controller senses breathing and oxygen rates.

Description

The Demand Oxygen Controller reduces the required amount of oxygen to one-third the usual amount needed for standard ventilation and was completed in 1989.

Laboratory/Developer

U.S. Army Medical Materiel Development Activity (USAMMDA)

Field Medical Oxygen-Generating and Distribution System



Mission

The Field Medical Oxygen-Generating and Distribution System (FMOGDS) provides oxygen refill capabilities.

Description

The FMOGDS is a lightweight system that provides bedside and cylinder-refill oxygen capabilities. Completed in 1993, it provides greater mobility and flexibility with reduced logistics dependence on medical-grade oxygen resupply.

Laboratory/Developer

USAMMDA



Golden Hour Blood Container

Mission

The Golden Hour Blood Container can hold red blood cells and needs no power source to maintain its internal temperature.

Description

The Golden Hour Blood Container holds four units of red blood cells and uses a combination of vacuum-insulated panels and an internal container that has a liquid phase-change material like reusable freezer packs. At room temperature, units of blood cells can last 121 hours at well below freezing (-9°F) for more than 97 hours, and at 105°F, they are good for more than 78 hours. It extends the amount of time a medic can transport blood products and allows for extended evacuation times necessary for far-forward combat units. The Golden Hour Blood Container was named one of the Army's Greatest Inventions for 2003.

Laboratory/Developer

WRAIR



Impedance Threshold Device

Mission

The Impedance Threshold Device (ITD) is a resuscitation device that requires no power.

Description

The ITD is a small, lightweight plastic valve that attaches to a standard facemask or mouthpiece and acts as a temporary resuscitation device that requires no power. Use of the ITD results in a vacuum within the thorax during each inspiration to increase central blood volume and cerebral blood flow, reducing the risk of hemorrhagic shock. Completed in 2005, the ITD is used in Operation Iraqi Freedom.

Laboratory/Developer

USAISR



Improved First Aid Kit

Mission

The Improved First Aid Kit was developed in response to the Tactical Combat Casualty Care Doctrine.

Description

The Improved First Aid Kit increases an individual service member's capabilities to provide self-aid/buddy aid and provides interventions for two leading causes of death on the battlefield—severe hemorrhage and inadequate airway. An improved first aid kit is issued to every deploying service member via the rapid fielding initiative. The Improved First Aid Kit was completed in 2005.

Laboratory/Developer

Managed by Program Executive Office Soldier
USAMRMC



Individual Chemical Resuscitation Device

Mission

The Individual Chemical Resuscitation Device restores normal breathing to a battlefield casualty.

Description

This device provides manually operated, positive-pressure respiratory resuscitation to assist in the restoration of normal breathing of a battlefield casualty. It also filters chemical warfare agents from ambient air and can be used with an oropharyngeal mask or cricothyroid cannula. The individual chemical resuscitation device was completed in 1987.

Laboratory/Developer

USAMMDA



Low-Power Blood Cooling and Storage Device

Mission

The Low-Power Blood Cooling and Storage Device is used for the storage and transport of blood fluids.

Description

The Low-Power Blood Cooling and Storage Device extends the capability of the current blood refrigerator and cools fresh whole blood using very low power requirements. It provides greater flexibility and reduces the logistical strain of storage at all levels of medical care from field hospitals to the battlefield. Completed in 2002, this device is being used in Operation Iraqi Freedom.

Laboratory/Developer

USAMMDA

Optimal Fluid Resuscitation Guidelines

Mission

Guidelines for the administration of resuscitative fluids by medics and forward-deployed medical personnel will provide optimal fluid resuscitation for wounded service members.

Description

Using current understanding, a set of guidelines were developed regarding optimal fluid resuscitation in injured warfighters who have experienced substantial blood loss and may experience long delays in evacuation.

The guidelines will reduce or eliminate consequences frequently associated with fluid replacement after severe blood loss.

Laboratory/Developer

USAISR

WRAIR





Rapid Blood Sterilization System

Mission

The Rapid Blood Sterilization System allows whole blood collection and use within a short time frame.

Description

This purification system allows medics to collect whole blood from a donor, sterilize it, and place it into a recipient in a matter of only a few hours. This system enables the rapid sterilization of blood products for use on the battlefield as well as for blood banks.

Laboratory/Developer

USAMMDA



Rapid Intravenous Infusion Pump

Mission

The Rapid Intravenous Infusion Pump is used to deliver intravenous fluids.

Description

The Rapid Intravenous Infusion Pump is a portable electronic infusion pump that delivers intravenous fluids to restore blood pressure and intravascular volume. It is battery operated and about the size of a deck of playing cards. It can be used far forward on the battlefield or in the transport of patients and is being used in the Global War on Terror.

Laboratory/Developer

WRAIR

Spray-On Protective Bandage

Mission

Wound stabilization is critical on the battlefield. The spray-on bandage can be self or buddy applied and used by the combat medic, physician's assistant, or surgeon for small and large wounds.

Description

The Spray-On Protective Bandage is an antimicrobial, flexible bandage that will reduce or eliminate blood and fluid loss, reduce or eliminate pain associated with motion, and protect wounds from environmental contamination. The bandage is capable of reducing or stopping blood and fluid losses, including compressible hemorrhage and amputation stumps after minimal tourniquet control. Wound stabilization is provided for 2 or more days after injury. It may be used in conjunction with enzymatic and chemical debridement.

This product is easily applied on the battlefield and allows mobility for the warfighter with small wounds. Large wounds can be stabilized following initial treatment with compression-style and hemostatic dressings or minimal tourniquet use.

Laboratory/Developer

USAISR



Thermal Infusion System (formerly Cartledge Infuser)

Mission

In any military conflict or civilian disaster, it is an unfortunate fact that there will be casualties requiring rapid infusion of blood and/or resuscitative fluids. To normalize a casualty's hemodynamic status, a physician must possess the capability to rapidly infuse warm blood or resuscitative fluids.

Description

The Thermal Infusion System is a portable, rugged, easy-to-use, state-of-the-art fluid infusion device capable of warming and infusing fluids at rapid rates to treat and sustain hypovolemic trauma patients. It can infuse normothermic blood or fluids at rates as low as 10 milliliters per hour up to 1,200 milliliters per minute. The system weighs 22 pounds. The U.S. Food and Drug Administration cleared this product for marketing in October 2006.

Laboratory/Developer

USAMMDA





Ventilatory Assist Device for Anesthesia Machine

Mission

The Ventilatory Assist Device for Anesthesia Machine ensures the proper ventilation of patients.

Description

The Ventilatory Assist Device for Anesthesia is an integrated ventilator and anesthesia machine that ensures proper ventilation of patients during surgery and is compatible with low-pressure oxygen sources such as oxygen generators and concentrators. It provides forward surgical teams with the ability to properly ventilate a wounded service member while replacing the more labor-intensive system of an anesthetist hand-bagging a patient and reducing equipment load. Completed in 2005, the Ventilatory Assist Device for Anesthesia Machine is being used in Operation Iraqi Freedom.

Laboratory/Developer

USAMMDA



Antimicrobials for Orthopedic Injuries

- ◆ Antimicrobial Bone Replacement Material
- ◆ Antimicrobial External Fixator Pins

Mission

Through the use of Antimicrobial Bone Replacement Material and External Fixator Pins, the risk of infection from bone fractures will be reduced.

Description

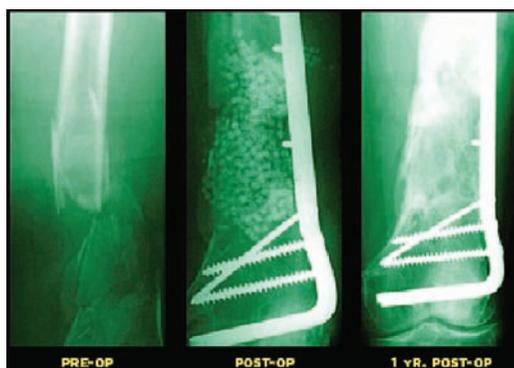
Treatment of casualties in austere environments necessitates extra precautions be taken to minimize the risk of surgical wound infection. Antimicrobial bone repair and stabilization items are impregnated with antibiotics to reduce or eliminate the occurrence of infection associated with bone fracture injuries.

Antimicrobial Bone Replacement Material. This device will replace lost bone and help stabilize bone fractures.

Antimicrobial External Fixator Pins. Surgical pins and screws will be used to stabilize bone fractures.

Laboratory/Developer

USAISR



Military Amputee Research Program

Mission

The Military Amputee Research Program provides support services in clinical settings, creates innovative rehabilitation strategies, develops traumatic amputee patient care plans, and fosters advances in prosthetic technology.

Description

This program provides state-of-the-art physical therapy and prosthetic treatment to service members. It enables service members to get back on their feet, in some cases back in the fight, and returns to all of them much of the independence lost as a result of battle injuries.

Laboratory/Developer

U.S. Army Medical Research Acquisition Activity



Splints, Extremity and Pelvic

- ◆ **Lightweight Extremity Splint**
- ◆ **Pelvic Fracture Stabilizer**

Mission

Immobilization of bone fractures is vital to prevent further injury. These new splints will not only prevent further injury but in some cases will also allow the continued mobility of the injured service member. The splints will be used on the battlefield by buddy care, the combat lifesaver, combat medic, physician's assistant, or surgeon.

Description

The Lightweight Extremity Splint. Replacing the current board splints, this is a spray-on contractible or pneumatic expandable splint fabricated from new, lightweight material(s) and deployable far forward in the battle area. Service members with immobilized and nondisplaced fractures may be able to continue their mission, and service members with serious open fractures may be stabilized and transportable for several days under battle conditions. The splint will enable a service member with a single upper extremity fracture to remain functional, perhaps even operating a weapon until evacuation. A service member with a lower extremity fracture may be able to evacuate with crutches or one other person instead of needing a stretcher evacuation team.



The Pelvic Fracture Stabilizer. This splint system will stabilize a fractured pelvis to facilitate movement of injured patients without risk of further pelvic organ damage due to pelvic instability. Pelvic fractures are very difficult to immobilize and stabilize especially during evacuation from the battlefield via carried litter or ambulance.

Laboratory/Developer

USAISR



Armored Medical Evacuation Vehicle

Mission

The Armored Medical Evacuation Vehicle provides a medical interior for use on an existing armored vehicle.

Description

This medical interior for an existing armored vehicle provides protection from chemical and biological agents and has an environmental control system and separate power source for medical systems. Telemedicine and life support for trauma and transport capabilities are included with equipment for ventilation, suction, and vital signs monitoring. Completed in 1998, the Armored Medical Evacuation Vehicle replaces the M113 armored ambulance used in the evacuation of patients from the battlefield. It provides mobility, survivability, and the ability to rapidly treat combat casualties.

Laboratory/Developer

USAMRMC

Program Executive Office, Ground Combat and Support Systems

Army Medical Department Interim Tent System

Mission

Develop an interim replacement for the Tent Extendable Modular Personnel, or TEMPER, tents used in deployable medical system hospitals.

Description

The Army Medical Department Interim Tent System provides lighter, brighter, and more environmentally resistant patient areas. Future plans call for air beam technology to reduce the weight by two-thirds and setup time by half; this will become the Future Force tent system. The Army Medical Department Interim Tent System was completed in 2004.

Laboratory/Developer

USAMRMC



Chemical Warfare Agent Protective Patient Wrap

Mission

The Chemical Warfare Agent Protective Patient Wrap protects service members from chemical warfare agents.

Description

Completed in 1987, the Chemical Warfare Agent Protective Patient Wrap protects service members from chemical warfare agents during evacuation in a field environment.

Laboratory/Developer

USAMMDA



Field Computed Tomography Scanner

Mission

The Field Computed Tomography (CT) Scanner provides diagnostic-quality CT information.

Description

The Field CT Scanner is a commercial x-ray CT system that is shock mounted and installed in an International Standard Organization Shelter. This device was completed in 1993.

Laboratory/Developer

USAMMDA



Field Operating Table Improvement

Mission

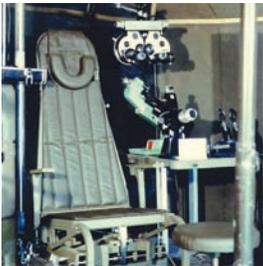
The Field Operating Table Improvement addresses problems with the previous version.

Description

The Field Operating Table Improvement fixes problems with the rigidity and elevation gearing of the past version. Completed in 2004, the weight and size are significantly reduced from the deployable medical system table that is currently in use.

Laboratory/Developer

U.S. Army Medical Materiel Agency (USAMMA)



Field Optometry Set

Mission

The Field Optometry Set includes optometric equipment.

Description

The Field Optometry Set contains field operational optometric equipment, including examining chair, instrument pole, supporting accessories, optometric instrumentation, and field chests. The set was completed in 1988.

Laboratory/Developer

USAMMDA



Fluid Warming System

Mission

The Fluid Warming System is used to warm fluids in far-forward areas.

Description

The Fluid Warming System is a small, light-weight system for warming blood, lactated Ringer's solution, Hextend, and other fluids to be used in far-forward areas. It extends quality care further in the battle area and allows for extended evacuation times.

Laboratory/Developer

USAMMDA



Folding Decontaminable Litter

Mission

The Folding Decontaminable Litter is used to transport service members in need of medical treatment.

Description

The Folding Decontaminable Litter consists of aluminum poles and spreader bars, a polypropylene mesh fabric, and retractable nylon handles. Completed in 1990, all components are resistant to chemical agents and decontaminating solutions.

Laboratory/Developer

USAMMDA



High-Speed Mini-Sterilizer

Mission

The High-Speed Mini-Sterilizer is a small device used for steam sterilization.

Description

The High-Speed Mini-Sterilizer is a tabletop device with an inner chamber approximately 10 inches wide by 12 inches deep that sterilizes with bursts of steam on a cycle of approximately 1 minute. Completed in 1986, the High-Speed Mini-Sterilizer was later replaced with a commercial item.

Laboratory/Developer

USAMMDA

Life Support for Trauma and Transport

Mission

The Life Support for Trauma and Transport (LSTAT) is a portable, single-patient, trauma casualty care, surgical support, and evacuation platform.

Description

The LSTAT system incorporates a mechanical ventilator with a built-in compressor, vital signs monitor, intravenous infusion pump, suction apparatus, defibrillator, self-contained oxygen supply, and on-board computer for recording patient diagnostic and treatment data. The U.S. Food and Drug Administration cleared the LSTAT for marketing in June 1998, and it has been used in Operations Enduring and Iraqi Freedom. The LSTAT is being modified to meet Critical Care System for Trauma and Transport requirements. In addition, the U.S. Army Medical Materiel Development Activity, in collaboration with the Defense Advanced Research Projects Agency, is currently developing the LSTAT-Lite, which will be a lightweight, litter-mountable trauma casualty care system incorporating a ventilator with a built-in compressor, vital signs monitor, intravenous infusion pumps, and integrated display and control with patient data recording.

Laboratory/Developer

USAMMDA

WRAIR



Medical Supply Envelope

Mission

The Medical Supply Envelope is a container used for medical supplies.

Description

The Medical Supply Envelope is a fabric container with pockets for the storage, transportation, and disbursement of medical supplies required at a triage site. It is prepackaged with critical supplies, will fit into a medical chest, and can be retrieved for immediate use. The Medical Supply Envelope was completed in 1992.

Laboratory/Developer

USAMMDA



Military Transportable Field Radiographic and Fluoroscopic System

Mission

The Military Transportable Field Radiographic and Fluoroscopic System provides radiographic and fluoroscopic capabilities.

Description

This radiographic and fluoroscopic system incorporates solid-state electronics, composite materials for lightweight construction, and military-specific components for system reliability. Completed in 1987, it is also referred to as the High-Capacity X-ray System.

Laboratory/Developer

USAMMDA



Patient Holding and Evacuation Heater Unit

Mission

The Patient Holding and Evacuation Heater Unit protects service members from cold conditions.

Description

This unit provides protection against the cold for casualties during evacuation when used with existing evacuation bags. The unit was completed in 1987.

Laboratory/Developer

USAMMDA



Portable Field X-ray Table

Mission

The Portable Field X-ray Table is used to position patients for medical imaging.

Description

The Portable Field X-ray Table is a lightweight platform for positioning patients for medical imaging in the field. It weighs less than 100 pounds and has a “buckey system” to allow patient imaging in either the horizontal or vertical position. The table was completed in 1999.

Laboratory/Developer

USAMMDA



Single Litter Casualty Evacuation Kit for the M1114

Mission

The Single Litter Casualty Evacuation (CASEVAC) Kit for the M1114 aids in the fast evacuation of service members.

Description

The single-litter CASEVAC capability provides a mechanism to evacuate service members from the theater of operations in a quick manner using a current up-armored asset. The utility vehicle, the M1114, transforms into a CASEVAC vehicle in less than 1 minute.

Laboratory/Developer

USAMMDA



Special Medical Emergency Evacuation Device

Mission

The Special Medical Emergency Evacuation Device (SMEED) is a platform used to hold medical monitoring equipment in the evacuation of service members.

Description

The SMEED is a lightweight platform that attaches to a North Atlantic Treaty Organization litter and accommodates patient movement items for evacuation. The platform has modular flexibility and significantly improves the ability to evacuate ventilated patients with multiple IVs and monitors. Completed in 2004, the SMEED has been used in Operation Iraqi Freedom.

Laboratory/Developer

USAISR



Steam Vacuum Pulse Sterilizer

Mission

The Steam Vacuum Pulse Sterilizer is used for sterilization in field hospitals.

Description

The Steam Vacuum Pulse Sterilizer is a ruggedized, highly reliable sterilizer for field hospital use with large throughput. It employs a pressure and vacuum pulsing-conditioning principle for air removal and is designed to sterilize instruments, linens, and solutions. This sterilizer was completed in 1991.

Laboratory/Developer

USAMMDA



Stryker – Medical Evacuation Vehicle

Mission

The Stryker – Medical Evacuation Vehicle is the medical evacuation variant of the Stryker Armored Vehicle platform for the Stryker Brigade Combat Team.

Description

Capabilities of the Stryker – Medical Evacuation Vehicle include an automated litter lift system, on-board oxygen, suction, storage space for essential medical items and equipment, and the capacity to carry four litter patients or six ambulatory patients and a crew of three. Completed in 2003, this vehicle has been used in Operation Iraqi Freedom.

Laboratory/Developer

USAMMDA



Warrior Medic

Mission

Warrior Medic provides state-of-the-art protective, visual sensor, navigation, and weapon-targeting warfighting equipment.

Description

An enhancement to the Land Warrior System, Warrior Medic consists of the Land Warrior Leader configuration, excluding the weapons subsystems, with enhancements to include electronic casualty reporting for all service members and access to applicable electronic medical field manuals. Warrior Medic enables wounded service members or their buddies to instantaneously send a “call for medic” request with location to both the combat medic and commander. Completed in 2004, Warrior Medic increases medical situational awareness and reduces the time from injury to treatment of battlefield casualties.

Laboratory/Developer

USAMMDA





Dental Field Treatment and Operating System

Mission

The Dental Field Treatment and Operating System (DEFTOS) is a dental operating system to be used in the field.

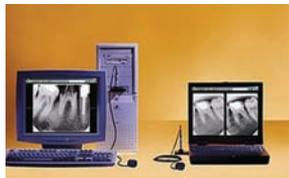
Description

DEFTOS is a small, lightweight, mobile dental operating system for dental officers in the field that uses the latest electric motor-driven handpiece technology and can be quickly assembled or disassembled and packed into one molded shipping container, reducing the footprint of the field dental operating unit. The system includes both a high-speed and low-speed handpiece, air and water supply, air and water syringe, high-volume evacuator, saliva ejector, variable-speed foot switch, and oil-less air compressor. Completed in 2003, DEFTOS has been used in Operation Iraqi Freedom.

Laboratory/Developer

U.S. Army Dental Research
Detachment





Dental Filmless Imaging System

Mission

The Dental Filmless Imaging System provides digitized dental images to forward-deployed service members.

Description

The Dental Filmless Imaging System consists of an x-ray detector and image acquisition and storage components to digitize images for storage and viewing. It is compatible with currently fielded x-ray sources. Images are available immediately for the treating dentist. It is used by forward-deployed dental technicians and officers and replaces conventional x-ray film, film processors, and the associated chemicals, eliminating the logistical burden of temperature- and time-sensitive components. Also, volume, weight, and power requirements are reduced. This system was completed in 2002.

Laboratory/Developer

Telemedicine and Advanced Technology Research Center (TATRC)



Field Dental Operating Unit

Mission

The Field Dental Operating Unit provides emergency dental care in the field.

Description

The Field Dental Operating Unit is a small, lightweight, mobile dental unit used to provide emergency and limited preventive and sustaining dental care in the field. It consists of a light source, suction apparatus, water reservoir, and high- and low-speed drills. The unit was completed in 1990.

Laboratory/Developer

USAMMDA



Miniature Dental X-ray System

Mission

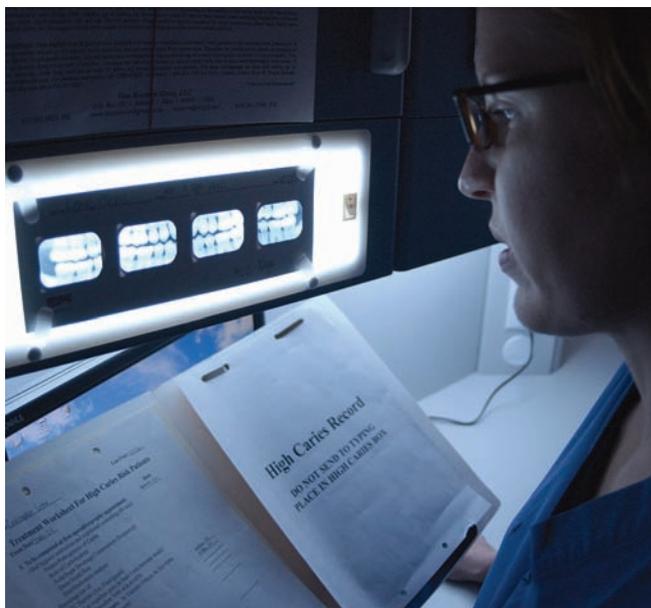
The Miniature Dental X-ray System is used to provide dental x-rays in the field.

Description

The Miniature Dental X-ray System is a small, lightweight, handheld dental x-ray system for field use. It is battery operated and suitable for use with self-developing film or a digital imager. The system was completed in 1993.

Laboratory/Developer

USAMMDA



Advanced Resuscitation Fluid

Mission

Advanced Resuscitation Fluid for small-volume fluid resuscitation and hypotension will assist the combat medic, physician's assistant, and surgeon in reducing mortality and morbidity associated with trauma and blood loss.



Description

Advanced Resuscitation Fluid will help to maintain critical levels of blood pressure and tissue perfusion to preserve organ integrity and function. The fluid is designed for small-volume resuscitation for trauma and blood loss with delayed evacuation for up to 72 hours.

This product will support the continuing effort to extend the “Golden Hour” for far-forward treatment to improve survival and minimize morbidity after life-threatening injuries. Specifically, the product will counter vascular injury and immune system activation caused by decreased perfusion and oxygen radical generation during tissue re-oxygenation. The product will also not interfere with the ability of the blood to coagulate or form clots.

Laboratory/Developer

WRAIR



Ceramic Oxygen Generator

Mission

The generation of oxygen where it is needed reduces the logistical requirements for the transport of oxygen cylinders to and within the operational theater.

Description

The Ceramic Oxygen Generator (COG) uses a metal reinforced composite, thin-film ceramic membrane to generate oxygen. Producing 1 liter of oxygen requires 30 watts of electricity. The device will be battery powered and weigh only 10 pounds.

Existing oxygen production technology uses techniques such as pressure swing adsorption or cryogenics to separate oxygen from air. The COG uses no major moving parts; instead it uses a thin, hot ceramic membrane that has a voltage applied to it. The applied voltage drives atmospheric oxygen and only oxygen through the membrane to a collection chamber. The mechanical simplicity and high efficiency make this a promising technology.

Laboratory/Developer

IGR Enterprises, Inc.

USAMMDA



Fibrinogen Bandages

Mission

Medics, combat lifesavers, and other medical personnel will use the Fibrinogen Bandage on the battlefield to aid in the control of severe hemorrhage in injured service members.



Description

The Fibrinogen Bandage will be composed of human fibrinogen and thrombin. When used with direct pressure, the dressing is intended to stop severe arterial, venous, or mixed bleeding in 2 to 4 minutes.

Laboratory/Developer

USAMMDA
USAISR

Hemoglobin-Based Oxygen Carrier

Mission

A resuscitation fluid with oxygen-carrying capability will be used for casualties who have suffered life-threatening hemorrhage on the battlefield and who require red blood cells that are not available.



Description

The Hemoglobin-Based Oxygen Carrier (HBOC) is a non-blood-type-specific solution of hemoglobin polymer derived from either human or animal blood. Hemoglobin is the oxygen-carrying component of red blood cells. Depending on the manufacturer, the HBOC is stable for up to 1 year at room temperature and for 2 years at 4°C. This product provides a more temperature-stable alternative to red blood cells, eliminates the need for blood typing, and can be used in a far-forward environment for casualty resuscitation.

Laboratory/Developer

Biopure Corporation

Northfield Laboratories

USAMMDA

USAISR



Red Blood Cells, Extended Life

Mission

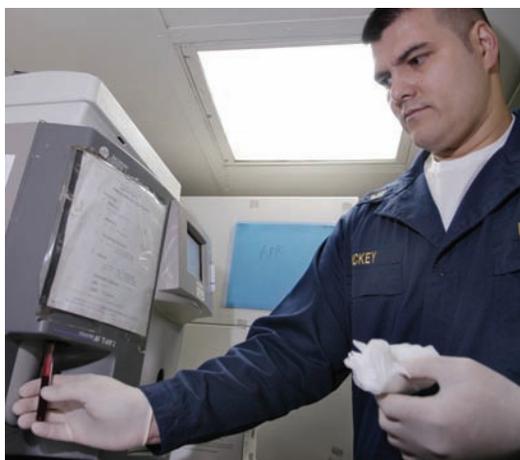
Researchers aim to improve the availability and quality of packed red blood cells on the battlefield by extending their shelf-life.

Description

Red Blood Cells, Extended Life (RBCXL) consist of a new additive solution that extends the total shelf-life of packed red blood cells from 6 weeks to at least 8 weeks and extends the deployed shelf-life from approximately 3 weeks to at least 5 weeks—an increase of approximately 60 percent. Enhanced shelf-life not only reduces the expiration of packed red blood cells but also improves the management of type O blood (universal donor) units. RBCXL may also mitigate the degradation of packed red blood cells, which may have a negative impact in casualties who receive more than 10 units of packed red blood cells in a single transfusion.

Laboratory/Developer

Hemerus Medical, LLC
USAMMDA



Rotary Valve Pressure Swing Oxygen Generator

Mission

The Rotary Valve Pressure Swing Oxygen Generator (RVPSOG) is a smaller, more efficient product and will reduce the logistical burden of the oxygen generator for forward-deployed medical assets for use in single-patient care and transport.

Description

Existing pressure swing adsorption oxygen generator technology is being miniaturized into a portable device. Miniaturization requires the development of a small but reliable compressor. A rotary valve driven directly by a small motor will eliminate complex valve and control systems used in conventional oxygen generators.

The logistical burden of resupply and refill of oxygen cylinders will be eliminated. The generator replaces the standard “D” cylinder for patient care and transport and yields increased efficiency and reduced size and weight.

Laboratory/Developer

USAMMDA



Transportable Pathogen Reduction Blood Safety System

Mission

This program evaluates the efficacy of the technology to inactivate pathogens that could be a risk to military and civilian blood supplies.

Description

The possibility of transmitting disease by the transfusion of blood or blood components to a patient is a longstanding problem in transfusion medicine. Currently, donors are asked about their medical and behavioral history, and samples of their blood are tested for the presence of several viruses. While this approach provides a high level of safety, it has limitations. If an infected person donates blood with virus levels below the detection limit of the screening tests, the test will not detect virus, but the blood could still transmit disease. Another limitation of current practice is that testing is only done for a limited number of viruses; a number of well-known viruses, as well as emerging viruses, will not be detected. Also, testing is not done for parasites and is not routinely done for bacteria.

The proposed approach to pathogen reduction uses light and riboflavin to inactivate pathogens in blood components. This technology is currently in development for application to red blood cells and platelet and plasma products. Treatment of platelet and plasma products is in a later stage of development than that of red blood cells; it has been used in clinical studies in the United States and South Africa with platelet products. The technology requires the addition of a riboflavin solution to plasma or platelets followed by exposure to ultraviolet light. Red blood cells are treated with the addition of a riboflavin solution and exposure to visible light. With the riboflavin-and-light technology, pathogen nucleic acids are damaged, preventing their replication and hence disease transmission in recipients of blood products.

Laboratory/Developer

TATRC/Research Area Directorate II

Advanced Regenerative Medicine Technologies to Regenerate Lost Tissues

Mission

This effort focuses on developing advanced regenerative medicine technologies to restore functional tissues using the latest advances in stem cell research combined with tissue engineering technologies to produce new cells and tissues to replace damaged cells resulting from combat injuries.

Description

Researchers seek to develop novel therapies to regenerate fingertips using extracellular matrix material, to repair and reconstruct injured or missing soft tissues using extracellular matrix as a bioscaffold, and to treat severe skin burns via extraction, expansion, and cell support technologies of autologous skin cells from a healthy area of a patient's skin to enable skin cell tissue engineering in the wound of a patient. Skin regeneration takes place directly in the wound of a patient by using a cell spray device followed by placing a temporary artificial capillary bed to support cell proliferation and cell migration in the wound thereby reducing in vitro culture time (i.e., no in vitro expansion).

Laboratory/Developer

Pittsburgh Tissue Engineering Initiative

University of Pittsburgh

USAISR

TATRC



Active Thermal Resuscitation

Mission

Active Thermal Resuscitation (ATR) is a methodology that uses a prototype portable warming system that can heat fluid to prevent the onset of hypothermia.

Description

Hypothermia is common and increases mortality in wounded personnel. Forward surgical teams currently use standard civilian fluid warmers and forced-air warming blankets to help prevent the onset of hypothermia. These systems, however, are not portable and do not effectively treat established hypothermia. Also, they require large amounts of generated electrical power and have a sizable transport footprint. Researchers have demonstrated a prototype portable warming system that can address this need while improving the mobility of a forward surgical team. The system uses the most favorable thermodynamic and physiologic methods to achieve rewarming of the hypothermic service member.

Laboratory/Developer

University of Texas
Health Science
Center at Houston



Advanced Medic Training Technologies

Mission

The Advanced Medic Training Technologies (AMTT) effort has successfully developed the first wireless, field-capable patient simulator and a game-based simulation with courseware to train life saving skills to combat medics, combat lifesavers, and warfighters in realistic environments and while deployed.

Description

Warfighters have no capability to practice treating realistic patients in relevant environments or while deployed. Current simulators are too expensive, too large, and require too much logistic support to train a large number of service members in a field environment.

The AMTT effort was part of a 3-year Army Technology Objective that yielded two products for combat medics, combat lifesavers, and warfighters to address these concerns. The first is the Stand Alone Patient Simulator (SAPS), the first completely wireless, physiologically based, deployable, and rugged patient simulator that allows training in a field environment. The second is the TC3 (Tactical Combat Casualty Care) simulation, a low-cost game-based simulation that was developed to meet Army TC3 learning objectives. SAPS is gaining congressional and high-level Army support to be fielded as a rapid-fielding initiative to speed up the fiscal year 2010 transition to the Medical Simulation Training Center. The onboard bleeding capability developed for SAPS has already been transitioned to the Army's standard patient simulator in the Medical Simulation Training Center. The TC3 simulation transitioned to the Department of Combat Medic Training in May 2007.

Laboratory/Developer

U.S. Army Research, Development and Engineering Command,
Simulation and Training
Technology Center

USAMRMC



Field Sterilizer Improvement Device

Mission

This newly improved sterilizer will reduce the water consumption of the device currently used by forward-deployed medical facilities.

Description

While the current field sterilizer is a well-proven piece of equipment, one shortcoming has been its high water consumption; it uses 2 ½ gallons of water every time it sterilizes a load of materials. A water recovery module will be added to the sterilizer to condense the exhaust steam and return it to the sterilizer's boiler. The design of the water recovery module has been updated to use currently available components and improve the access for maintenance and repair. This effort is intended to fully field a water recovery system.

Laboratory/Developer

USAMMDA



Future Combat System – Medical Variants

Mission

Medical variants of the Future Combat System vehicle platform will serve as the ground medical evacuation and treatment assets for highly mobile, far-forward combat units.

Description

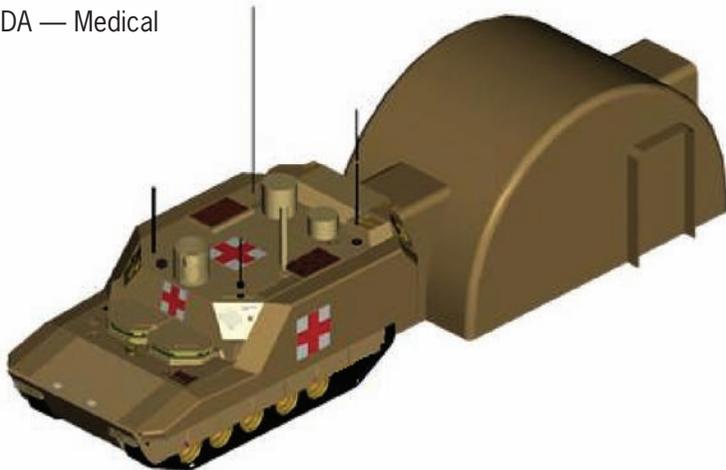
Two medical variants of the Future Combat System are planned: Medical Vehicle–Evacuation (MV-E) and Medical Vehicle–Treatment (MV-T). Medical capabilities will include on-board oxygen generation, suction, storage space for essential medical items and equipment, and automated data management. The MV-E version will carry four litter patients on an automated litter lift system or six ambulatory patients and a crew of three. The MV-T version will provide interior space for the treatment (surgery) of one patient and a crew of four.

Future Combat System – Medical Variants will provide the capability for medical response assets to move with the far-forward and mobile Units of Action. Additionally, use of the Future Combat System platform yields the same mobility, transportability, and supportability as the supported force.

Laboratory/Developer

Program Manager, Future Combat Systems, Brigade Combat Team - Vehicle

USAMMDA — Medical



Future Medical Shelter System

Mission

This future system will provide forward-deployed field hospitals with transportable, lightweight medical shelters.

Description

The Future Medical Shelter System (FMSS) is being designed with a self-contained emergency response concept in mind and is transportable along with its tactical transport vehicle by a C-130 aircraft. The FMSS consists of chemically and biologically hardened ISO containers with quick erect and strike times and integrated electrical, water, and medical packages, as well as 1,200 square feet of soft tentage for patient care wards.

The FMSS will replace the deployable medical systems operating room shelter. The design reduces the weight of comparable systems and enhances the transportability and deployability of forward medical care by reducing the number of airlift flights required to deploy a field hospital. The transport vehicle provides tactical mobility, which is a new capability for field hospitals.

Laboratory/Developer

USAMMDA



Intranasal Ketamine

Mission

The U.S. military has identified a need for improved acute pain relief that allows a warfighter to remain cognitively functional. Effective analgesia on the battlefield lessens adverse pathophysiologic responses to pain, aids evacuation, and improves morale.

Description

Current military doctrine endorses morphine as the first-line agent for battlefield casualty analgesia. Morphine, administered intravenously (5 milligrams) or intramuscularly (8 milligrams), provides reliable analgesia. However, morphine at standard doses impairs cognitive function, often to the point of incapacitation, and can cause hypotension and respiratory depression to the point of being life threatening to a casualty. Re-dosing for refractory pain increases the likelihood of these complications. Service members administered morphine are essentially lost to a unit and require close observation by medics or other unit members for the duration. Casualties, especially those given morphine, can quickly overwhelm the combat health support available to a commander, potentially putting a mission in jeopardy.

Ketamine has been identified as a potential battlefield analgesic to replace morphine. Ketamine is an anesthetic commonly used for surgical procedures in both humans and animals. At sub-anesthetic low doses it produces significant analgesia mainly through selective, noncompetitive blockade of the N-methyl-D-aspartate receptor. It does so without the cardiopulmonary depressive effects of morphine and other anesthetics and centrally acting analgesics. This would be especially advantageous for the warfighter on the personnel-autonomous and geographically dispersed battlefield of the future.

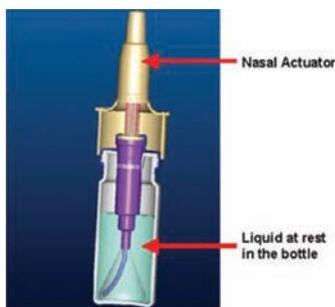
Laboratory/Developer

USAISR

U.S. Army Aeromedical Research
Laboratory

WRAIR

USAMMDA



Portable Noninvasive Shock Monitor

Mission

The Portable Noninvasive Shock Monitor will assist military medical personnel in preventing mortality and morbidity associated with shock.

Description

Trauma and hemorrhage are leading causes of death in the United States and a major concern of the military. Significant loss of blood leads to shock, a condition of inadequate organ perfusion, and tissue oxygenation. There is the need for intelligent medical systems to guide corpsmen and combat medics in triage and resuscitation of severely injured combatants. A prototype, portable sensor system based on near infrared spectroscopy to noninvasively measure tissue perfusion has been developed and tested. This system quickly and accurately measures muscle pH, muscle oxygen tension, and hematocrit from light reflected off the palm of the hand and will guide combat medical personnel in resuscitation care and evacuation. The noninvasive, continuous process provides earlier indication of life-threatening medical problems and a means of rapidly triaging casualties; medical information to guide treatment where none currently exists; and advanced medical capability not previously available near the battlefield and during transport. Prototype development was completed in 2005 and capability was demonstrated in 2006. Evaluations are planned at Brooke Army Medical Center's Burn Unit and Beth Israel Deaconess Hospital Emergency Department in 2007.



Laboratory/Developer

Congressionally Directed Medical Research Programs
Luxtec Corporation
University of Massachusetts Medical School
USAISR

Robotic Integration of High Intensity Focused Ultrasound with Life Support and Trauma and Transport

Mission

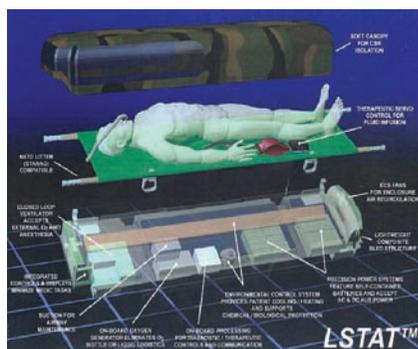
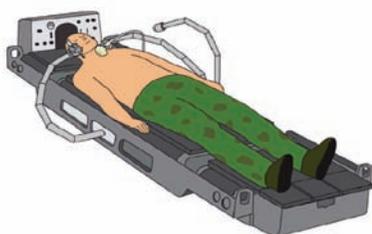
To develop a robotic High Intensity Focused Ultrasound (HIFU) system integrated with the Life Support and Trauma and Transport (LSTAT) system.

Description

The main advantages of HIFU are its noninvasive nature and that therapy occurs deep within a patient's body without affecting the intervening tissue. The objective of this project is to create a revolutionary teleoperated HIFU system that is robust and at least as effective as a local, non-telerobotic system. To do this, a telerobotic system will be developed that employs a master-slave design, an innovative control system that is stable even in the presence of data latency and bandwidth constraints, a unique series-elastic actuation system for arm flexibility, new methods of detecting and controlling hemorrhaging through HIFU, and an intuitive human interface—all seamlessly integrated with the LSTAT system. This will allow a trauma surgeon or a trained operator to remotely perform noninvasive HIFU surgery on a casualty in the field.

Laboratory/Developer

TATRC



Robotic Laser Tissue Welding

Mission

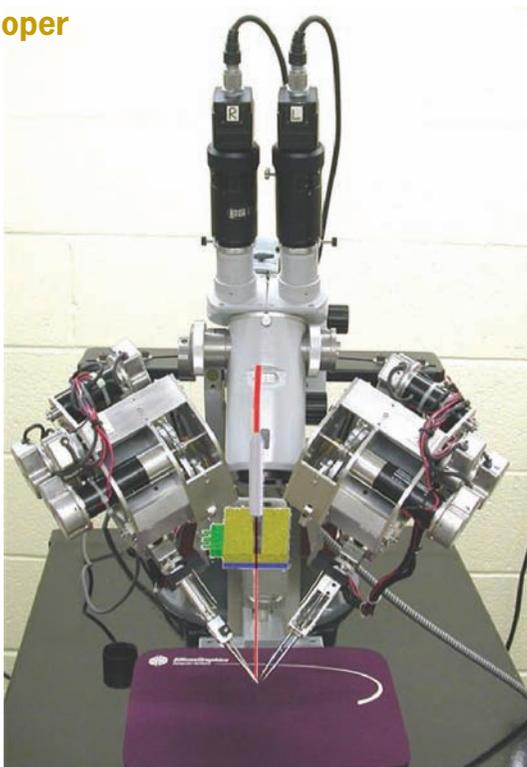
SRI, Inc., will use a robotically controlled laser to test various materials to improve adherence and repeatability of tissue welding as an alternative to sutures.

Description

Incorporating laser tissue welding into a surgical robotic platform provides greater control over some of the parameters that are critical for a successful outcome of the bonds. The synergy between laser tissue welding and robotic surgery has the potential to improve the state of the art of microsurgical procedures and robotic minimally invasive surgery. High precision and lack of tremor of the manipulator, together with the increased uniformity of solder and power delivery, should result in higher quality bonds.

Laboratory/Developer

TATRC



Special Operations Forces Medical Handbook



Mission

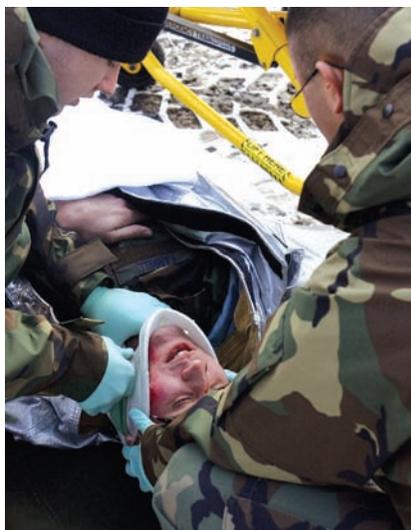
On the battlefield, it is crucial for first responders to have current medical information at the point of care. The Special Operations Forces Medical Handbook (SOFMH™) provides an up-to-date, portable field medical reference for Special Operations Forces medics and other first responders working in austere environments.

Description

The SOFMH was developed through a collaboration between the USAMRMC and the Headquarters U.S. Special Operations Command to make available comprehensive military medical reference materials, including pictures where appropriate, for first responders. The SOFMH is available in printed format or electronic format and has an established online authoring and editing tool to assist in updating and providing the most relevant military medical materials. In the electronic format, the SOFMH is a standard reference provided with Armed Forces Health Longitudinal Technology Application-Mobile (AHLTA-Mobile), a wireless handheld device that is in place throughout the DoD. The SOFMH helps improve military health care by enhancing training and assisting in effective decision making by providing a quick reference tool. Since its publication, the SOFMH has been used extensively in Operation Enduring Freedom and Operation Iraqi Freedom by all levels of U.S. and allied military health care personnel.

Laboratory/Developer

TATRC



3DiMD: Gaming Environment for Training Team Coordination Skills

Mission

A three-dimensional, interactive networked system assists in training military health care team coordination skills.

Description

The main objective is to develop an immersive three-dimensional environment to train and assess military health care team coordination skills. Because this is a development project, there is no formal experimental hypothesis to test. However, the design specification and prototype will be evaluated qualitatively. Ease of use, practicality, scope, and effectiveness of the training system will be assessed through heuristic analysis by experts in team training. Future work will assess the impact of the prototype training environment on the team coordination skills of military health care providers. Future efforts will also evaluate the efficacy of the prototyped interactive team coordination assessment tools.

The development of 3DiMD will provide an effective solution to the problem of expanding the scope of team coordination skill training in military health care environments. In addition, the software platform to be developed will allow for the integration of multiple scenarios and work environments (e.g., training modules) to allow expansion into public health care environments.

Laboratory/Developer

Duke University Medical Center
TATRC



Assessment of Learning with the Mobile Telementoring Intubating Video Laryngoscope in Endotracheal Intubation Training

Mission

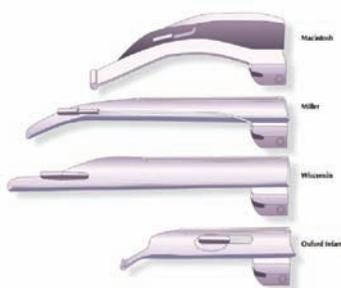
During a mass casualty scenario (whether man made or a natural disaster), health care providers could be overwhelmed by patients, many of whom would need airway support.

Description

The study will evaluate the efficacy of the Berci Video Macintosh Intubating Laryngoscope System, which has a camera incorporated into its handle with a short image and light bundle, allowing video projection to a monitor screen. Specific research objectives are to: (1) Measure the efficacy of the video laryngoscope for airway training compared to the standard laryngoscope, (2) measure the performance of students using the video laryngoscope compared to the standard laryngoscope, and (3) develop a curriculum for the use of the video laryngoscope in airway training to support anesthesia training programs, advanced cardiac life support airway training, the far-forward battlefield medic, and the conscious sedation training program.

Laboratory/Developer

University of Nebraska Medical Center
TATRC



Center for Advanced Surgical and Interventional Technology

Mission

The Center for Advanced Surgical and Interventional Technology (CASIT) of the David Geffen School of Medicine at the University of California, Los Angeles, is working on the TATRC-supported project, “The Application of Novel Technologies in Computer-Mediated Medicine.” CASIT uses the resources of the School of Medicine, the Biomedical Engineering Department, the California Nano-Systems Institute, and industry to advance the technology of interventional medicine; to improve telementoring, telesurgery, and telepresence; and to facilitate on-site diagnosis and treatment. The project has seven interrelated subprojects.

Description

CASIT is uniquely suited to develop technologies that will enhance the care of the warfighter as well as provide new and sophisticated simulators for education, training, telementoring, and telesurgery. The close proximity of engineers and scientists to physicians, investigators, surgical robots, and other instruments provides a unique opportunity for interaction resulting in greater potential for innovation, rapid transition of technology into useful medical applications, and effective coordination with TATRC and DoD experts.

Project 1 is a haptic-guided telementoring system that will improve expert surgeon telepresence at remote surgical sites. Project 2 will develop a haptic feedback system for minimally invasive surgery, which will also be applicable to extremity prosthesis. Project 3 is developing a wireless, implantable, catheter-mounted sensor for physiologic monitoring. Project 4 involves a telepresent application using a robotic wireless system that is integrated with a system that delivers relevant and real-time patient information directly to a caregiver’s computer. Project 5 is a PC-based multimodal procedure trainer. Project 6 will use flexible three-dimensional ultrasound technology to enhance diagnosis of injuries and facilitate interoperative guidance. Project 7 takes advantage of the development of thin film nickel titanium for an intravascular prosthesis.

Laboratory/Developer

TATRC

Developing Generalized Algorithms for Objectively Assessing Medical and Surgical Skill with Various Modalities – Data

Mission

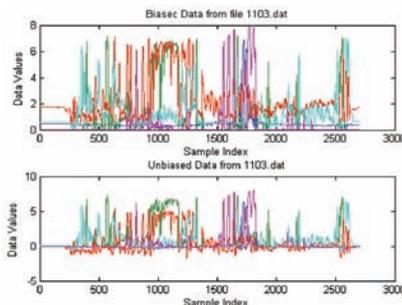
New simulators being developed will produce large amounts of data that will provide insight into human performance.

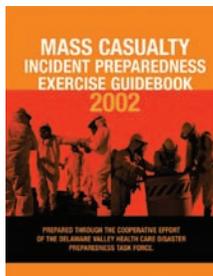
Description

Inherent difficulties in evaluating clinical competence for physicians have spawned the wide use of various subjective assessment techniques. Inspired by objective methodology, algorithms are based on a mathematical finite-state model. Statistical distances measured between models representing subjects with various skill levels are sensitive enough to provide an objective measure of medical or surgical skill level. The goal of the proposed research project is to develop a generalized methodology based on Markov models independent of the modality being used and to test it using data acquired from three different modalities including: (1) An instrumented surgical tool, (2) a physical simulator (e-pelvis), and (3) a robotic system (DeVinci by Intuitive Surgical). The type and severity of the injuries that military medical personnel will have to cope with in the battlefield may exceed the nature and complexity of the injuries that a civilian clinician has to treat. These circumstances make simulators, along with software for assessing skill level, critical elements for military medical training. The proposed methodology could one day be extended to other nonmedical military simulators.

Laboratory/Developer

University of Washington
TATRC





Emergency Department Self-Assessment Survey and Incident Scenario Exercise Guidebook for Chemical, Biological, Radiological/Nuclear, and Explosive Response Preparedness

Mission

This guidebook will promote the development of an effective response by the civilian medical community to chemical, biological, radiological/nuclear, and explosive (CBRNE) terrorist attacks through the use of online tools and advanced distributed learning.

Description

A hospital self-assessment survey for emergency department preparedness has been developed by the National Bioterrorism Civilian Medical Response Center (CIMERC) at Drexel University as a deliverable under a government contract funded by congressional appropriation. Based largely on the Soldier and Biological/Chemical Command Domestic Preparedness Training Manual and input from an expert consensus panel, the survey was designed to determine emergency department readiness to generate a minimal level of reasonable response to a chemical or biological mass casualty event, regardless of population base or surge capacity. The self-assessment survey, containing 14 questions, can be accessed online at www.cimerc.org and can be completed within several minutes. References and expert opinions are also accessible. The survey can be used to provide a snapshot of regional readiness as well as to support targeted allocation of health care resources. Also developed by CIMERC and available on the web site is the online version of a guidebook entitled, "Strategies for Incident Preparedness: A National Model." This disaster preparedness training handbook contains 20 different CBRNE disaster scenarios. Both the self-assessment survey and guidebook have been translated into Spanish, and they are currently being evaluated in Latin America.

Laboratory/Developer

CIMERC

TATRC

Immersive Technologies Approach to Medical Modeling and Simulation

Mission

Identifying, developing, integrating, and assessing virtual reality technologies will improve cognitive training effectiveness for health care personnel.

Description

Immersive technologies offer promise to improve medical training in the area of reinforcing cognitive skills for individuals and small units. Forterra Systems, Inc., in collaboration with the Stanford University Medical Media and Information Technologies group, is developing an avatar-based system to train medical first responders for CBRNE events. The avatars can be manipulated in a persistent virtual environment equipped with the features and facilities required to “play the game.” CBRNE scenarios can be practiced by multiple players at various locations who are connected over the Internet. Taking a different approach, SIMmersion LLC, in collaboration with the Uniformed Services University of the Health Sciences, is developing a virtual reality (movie-based) training system to teach differential diagnosis skills, such as smallpox versus chicken pox, required by health care providers in response to CBRNE events. This has the potential to augment today’s use of standardized patients. Specific to military combat medic training, the Virtual Reality Medical Center is developing a low-cost, interactive virtual reality video game trainer that is hypothesized to improve combat medic skills. The trainer is based on the Army’s Combat Medic Advanced Skills Training curriculum. The purpose is to determine the degree to which lower cost, lower fidelity training platforms have a positive “training transfer” from the simulation experience into the delivery of real health care.

Laboratory/Developer

Forterra Systems, Inc., collaborating with Stanford University Medical Media and Information Technologies

SIMmersion LLC, collaborating with the Uniformed Services University of the Health Sciences

Virtual Reality Medical Center

TATRC

Medical Modeling and Simulation

PC-Based Interactive Multimedia: Simulation Technologies for Advanced Trauma Care

Part-Task Trainers

VIRGIL™

Virtual Reality Demo

Advanced Ureteroscopic Surgical Training System, Transurethral Resection of the Prostate

Dynamic Injury Creation Simulator

Medical Simulation Training Initiative

Mission

TATRC is spearheading improved training of both military and civilian health care providers by managing the development of simulation technologies and integrating them into medical training systems. These systems will allow health care personnel to practice critical skills on simulated patients and in “immersive environments” to create a realistic “look and feel” of patient treatment.

Description

Simulation technologies revolutionized aviation safety and warfighter training. In medicine, simulation technologies offer the potential to train people from the foxhole to the operating room. By using simulators that have been embedded into medical curricula to create systems of training, users can develop and sustain their skill proficiency with no risk to real patients. They can gain the confidence required for managing high-risk patient conditions by training in a controlled situation. TATRC is integrating research funded by many sources, for example, congressionally directed, U.S. Army core funding, dual-use, SBIR, and Small Business Technology Transfer. TATRC’s Medical Modeling and Simulation (MM&S) research portfolio falls into four main areas: PC-based interactive multimedia, digitally enhanced mannequins, part-task trainers (sometimes called virtual workbenches), and total immersion virtual reality.

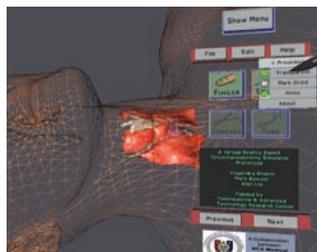


PC-Based Interactive Multimedia.

Simulation Technologies for Advanced Trauma Care (STATCare) by RTI International is a trauma patient simulator that gives sustainment training for emergency medical technicians on a PC-based interactive multimedia “virtual patient.” The patient responds

physiologically and pharmacokinetically to user diagnosis and treatment. User interaction is recorded for after-action review. With additional funding directed through another agency (the Office of the Secretary of Defense for Health Affairs is expanding STATCare’s capabilities into Sim-Patient™, also developed by RTI International), it will have the capability to simulate multiple patients and provide training beyond the emergency medical technician level. TATRC has also begun work to develop PC-based “sim games” for CBRNE training.

Part-Task Trainers. Much work is ongoing to develop “part-task” trainers that allow training to focus on high-risk, high-consequence parts of clinical procedures. Work is progressing in many procedures, such as virtual cricothyroidotomy, needle thoracocentesis, central venous catheterization, exsanguinating hemorrhage, fractured femur, and intracranial burr hole. Two new areas of development are the Haptics-Optional Surgical Training System and the Simulation-Based Open Surgical Training Systems.



VIRGIL. The Center for Integration of Medicine and Innovative Technology (CIMIT) Simulation Group is developing this prototype chest trauma training system, which teaches trainees how to diagnose and treat a chest trauma victim in a combat situation. It integrates a hybrid mannequin, virtual reality tools, and a computer-based system and

offers several levels of difficulty. In April 2004, VIRGIL was selected as one of the Army’s 10 Greatest Inventions for 2003. Initial validation studies at the National Capital Area Medical Simulation Center have shown that VIRGIL



trains third-year medical students as effectively as pig training.

Virtual Reality Demo (VR-Demo). Skills degrade over time, may be lost at a moment of need, and are needed for the unexpected. The VR-Demo psychomotor skills trainer/tester is a portable, flexible, self-contained haptics-based simulator. It allows training to be

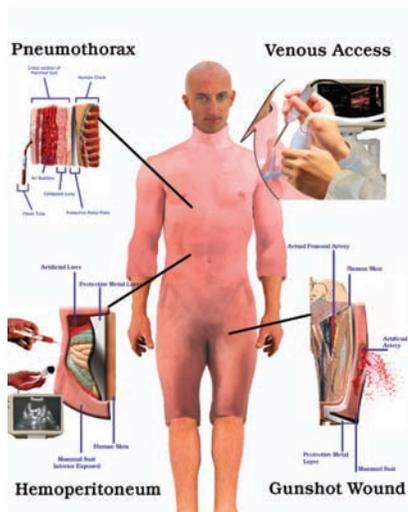
moved from the laboratory to the workplace or to field conditions for just-in-time training.

Transurethral Resection of the Prostate (TURP). Under SBIR Phase II funding, validation, software, and force feedback research is being conducted to increase training effectiveness. The National Capital Area Medical Simulation Center, together with Emory University, is conducting a comprehensive “virtual reality to operating room” validation study on the URO Mentor™ simulator. The main components of the software module and also external software and hardware modules as well as their relations to each other were



designed. The haptic device was adapted to laser TURP. The interface with the force feedback device was designed at high frequency to maintain a smooth response.

Dynamic Injury Creation Simulator. The Virtual Reality Medical Center is producing a functional, medically and militarily tested prototype of the injury creation simulator to provide a realistic training experience at two levels. For corpsmen embedded with their squads, the goal is rapid initial assessment



and stabilization. Medical scenarios will include only wounds that corpsmen address in the field. The medical scenarios for Echelon II will be selected from a broader choice of procedures while still focusing on the treatment of injuries for which corpsmen have existing equipment. These scenarios will provide medics and corpsmen with the actual experience in the field that they must master. The training exercises take place under live or simulated fire complete with “enemy” actors and combatants, explosions, and other special effects. The investigators will bring all the tools of Hollywood special effects to live training, culminating in a near-real battlefield experience.

Medical Simulation Training Initiative (MSTI). Looking into the future, MSTI is a long-term research effort to identify, develop, and integrate fundamental “enabling technologies” into medical simulation devices and even entire medical training systems. The CIMIT Simulation Group is executing the MSTI program.



Examples of enabling technologies are tissue properties measurement, tool-tissue interactions, haptics, virtual reality graphics and visualization, learning, and open systems architecture. Under the auspices of this technology development initiative, concepts have been prototyped into products related to computer-based simulation training systems, for example, VIRGIL™ and Smallpox Inoculation Training, also called SITU.

TATRC is leading two significant initiatives to pave the way for widespread adoption: Validation and open standards development leading to interoperability. TATRC has funded more than a dozen studies to validate the degree to which skills developed via simulation transfer to the delivery of health care. To enhance interoperability among medical simulation systems, TATRC is now facilitating informal discussions to spur the development of “open source standards” for MM&S.

Laboratory/Developer

TATRC

Mimic Technologies: Affordable Haptics for Surgical Training

Mission

Mimic Technologies will use advanced technologies in haptics and simulation to improve proficiency and safety in surgical training.

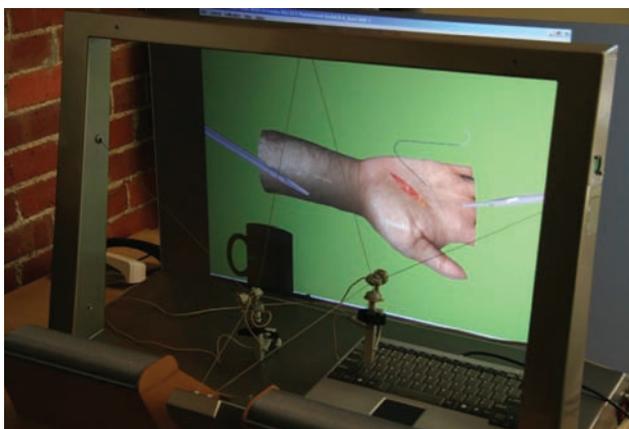
Description

Wound trauma care is a culmination of many basic skills (regulation of bleeders, wound debridement, and suturing, etc.). A basic skills trainer, like the Wound Trauma Simulator, would not only be appropriate for teaching surgeons but would also be appropriate for training paramedics, emergency medical technicians, and nurses.

Mimic Technologies has developed an affordable two-handed haptic system that can be used for open surgery simulation. The system includes a stereoscopic display that will colocate virtual images with the surgical tools held by the user. To demonstrate this platform, the development of a Wound Trauma Simulator will be initiated, which has the potential to help train medical personnel to treat projectile wounds to the pelvis.

Laboratory/Developer

TATRC



Part-Task Trainer Approach to Medical Modeling and Simulation

Mission

Health care personnel can improve their cognitive and psychomotor skills with “part-task” trainers.

Description

Aviation crews simulate portions of missions that are high risk, high consequence, rather than an entire mission from start to finish. This has led to the term “part-task trainer.” In medical modeling and simulation, many “part-task” efforts are under way to support physician, nursing, and allied health care personnel training. End user input has formed the foundation for current efforts to develop part-task simulators for specific procedures. In addition, platforms are being developed for the purpose of training specific skill sets or hosting different surgical simulators, such as the haptics-optional surgical training system, simulation-based open surgery training system, affordable haptics for surgical training, deployable simulation workstation (Sim-Pod), and portable simulator for training robot assisted surgery. In addition to training, these simulation platforms have the potential to host the development of new clinical procedures and testing of new medical devices during development.

Laboratory/Developer

Fractured Femur – Simulation, Touch of Life

Compartment Syndrome – Touch of Life

Intracranial Hematoma/Burr Hole and Trauma Flap – SimQuest LLC, Verefi Technologies, Inc.

Chest Trauma Training System – CIMIT Simulation Group

Regional Anesthesia – Energid Technologies, Touch of Life

Cricothyroidotomy – National Capital Area Medical Simulation Center

Exsanguinating Hemorrhage – SimQuest LLC

Haptics-Optional Surgical Training System – Energid Technologies, SimQuest LLC

Simulation-based Open Surgery Training System – SimQuest LLC, Touch of Life

Affordable Haptics for Surgical Training – Mimic Technologies

Portable Simulator for Training Robot-Assisted Surgery – SimSurgery TATRC

SimSurgery: Development of a Portable Simulator for Training Robot-Assisted Surgery

Mission

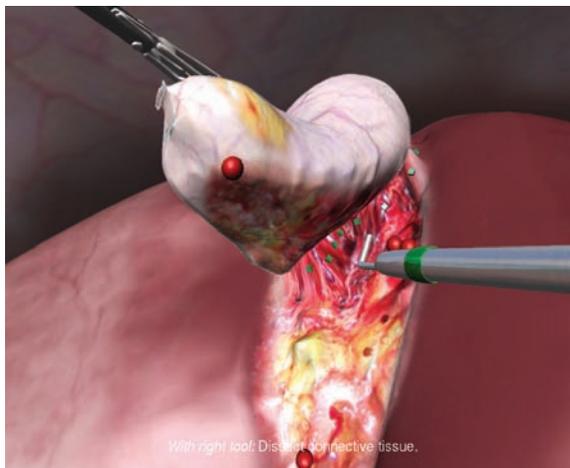
SimSurgery will use advanced technologies in simulation and software development to improve proficiency and safety in surgical training.

Description

SimSurgery has developed technology for virtual reality simulation with special focus on surgical suturing and soft tissue deformation such as tissue dissection. SimSurgery's vision is to increase clinical performance and reduce health care costs by offering solutions for better training and computer-assisted tools in surgery. This project will produce a portable device that resembles the surgeon console in a surgical robot system as well as surgical simulator software that replaces the need for biological tissue (animals or patients) and equipment. Once this has been accomplished, the performance of surgical robotics versus traditional laparoscopy by use of simulators will be compared.

Laboratory/Developer

TATRC



The Use of Cognitive Task Analysis and Simulators for After Action Review of Medical Events in Iraq

Mission

Researchers are developing an innovative protocol for streamlining expert medical knowledge into simulation development and enhancing learning for hands-on clinical skills.

Description

This project attempts to improve medical after action review with a novel combination of cognitive task analysis conducted while interviewees moulage simulators. Three medical experts who have experienced and solved the same type of important medical problem in Iraq will be interviewed separately and together. It is hypothesized that interview protocols employing a novel combination of medical cognitive task analysis combined with the moulage of simulators will more accurately capture the mix of automated and conscious decisions used to solve critical medical problems on the battlefield in Iraq. Each expert will be interviewed separately and, after reviewing the results, the other two experts will be asked to correct and improve on the information gathered from the “other” experts. This process has been found to identify and eliminate errors as well as provide accurate and efficient descriptions of medical decisions and actions that solved battlefield problems.

Laboratory/Developer

University of Southern California
TATRC



Blood Product Shipping and Transport Containers

Mission

Researchers are finding ways to deliver viable blood products from blood banks in the United States to hospitals in the combat theater.

Description

The shipping and transportation containers for blood products are boxes that need no power source to maintain an internal temperature within the ranges required for blood product shipping (4°C, 20°C–24°C, or -20°C). These boxes are the next generation of the “Golden Hour Blood Container,” an award winning, fielded USAMRMC product, which uses a combination of vacuum-insulated panels with an internal container that has a liquid phase-change material similar to that in reusable freezer packs. The internal portion of the container is cooled to below the phase-change temperature (effectively frozen) then returned to the container along with the units of blood product. Different internal containers allow the shipping and transport containers to transport packed red blood cells, fresh frozen plasma, or liquid platelets in their appropriate temperature ranges without the use of wet or dry ice.

Blood products will break down and can significantly harm a recipient if not stored at the right temperature. These containers will replace the Styrofoam™ and wet or dry ice currently used to ship blood products. They will allow movement of blood products to and storage of blood products at locations much further forward than the current system allows, thus getting the much needed product to a combat casualty sooner. The product is not blood specific and could be used for transporting any temperature-sensitive products, such as biologicals, vaccines, or reagents. Future versions of the container may incorporate constant monitoring of the internal temperature.

Laboratory/Developer

WRAIR



Clotting Agents

◆ Intravenous Hemostatic Drugs

Mission

Clotting agents will control internal hemorrhage when injured personnel are in far-forward locations.

Description

Clotting agents are drugs or other formulations that act to control bleeding that is not accessible for compression, such as an intra-abdominal hemorrhage. There are no equivalent products currently, and treatment requires immediate surgery. The products will prolong the lives of service members awaiting evacuation.

Intravenous Hemostatic Drugs. These are drugs that are administered via intravascular, oral, or other novel routes to enhance natural clot formation. One such drug is NovoSeven® (recombinant human factor VIIa), which is currently in clinical trials for use in trauma patients.

Laboratory/Developer

USAISR



Complement Inhibitor as a Resuscitation Fluid Adjuvant

Mission

The complement inhibitor, when given in addition to fluid resuscitation, will assist the combat medic, physician's assistant, or surgeon in reducing mortality and morbidity associated with trauma and blood loss.

Description

Hemorrhage and the resuscitation fluids used to treat it cause excessive activation of the complement system, a natural body defense mechanism consisting of a system of proteins meant to protect against infection. However, excessive complement activation will cause tissue damage. Complement activation inhibitors greatly reduce organ injury and the required resuscitation fluid volume in animal tests.

One type of complement inhibitor is already approved by the U.S. Food and Drug Administration and used for the treatment of autoimmune disorders, and others will soon be approved for use in cardiac artery bypass graft surgeries. One of these commercially produced complement inhibitors will undergo efficacy testing for a new indication to treat hyperactivation of the complement system during hemorrhagic shock and trauma.

Laboratory/Developer

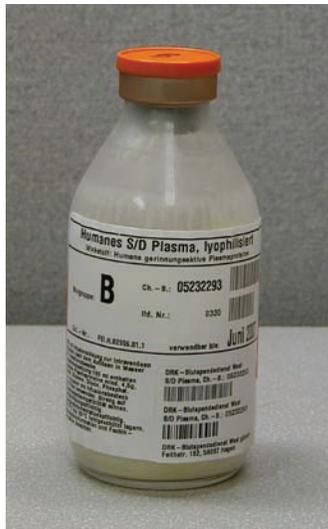
WRAIR



Freeze-Dried Plasma

Mission

A replacement blood product will be used for the treatment of blood clotting abnormality (coagulopathy) and control of hemorrhage far forward at the combat support hospital and the forward surgical team by the physician assistant or surgeon.



Description

Freeze-dried plasma is lyophilized human plasma packaged for rapid reconstitution and administration. The functional activity of this blood product is equivalent to fresh frozen plasma including clotting function. Key attributes of freeze-dried plasma include extended shelf-life and temperature stability.

Freeze-dried plasma will reduce the logistical footprint by reducing refrigeration requirements associated with fresh frozen plasma and can be used in far-forward medical treatment facilities for casualty management.

Laboratory/Developer

WRAIR

USAMMDA



Hypertonic Saline Dextran

Mission

This low-volume resuscitative fluid will aid medics and forward-deployed medical personnel in the management of traumatic hypotension and hemorrhagic shock.

Description

Hypertonic Saline Dextran (HSD) is a small-volume resuscitative fluid of 7.5 percent sodium chloride and 6 percent Dextran 70. Vascular fluid volume is increased and maintained by the osmotic properties of the solution pulling water from the surrounding tissue into the blood stream. For a 1,000 milliliter blood loss, a 250 milliliter infusion of HSD is required and will provide resuscitative support for 4 to 6 hours. The product is marketed outside of the United States under the trade name of Rescue Flow™.

HSD is a concentrated resuscitation fluid that requires one-twelfth the volume of current fluids. The product provides an alternative to blood and blood products for fluid resuscitation along with reductions in weight and cube for logistical support. The medic will use this product far forward to replace lost blood and allow a casualty to be evacuated to available medical assets further back, again reducing the logistical burden far forward.

Laboratory/Developer

BioPhausia AB

National Heart, Lung, and Blood Institute

NIH/DoD – PULSE, Research Outcome Consortium

USAMMDA



Medium Troop Transport System-Ambulance

Mission

The Medium Troop Transport System-Ambulance (MTTS-A) will provide area support in theater for 4 litter or 6 ambulatory patients. In current operations it will have two primary roles: Moving patients from medical treatment facilities to departure airfields and providing evacuation support to supply convoys and local area patrols.

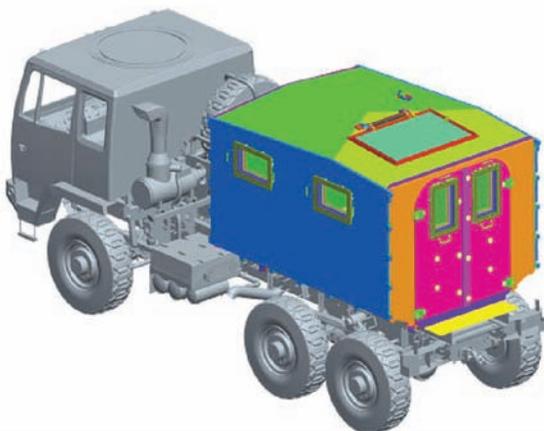
Description

The focus of this effort is to develop an up-armored medical ambulance using a current medium tactical vehicle. Through conversion of the Army's next generation of wheeled troop transport vehicles, an up-armored ground medical evacuation vehicle is being developed. The prototype development includes, but is not limited to, necessary vehicle modifications and engineering to address medical equipment power needs, ingress and egress issues, loading and unloading of casualties, litter configurations, and appropriate medical sets. All necessary testing, life-cycle management, training, and support packages are included as part of this prototype development. The USAMRMC is concentrating on modifying the current armored medical evacuation vehicle's medical mission package for inclusion into the MTTS-A.

Laboratory/Developer

Product Manager Medium Tactical Vehicles – Vehicle

USAMMDA – Medical
Mission Package



Mine Resistant Ambush Protected Ambulance

Mission

Provide up-armored forward support for medical evacuation in current operations. The threshold requirement is for a 2-litter configuration that will evacuate casualties safely from forward areas in a timely manner.

Description

Working with the Mine Resistant Ambush Protected Ambulance (MRAP) Program Office and the Army Medical Department Center and School, USAMRMC will help develop an up-armored commercial off-the-shelf solution to meet the requirements for a forward area support mission to include the ability to evacuate at least 2 litter or 4 ambulatory patients while defending against current threats facing service members.

Laboratory/Developer

MRAP PM – Vehicle

USAMMDA/Army Medical Department Center and School – Medical Mission Package



Platelet Substitute

Mission

Liquid preserved platelets are the only major gap in the standard treatment of hemorrhage and clotting abnormality not routinely available at the combat support hospital or the forward surgical team. Platelet substitute will fill that gap so state-of-the-art care can be provided to combat casualties for the control of hemorrhage far forward on the battlefield at forward surgical teams and combat support hospitals.

Description

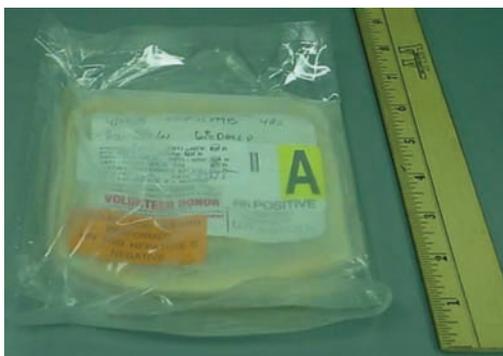
A platelet substitute is either cryopreserved (frozen) platelets or lyophilized (freeze-dried human platelets packaged for rapid reconstitution and administration). The functional activity of this blood product is similar to native platelets with regard to the clotting function. Key attributes of this product are battlefield availability, potentially prolonged shelf-life, and greatly enhanced temperature stability if the lyophilized preparation is successful.

Platelets are a key element in normal blood clotting after injury or surgical incision. The current blood-banked platelet product can be stored for only 5 days and is generally not available on the battlefield. Platelets continue to be absent in Operation Enduring Freedom but fresh whole blood and deployment of platelet apheresis have been used to fill the gap in Operation Iraqi Freedom. A platelet substitute will fill the current gap in effective medical management of hemorrhage at the combat support hospital. If the lyophilized preparation is successful, additional attributes include greatly enhanced shelf-life at ambient temperatures and the capability to be deployed far forward, including the forward surgical team and perhaps the battalion aid station for casualty management.

Laboratory/Developer

WRAIR

USAMMDA



Remote Acoustic Hemostasis Device

Mission

Internal bleeding is one of the largest causes of death on the battlefield. Control of internal hemorrhage by the Remote Acoustic Hemostasis Device will stabilize bleeding.

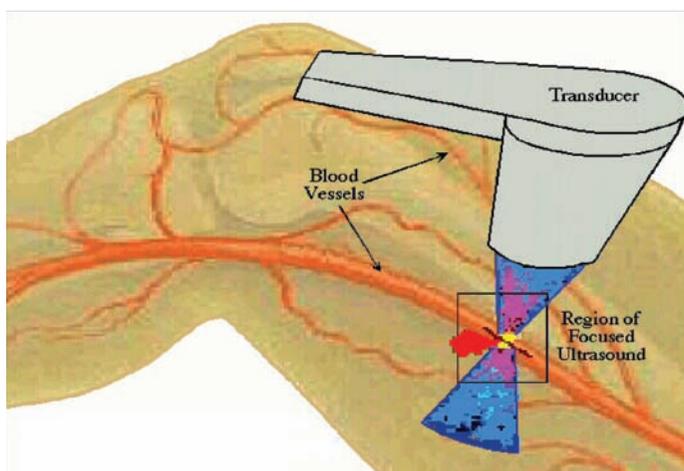
Description

This High Intensity Focused Ultrasound device functions by focusing ultrasonic waves to cause cauterization of both internal and external bleeding structures without damaging overlying or surrounding tissues. The Remote Acoustic Hemostasis Device will feature a computerized Doppler guidance system designed to locate and focus on hemorrhaging structures.

Laboratory/Developer

USAISR

Defense Advanced Research Projects Agency



Rapid Wound Cleansing System

Mission

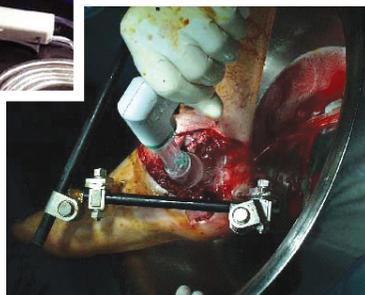
Rapid wound cleaning is necessary to avoid wound sepsis and achieve optimal healing. This wound cleansing system will replace the current heavier system.

Description

Reducing the amount of fluid and the weight a medic carries without compromising care is important for the medic's mobility on the battlefield. The product will be a small-volume wound cleaning device. Replacing the current system will reduce the required volume from 12 liters to less than 2 liters.

Laboratory/Developer

USAISR



Neuroprotective Drugs

Mission

Neuroprotective drugs will improve the outcome following acute brain trauma.

Description

Two neuroprotective drugs will be developed to protect injured brain tissue, enhance neuronal repair and functional recovery after brain trauma, and stop the development of silent brain seizures occurring as a deleterious consequence of a penetrating brain injury.

Neurological trauma is the number one cause of traumatic mortality on the battlefield and is often associated with significant morbidity, disability, and delayed mortality in those who survive the initial injury. A neuroprotective drug used to preserve or protect otherwise uninjured neurological tissue in the face of direct penetrating head trauma will reduce residual disability and subsequent long-term care demands. The capability to stimulate or enhance neuronal healing and repair as well as functional recovery will further reduce residual disability.

Laboratory/Developer

WRAIR



Neurotriage Diagnostic Tools

Mission

Diagnostic tools will guide the combat medic and others to rapidly assess and triage brain injury casualties.

Description

A rapid, field-implementable, diagnostic device will be developed for the objective assessment of neurological trauma—the number one cause of mortality on the battlefield. A small volume of blood will be analyzed to determine the levels of brain-specific biomarkers. The results of this bioassay will be combined with an analysis of physiological parameters from the casualty's Warfighter Physiological Status Monitoring or standard hospital vital signs monitoring system to provide a diagnosis of injury magnitude, ascertain casualty triage status, and provide treatment recommendations specific to the casualty's condition.

The diagnostic tools being developed will help manage the injury and may reduce subsequent residual disability and associated long-term care demands.

Laboratory/Developer

WRAIR



Automated Critical Care Life Support System

Mission

The Automated Critical Care Life Support (ACCLS) system will provide automated life support capability up to 72 hours on the battlefield for surgical and post-surgical environments including the en route care transport of patients during recovery and evacuation.

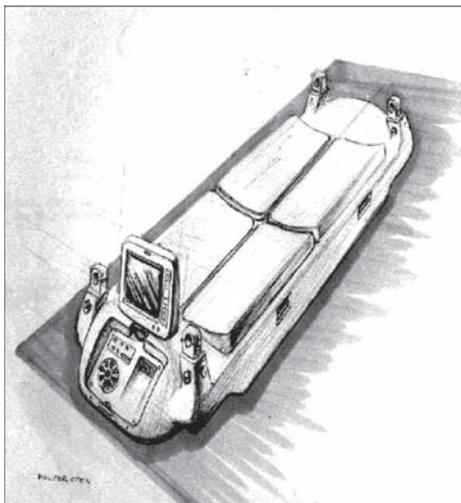
Description

The system is a portable, self-contained, lightweight (less than 40 pounds), protected environment for one casualty. Life support functions are automated including computer-driven, closed-loop control of ventilation, fluid, drug, and oxygen administration. It also incorporates data logging and telecommunication capabilities to facilitate record keeping and to enable real-time communication of patient data to the receiving hospital for assistance with monitoring and decision assistance from a remote location.

The ACCLS system automatically optimizes the patient's treatment while freeing the medical staff to care for other casualties once a seriously injured casualty has been stabilized. The system will provide increased and improved holding capability at the forward surgical team as well as extended critical care capability within the ground and air ambulance platforms.

Laboratory/Developer

WRAIR



Automated Trauma Treatment Future Force Warrior Suit

Mission

Medical monitoring and trauma treatment devices will be integrated into the Future Force Warrior (FFW) suit to provide initial wound treatment thereby reducing severity and consequences.

Description

On the Future Force battlefield, the FFW is widely dispersed with the potential for significant delays in the treatment of combat casualties. The medical technologies embedded in the FFW uniform ensemble will initiate treatment of the warfighter immediately after wounding thereby extending the chance of survival until treated by a medic, reducing subsequent residual deficits, and enhancing the likelihood of early return to duty.

The FFW uniform will include wound detection and location abilities; integrated closed-loop, servo-controlled tourniquets; embedded autoinjectors for injecting enhanced clotting agents, analgesics, and antibiotics into a wounded warfighter; physiological monitoring to provide a combat medic with remote casualty triage capability; and knowledge-based systems that use monitored physiological data to provide a medic with diagnosis and treatment options.

Laboratory/Developer

USAISR
USARIEM
WRAIR



Emergency Hypothermia and Smart Aortic Catheter

Mission

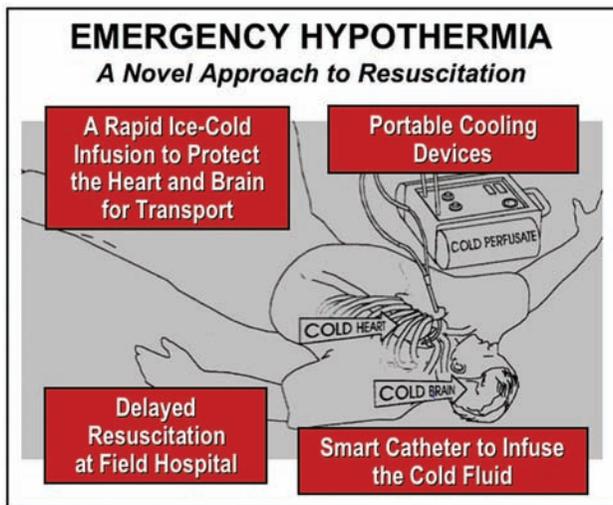
This catheter will help stabilize a casualty's temperature to slow down metabolism during emergency transport to a medical facility.

Description

The Emergency Hypothermia and Smart Aortic Catheter induces hypothermia to slow down metabolism. This device is particularly useful in slowing trauma casualty deterioration during evacuation and surgery.

Laboratory/Developer

TATRC



Medical Ultrasound, Three-Dimensional, Portable with Advanced Communications

Mission

The medic or a layperson will transmit ultrasonic data in a three-dimensional image for distant review and diagnosis.



Description

The Medical Ultrasound, Three-Dimensional, Portable with Advanced Communications (MUSTPAC 3) allows a user to capture ultrasonic information from a conventional ultrasound unit in the form of a three-dimensional databank. The device maps standard two-dimensional volume by coupling the ultrasound machine to a mechanical arm providing six degrees of freedom information. The three-dimensional data are forwarded to a radiologist who then uses the virtual probe to “scan” the imaginary patient in any directional plane and make a diagnosis.

The benefits of the portable ultrasound device are that data are digitized for storage and transmission and reconstructed into three-dimensional images, images are rendered in color, a layperson can operate the ultrasound unit, and distant review and diagnosis can occur.

Laboratory/Developer

TATRC

Monitors

- ◆ **Non-contact Heart Monitor (Vital Signs Monitor 1)**
- ◆ **Non-contact Respiration Monitor**

Mission

These devices will provide combat medics with the ability to assess vital signs of casualties wearing protective gear.

Description

These devices allow for the monitoring of casualties enclosed in chemical protective overgarments without exposing either the patient or medical personnel to a contaminated environment. Mass casualty triage and high noise and vibration evacuation environments are situations where these monitors will be useful.

Non-contact Heart Rate Monitor. This is a handheld diagnostic attachment to the Warrior Medic System or a stand-alone system that will measure



life signs in wounded service members. Sensors measure heart rate and possibly cardiac stroke volume to assess the injury status of a patient, and artificial intelligence coding provides treatment suggestions.

Non-contact Respiration Monitor.

This is a small, self-contained monitor that attaches to a gas mask filter canister or is incorporated in the gas mask that will sense the flow of air entering the gas mask and indicate the state of breathing audibly and visually.



Laboratory/Developer

USAMMDA

WRAIR

Pneumothorax Detector (Vital Signs Monitor 2)

Mission

Early detection of a collapsed lung (pneumothorax) will help avoid later complications in treatment. With this device, medics and forward-deployed medical personnel can diagnose a collapsed lung in a patient with a chest wound.

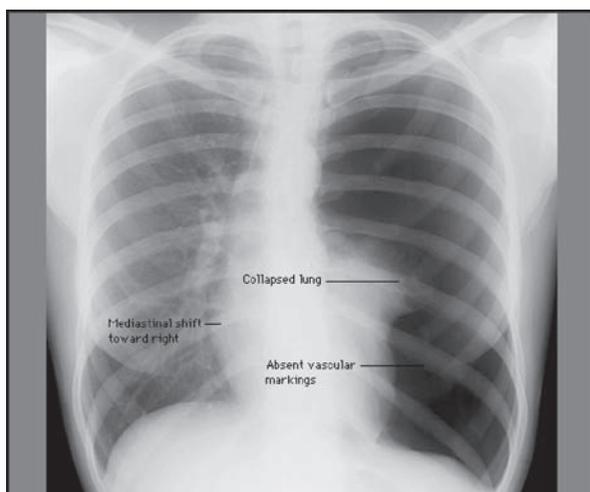
Description

The Pneumothorax Detector indicates the presence of a collapsed lung in patients with chest wounds. Measurements are made noninvasively using either breath sounds or microwaves.

Penetrating wounds of the chest can result in a collapsed lung that if not readily identified can further complicate treatment. The Pneumothorax Detector replaces radiography for diagnosis and will help guide the rapid, appropriate management of a collapsed lung.

Laboratory/Developer

WRAIR



Severe Trauma Simulation

Mission

The Severe Trauma Simulation (STS) effort will research and develop simulated skin, flesh, blood, and smells to realistically simulate severe trauma for training combat medics, combat lifesavers, and warfighters.

Description

Blast injuries from roadside and car bombs, rocket-propelled grenades, and mortars account for more than half of U.S. combat deaths in Iraq and Afghanistan. The objective of this effort is to research STS technologies to prepare the Army's warfighters to deal with severe injuries encountered on the battlefield. Medical personnel are not always prepared to treat such injuries and are thus less effective in the use of their medical skills. Additionally, battlefield conditions are vastly different from traditional training in sterile environments. Lessons learned from Iraq and Afghanistan show that traditional techniques and procedures for treating injuries can be improved.

The STS effort is part of a 3-year Army Technology Objective starting in fiscal year 2007 that will produce STSs with skin, flesh, blood, and smells that integrate with patient simulators or actors. Research will be conducted to identify trade-offs between cost and realism for training efficacy with such simulations. Training scenarios more appropriate for the current operational tempo in the global war on terror will also be developed under this effort.

Laboratory/Developer

U.S. Army Research,
Development and
Engineering Command,
Simulation and Training
Technology Center

USAMRMC



Temporary Implantable Lactate Sensor Biochip

Mission

The goal of this project is to develop an implantable lactate-sensing biochip for temporary implantation that is capable of telemetered reporting of local lactate levels that can indicate level of injury and hemorrhage risk.

Description

Following injury that results in tissue hypoxia, interstitial lactate levels increase and are the main source of metabolically produced acid responsible for tissue acidosis. Lactate levels have also been found to correlate with the severity of injury, including hemorrhage. In preliminary development studies these biochips are temporarily implanted into a skeletal muscle bed of animals. Lactate levels are continuously monitored for implantation periods varying from several hours to 3 months and include testing in a model of severe hemorrhagic shock. A hemorrhage rat model has been developed, and lactate- and glucose-specific biosensors have been fabricated, packaged, and implanted into hemorrhaged rats. Preliminary results obtained using an implanted but tethered biochip and portable potentiostats have produced good correlations between blood lactate and tissue lactate levels. Design considerations for the technical performance and the desired “foot-print” for an implantable biochip have produced a comprehensive set of technical specifications. A prototype device is pending further in vivo studies on biocompatibility and analysis in another hemorrhage rat model of trauma.



Laboratory/Developer

Congressionally Directed
Medical Research Programs
Virginia Commonwealth
University

Thirty-Minute Cold Sterilization Solution

Mission

An alternate method of sterilization will reduce reliance on larger, less mobile sterilization equipment for use by far-forward dental personnel, Special Forces medics, and forward surgical teams.



Description

The cold sterilization solution is produced by reconstituting a dry chemical compound with water. Following mechanical cleaning, instruments are soaked in the solution for 30 minutes to sterilize them.

Medical and dental care requires sterilization of instruments that is typically done with steam, heat, or chemicals, alone or in combination, using relatively large equipment. Field medical and dental personnel carry a limited number of presterilized instrument packs, and once used, the instruments must be resterilized prior to reuse. The cold sterilization solution will reduce the logistical burden associated with maintaining a supply of sterilized instruments.

Laboratory/Developer

WRAIR

Warfighter Remote Triage

Mission

Remote monitoring of wounding and vital signs capability via the Land Warrior Suit will enable a combat medic to attend to the most critically injured first.



Description

A minimal set of sensors to detect wounding and monitor vital signs will be embedded in the FFW suit to diagnose and evaluate a casualty's physiological status and triage priority from a remote location to focus and optimally direct the medic's lifesaving skills to the appropriate casualty. Future Force medics will have a small and wearable PC capable of interfacing with physiological sensors and of hosting diagnostic algorithms that will provide medical decision assistance and the capability to send information through the medical alert system.

Warfighter Remote Triage aids in a medic's diagnosis and treatment of casualties thereby enhancing survivability.

Laboratory/Developer

USAISR

Anticaries Components

Mission

Reduction of dental plaque-related emergencies in deployed forces via field ration additives will significantly mitigate or eliminate the impact of dental disease and dental trauma on military forces.

Description

The Anticaries Components constitute a system of simple, safe, U.S. Food and Drug Administration-approved chemical additives, including antimicrobial peptides, to field rations.

Dental problems cause a significant percentage of lost duty time, and in the austere environment of lengthy deployments and combat, lack of good dental hygiene practice is commonplace. The Anticaries Components will help prevent the occurrence of dental plaque-related emergencies in deployed forces.

Laboratory/Developer

WRAIR



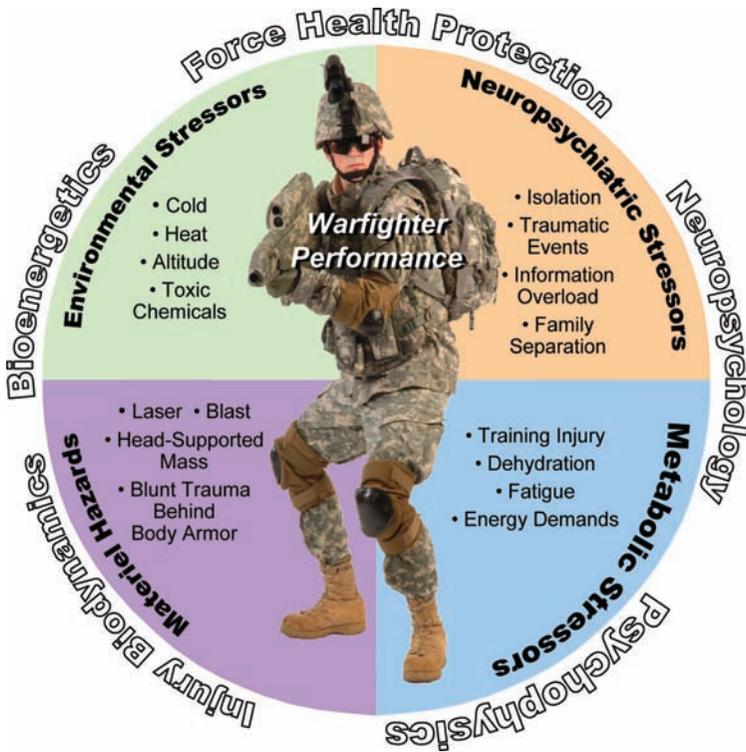


Military Operational Medicine



Overview

Service members' living and working conditions can be unlike any that civilian workers face. The Military Operational Medicine Research Program (MOMRP) provides biomedical "skin-in" solutions that protect service members and enhance their performance in operational and training environments that include multiple internal and external stressors. It is a unique biomedical research program with relevant core capabilities, a problem-solving orientation, and a human physiology research focus.



The MOMRP represents unique expertise in both health and performance effects of multiple interacting operational hazards and stressors. The focus is on multistressor interactions involving human tolerances, metabolic physiology, and brain functioning. The core biomedical research is organized into two key focus areas: Human Performance Optimization and Force Health Protection. Within these focus areas are 13 program areas that span a wide range of scientific disciplines, expertise, and research topics:

- ◆ Human Performance Optimization
 - ❖ Bioenergetics and Metabolism
 - ❖ Physiological Monitoring and Predictive Modeling
 - ❖ Environmental Extremes
 - ❖ Biomedical Aspects of Visual and Auditory Performance
 - ❖ Cognitive Performance Assessment
 - ❖ Stress and Psychological Resilience
 - ❖ Fatigue and Performance Modeling and Interventions

- ◆ Force Health Protection
 - ❖ Nonionizing Directed Energy Bioeffects
 - ❖ Traumatic Brain Injury and Spine Injury Hazards
 - ❖ Pulmonary Injury Hazards
 - ❖ Occupational Task Performance and Injury Prevention
 - ❖ Deployment and Post-Deployment Health Protection
 - ❖ Environmental Health Risk Assessment Methods





Current operations in Iraq, Afghanistan, and Bosnia have illustrated the urgent need for the biomedical solutions that the MOMRP provides. A Soldier standing watch, a pilot securing a helmet, or a commander leading troops in the field are all affected by research that the MOMRP provides. The resulting products of this biomedical research transition to Army planners, doctrine and materiel developers, and the Army medical community.

Examples of the MOMRP's biomedical research products include physiological response models and tools for mission planning, equipment design specifications and guidelines based on human tolerances, physiologically based nutritional guidelines for ration developers, strategies to enhance psychological resilience, and injury prediction tools for health hazard and service member survivability assessors. These products ultimately protect service members, enhance their performance, and provide the best available answers for immediate military decision making.

The MOMRP conducts collaborative research with university and commercial laboratories and other federal agencies oriented toward solving critical problems facing the Army today and in the future. Service- and platform-specific issues are addressed through close coordination with Navy and Air Force counterparts to prevent duplication of effort. The MOMRP uses an independent, external scientific peer review process to ensure the high quality and validity of its research, review milestone accomplishments, and prepare these findings for publication in the open scientific literature.

General Peter J. Schoomaker, former Chief of Staff of the Army, wrote:

“Our individual and organizational approach to our duties and tasks must reflect the seriousness and sense of urgency characteristic of an Army at war. Our Soldiers and our nation deserve nothing less. This is not business as usual.”

The MOMRP understands this level of seriousness and sense of urgency and is committed to providing timely and relevant biomedical products and solutions that protect our service members and enhance their performance during training and on the battlefield.



Case Studies

Aquatic Biomonitor

Challenge

Water is one of the most valuable natural resources and is highly susceptible to contamination. Contaminants in a water supply can originate from different sources such as petroleum product spills, agricultural runoff, wastewater treatment plants, as well as intentional toxic contamination. Ensuring that drinking water is clear of contaminants is a difficult process as conventional chemical analyses are very expensive and time consuming. Monitoring water quality characteristics such as residual chlorine or turbidity, while inexpensive and routine, cannot detect chemical spill events, and analytical chemistry techniques cannot directly measure toxicity. Further, to protect service members from exposure to drinking water supplies contaminated with toxic industrial and agricultural chemicals, the military requires methods to continuously monitor and quickly identify changes in water quality.



Contribution

In 2004, the U.S. Army Center for Environmental Health Research (USACEHR) executed an exclusive patent license agreement with a small engineering and design company, Intelligent Automation Corporation, for commercial development of an aquatic biomonitor—the intelligent Aquatic Biomonitoring System (iABS). The biomonitoring system continuously monitors water and rapidly identifies toxic conditions caused by a wide range of chemicals or chemical mixtures. The iABS device uses live bluegill fish to detect biohazards. Fish respond to a wide range of unsuspected toxic chemicals or chemical mixtures in water. If fish are stressed as a result of inhaling toxins in water, one of the first symptoms is a change in their breathing patterns. The iABS is a portable, web-enabled aquatic early warning system

that uses the ventilatory and body movement patterns of fish as a biosensor to provide continuous real-time detection of developing toxic conditions in water. Considering that a significant threat to homeland security involves the potential for terrorists to release hazardous chemicals into local water supplies, the iABS was evaluated through partnerships with local governments in the Washington, DC area, which used the system to monitor several of the city's reservoirs. These successful field tests led to a Cooperative Research and Development Agreement with the Metropolitan Washington Council of Governments for the purchase of several biomonitoring systems for installation at various locations in the Potomac River in Maryland to monitor the river's source water and distribution systems.

Benefit

The iABS, developed in a federal laboratory and tested and proven through partnerships with city governments, is an innovative system that protects service members in the field from exposure to harmful contaminants and is also available for use by cities and governments to ensure the purity of local water supplies as well. The system enables toxic conditions to be identified within a 15- to 30-minute period.





Case Study Caffeine Gum

Challenge

Sleep deprivation among service members is a common problem.

Military personnel work long hours

and often must struggle to remain awake to perform duties such as driving trucks all night long, engaging in nighttime battles, or performing routine ongoing tasks. They often use caffeine products that may take 20 to 30 minutes to produce effects in a sleep-deprived person. Because caffeine is such a well-accepted stimulant, researchers at the Walter Reed Army Institute of Research (WRAIR) developed a gum containing caffeine to help users stay awake. The gum was appropriately named Stay Alert.

Contribution

Stay Alert gum was introduced to the military in 1999 by its inventor, Mr. Ron Ream, who was working at Amurol Confections Company, a subsidiary of the Wrigley Company. The military immediately showed interest in developing this product as a way of helping service members stay awake. Amurol had performed test marketing studies with 50 milligrams of caffeine per piece of gum. The gum easily held the caffeine, hid the bitter taste of caffeine, and delivered stimulant much faster. In 2000, WRAIR received congressional funding to conduct a study on the gum, primarily to validate the results presented by Amurol. Study results showed that the caffeine in the gum was absorbed by the body through the lining of the mouth about four to five times faster than caffeine taken in any other form. With these results showing that the caffeine gets into the body faster, the U.S. Army Medical Research and Materiel Command (USAMRMC) funded research for the gum to deal with fatigue in military personnel.

WRAIR researchers studied various doses of caffeine and found that 200 milligrams taken every 2 hours was the best dosage during a night without sleep to maintain alertness at 100 percent for a relatively boring task. Each piece of gum contains 100 milligrams of caffeine, and usually users are recommended to chew one piece for 5 minutes. If this does not increase alertness, they are to chew a second piece.

A 2001 report from the Committee on Military Nutrition Research of the National Academy of Sciences on “Caffeine for the Sustainment of Mental Task Performance” supported the use of this product. The report reviewed the detrimental effects of sleep deprivation on mental and physical performance, concluding that caffeinated gum was safe and effective for service members.

Benefit

The Department of Defense (DoD) Combat Feeding Program of the Natick Soldier Center in Massachusetts tested and approved the gum to include as a component of the experimental First Strike Ration for Special Forces.

The gum is made in pellet form and has been available for troops since April 2006 and is now provided to troops in Iraq and Afghanistan. Obtaining caffeine through gum has several advantages over caffeinated beverages including its quick impact, convenience, lack of acids to upset the stomach, and most importantly for service members in the field, it will not cause a need to urinate.



Case Study

Communications Earplug

Challenge

The search for improved hearing protection and speech communications throughout the past two decades has centered on the concept of active noise reduction. While active noise reduction provides protection for frequencies below 800 hertz, the shortcomings of this include weight, power requirements, source of electromagnetic interference, susceptibility to electromagnetic interference, and cost. An alternative to the active noise reduction approach is the Communications Earplug (CEP).



Contribution

The CEP was developed by the U.S. Army Aeromedical Research Laboratory (USAARL) at Fort Rucker, Alabama, and manufactured by Communications & Ear Protection, Inc., located in Enterprise, Alabama, to meet the military's requirement for a cost-effective device that provides the exceptional hearing protection of an expanding foam earplug while passing the clearest speech signal available. This need was based on the significant noise threat of Army helicopters. Tests conducted with aviation units showed the capabilities of the CEP in operational environments found in all helicopters in Army aviation. The mini-CEP was later developed under the Navy's Small Business Innovation Research program, improving on the Army's product.

Benefit

The CEP provides exceptional hearing protection with an expanding foam earplug and provides the clearest speech signal attainable. The miniature transducer and foam earplug are coupled in a unique arrangement to yield a lightweight, high-quality communications device that can be used either alone or in combination with circumaural hearing protection. The noise reduction of the foam eartips coupled with exceptional quality speech signals enable a user to achieve extremely high speech intelligibility in the noisiest environments. Tests conducted by the Army showed reductions of more than 30 decibels for low-frequency noise spectra that are prevalent in helicopters.



Cold Exposure Guidelines

Mission

Cold exposure guidelines were developed to prevent and reduce hypothermia and cold-related injuries to service members.

Description

Policy memoranda, field manuals, and training aids regarding hypothermia and other cold injuries were produced in conjunction with the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) and the Office of the Surgeon General. Examples include “Sustaining Health and Performance in Cold Weather Operations” and the training aids “Cold Weather Casualties and Injuries Chart” and “Avoid Cold Casualties.” These state-of-the-art guidelines are used for training and operational practice and serve to prevent and reduce cold-related injuries to service members. A comprehensive Technical Bulletin guidance document for health care providers entitled “Prevention and Management of Cold Weather Injuries” (TB MED 508) has been published.

Laboratory/Developer

U.S. Army Research Institute
of Environmental Medicine
(USARIEM)



DoD Body Fat Assessment Methods and Standards

Mission

DoD body fat assessment methods and standards were developed to provide consistency among the Services when providing physical evaluation of service members.

Description

A reconciliation of Service differences in body fat measurement methods, screening weights, and body fat standards yielded a single set of assessment methods and standards that were incorporated into DoD Instruction 1308.3, "DoD Physical Fitness and Body Fat Programs Procedures." The prevention of obesity in the military will lead to the increased combat readiness of service members.

Laboratory/Developer

USARIEM





Environmental Strain Prediction Models

Mission

Environmental strain prediction models are used to predict performance outcomes based on specific variables.

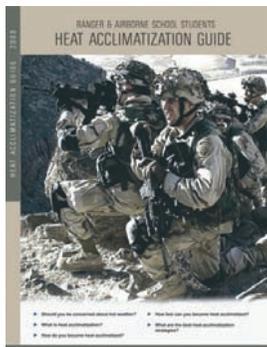
Description

Environmental strain prediction models are biomedically valid tools for predicting individual and unit-level performance outcomes based on environmental and operational variables. Given particular terrain characteristics, environmental temperature, and clothing requirements, these tools will provide accurate predictions of thermal strain with recommendations for fluid replacement and work/rest schedules. These prediction models provide mission planners and leaders the ability to simulate missions using accurate predictions regarding service member performance in environmental extremes.

Laboratory/Developer

USARIEM





Heat Exposure Guidelines

Mission

Heat exposure guidelines were developed to prevent and reduce heat-related injuries to service members.

Description

Policy memoranda, field manuals, and training aids regarding heat injury were produced in conjunction with USACHPPM and the Training and Doctrine Command Surgeon's Office. Examples include the "Heat Injury Protection Guide," the "Heat Acclimatization Guide," and the Technical Bulletin guidance document for health care providers entitled "Heat Stress Control and Heat Casualty Management" (TB MED 507). These state-of-the-art guidelines for training and operational practice serve to prevent and reduce heat-related injuries to service members.

Laboratory/Developer

USARIEM





Performance Enhancing Ration Components

Mission

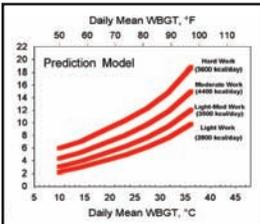
Performance enhancing ration components are added to rations to increase service member endurance.

Description

Carbohydrates are added to rations for the purpose of enhancing service member physical and mental endurance. Examples are the Hooah® bar and the Ergo® drink. These products offset fatigue and stress effects on performance.

Laboratory/Developer

USARIEM



Sweat Prediction Models

Mission

Sweat prediction models aid in determining the water needs of service members.

Description

Sweat prediction models are an extension of the model used to predict sweat rates of service members during operational stress. High work rates, extended durations, and clothing/equipment (including body armor) are incorporated in the extended algorithm. These models provide greater precision in estimating service member water needs, which enhances the safety and sustainability of a service member and improves the efficiency of water re-supply.

Laboratory/Developer

USARIEM

Body Armor Blunt Trauma Performance Testing Method

Mission

Developing a biomedically valid testing method for Army body armor will enable developers to design and field effective, lightweight, and comfortable body armor systems for service members.

Description

A biomedically valid body armor blunt trauma performance testing method consisting of two components: (1) a physical model known as the “Anthropomorphic Test Module” that measures the distribution of forces and motions behind body armor systems during a ballistic impact and (2) a biomedically valid, human blunt trauma injury prediction model packaged in a user-friendly, web-based software application known as Behind Armor Blunt Trauma Assessment. The human injury prediction model is the product of carefully controlled animal tests that included advanced medical imaging techniques and the latest mathematical modeling methods. The model’s predictions were validated with extensive injury data from the animal tests.

Laboratory/Developer

L-3 Communications
(formerly Titan
Corporation)

University of California,
San Diego





Evaluation of Human Exposure to Whole-Body Vibration: Method for Evaluation of Vibration Containing Multiple Shocks

Mission

The Method for Evaluation of Vibration Containing Multiple Shocks is used to predict injuries sustained by service members who ride in Army tactical ground vehicles at high speeds over rough terrain.

Description

This standardized method for health hazard assessment of whole-body vibration and repeated jolt in vehicles is based on laboratory studies of human responses to repeated jolts and a neural network of the lower spine. The method was published as an international standard (ISO 2631-5) and transitioned to the USACHPPM.

Laboratory/Developer

USAARL



INJURY

Mission

INJURY is a tool used to predict lung injuries.

Description

INJURY is used to predict lung injuries from exposure to blast overpressure from high-powered weapon systems. It uses blast overpressure data from weapon system tests and extensive large animal exposure studies and advanced biomechanical modeling techniques to estimate the probability and severity of lung injuries. It also enables other programs to predict the nature and extent of injuries and provides weapon systems developers with information necessary to develop safer and more survivable weapon system designs.

Laboratory/Developer

MOMRP
USACHPPM

Injury Prevention and Restraint Technologies for Ground Vehicles and Helicopters (Inflatable Restraint Systems)



Mission

Develop biomedically based design guidelines for improved helicopter and ground vehicle occupant protection systems. Provide system developers with the information and tools they need to design, develop, and field safer and more survivable air and ground vehicles for service members.

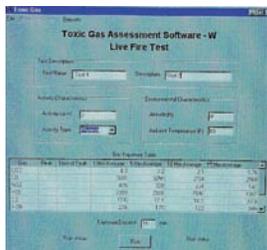
Description

Inflatable restraint technologies are being developed and integrated into Army aviation platforms. While these technologies have inherent crash protection capabilities, they also introduce new and novel injury hazards. USAMRMC testing revealed hazards to the upper extremities and ocular regions when the systems are not properly designed or the occupant is not in the design eye position. The prototype lateral bag design was found to present a greater than 90 percent risk of upper extremity injury, prompting a system redesign. The redesign eliminated 99 percent of the hazard. More than 300 UH-60L helicopters have been modified with the air bag system. Surveillance of injury resulting from crashes of these air bag-equipped vehicles is ongoing and will reveal the injury mitigation capabilities and new hazards associated with these protective systems. Expanded research and modeling efforts will provide guidelines to assist in the design of future inflatable restraint systems that reduce the risk of these inherent hazards.



Laboratory/Developer

USAARL



Toxic Gas Assessment Software

Mission

Toxic gas assessment software (TGAS) is used to predict outcomes following the inhalation of toxic gases.

Description

TGAS is a tool for predicting incapacitation and injury due to the inhalation of toxic gases by service members behind defeated armor. It is based on toxic gas concentration data from live-fire tests, small animal toxic gas exposure studies, and advanced systemic and biomechanical modeling techniques. TGAS provides weapon systems developers with information for developing a more survivable weapon system.

Laboratory/Developer

WRAIR



Army Medical Department Suicide Event Report



Mission

The Army Medical Department suicide event report (ASER) is a data system that captures information on suicide.

Description

ASER is a reporting instrument with both quantitative and qualitative information to better understand and summarize suicides in real time. It uses a web-based electronic data system containing information on all suicides and all hospitalized attempted suicides. Enhanced Army suicide surveillance will allow better targeting of current and future suicide prevention programs.

Laboratory/Developer

WRAIR

U.S. Army Medical Research Unit - Europe (USAMRU-E)



Battlemind Training System

Mission

Develop a military-specific, integrated, and evidence-based system of mental health training for service members and families to support adjustment across the deployment cycle.

Description

Prior to the development of Battlemind Training, there was no standardized system of mental health training in the military. Battlemind Training emphasizes successful ways to transition to and from combat while normalizing typical reactions. It was developed in part based on results from the Land Combat Study. Training modules include actions individuals can take to assess transition difficulties in themselves, their buddies, and their subordinates.

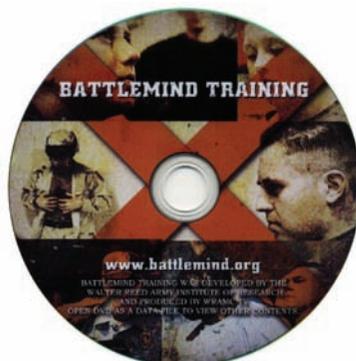
Battlemind Training products include briefs, a DVD, and brochures. Post-deployment Battlemind Training is now mandatory and has been integrated into the G-1's Deployment Cycle Support System. The U.S. Army Medical Command initiated a transition cell for WRAIR's Battlemind Products in 2007.

Randomized controlled trials of post-deployment Battlemind Training have demonstrated its efficacy, particularly with individuals exposed to high levels of combat. Service members receiving Battlemind Training report fewer mental health symptoms months later relative to individuals not receiving such training. Other pilot studies have demonstrated satisfaction with pre-deployment and spouse Battlemind Training. Future research will focus on enhancing Battlemind Training efficacy.

Laboratory/Developer

WRAIR

USAMRU-E





Cognitive and Psychomotor Assessment Methods and Metrics

Mission

Cognitive and psychomotor assessment methods and metrics are used to measure cognitive processes.

Description

The Automated Neuropsychological Assessment Metric is a DoD tri-service methodology for assessing cognitive performance and cognitive status. It includes a software application that can create up to 24 standardized cognitive tests (each with equivalent forms), display them, and capture and summarize the timeliness and accuracy of the person's performance being tested. Specific cognitive processes can be targeted (e.g., memory, attention, and switching from one task to another). It provides expedient measures of the impact of various moderators (e.g., dehydration, heat, workload, inadequate sleep, nutritional interventions, and training) on cognitive performance and cognitive status.

Laboratory/Developer

WRAIR



Early Interventions following Exposure to Potentially Traumatic Events

Mission

Evidence-based early interventions optimize the health and functioning of service members and units exposed to potentially traumatic events during combat.

Description

Military personnel are at risk for exposure to an array of potentially traumatic combat-related events. Such exposure is associated with increased risk for the development of post-traumatic stress disorder as well as other psychological and behavioral problems. These problems can reduce individual and unit functioning and may affect a service member after his or her military career.

Although some early intervention techniques exist, WRAIR has conducted the first randomized controlled trials with military personnel returning from combat. The first of these studies has yielded a post-deployment psychological debriefing technique that is effective in reducing stress-related symptoms in service members reporting high levels of combat exposure. This platoon-based debriefing technique incorporates Battlemind Training and has also been expanded for use in theater. The product integrates mental health interventions across the deployment cycle and provides structured methods of intervention adapted explicitly for the combat environment that are being used in training Combat Operational Stress Control Teams.

Research efforts are now under way to enhance the effectiveness of early interventions through expressive writing and training in cognitive behavioral skills. These two interventions will also be tested using randomized controlled trials with service members returning from combat. The goal is to develop empirically based early interventions to decrease or mitigate the impact of trauma on service members.

Laboratory/Developer

USAMRU-E

WRAIR





Guidance on Using Caffeine

Mission

Guidelines for the use of caffeine were developed to assist service members who are affected by operational conditions that interrupt adequate sleep.

Description

Guidelines for the use of caffeine to enhance service member cognitive performance and alertness during continuous and sustained operations were developed. Because caffeine is available over the counter, widely accepted, safe, and effective, it remains the drug of choice for improving performance and alertness during sleep loss. Doses ranging from 100 to 300 milligrams (the equivalent of 1 to 3 cups of coffee or 2 to 4 caffeinated sodas) or 1 to 3 sticks of caffeinated gum every 3 to 4 hours restore performance and alertness to well-rested levels, and lower doses (50 to 100 milligrams every 3 to 4 hours) may be sufficient in persons who normally do not consume caffeine. The use of caffeine provides extended cognitive performance when operational conditions restrict and interrupt sleep.

Laboratory/Developer

WRAIR



Pre/Post-Deployment Psychological Screening

Mission

Individual and unit functioning are improved through the early identification of service members with potential behavioral health problems using a simple, easily administered, valid, and cost-effective screening procedure.

Description

Prior to and returning from deployments, mental health providers are tasked with identifying service members who might benefit from behavioral health services. Through the use of survey instruments and brief structured clinical interviews, large groups of service members can be rapidly screened, and those with behavioral health care issues can be identified and referred for follow-up care.

In 2004, two blind-validation screening studies produced a short screen fielded in U.S. Army Europe. The research demonstrated that mental health concerns become more evident several months following return from combat. This screening research influenced the development of the DoD's Post-Deployment Health Reassessment program per policy guidance from the Assistant Secretary of Defense for Health Affairs. A third blind-validation study conducted by the USAMRU-E in 2005 provided scoring guidelines for the mental health component of the Post-Deployment Health Reassessment (DD Form 2900) and developed a structured interview guide to help triage service members.

By establishing a short and valid screening procedure and determining the optimal time to conduct screening, mental health support can be streamlined and brought forward to meet the needs of a deploying force.

Laboratory/Developer

USAMRU-E

WRAIR



Unit Behavioral Health Needs Assessment

Mission

Individual and unit functioning are improved by devising an assessment methodology and survey tool for commanders to measure and classify the behavioral health needs of their troops.

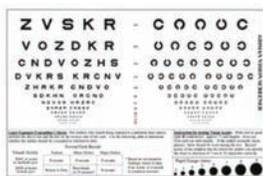
Description

Unit-based primary prevention requires unit needs assessment, command consultation, and population intervention methodologies. Using this field-deployable needs assessment technology, behavioral health care personnel can provide commanders with accurate assessments of unit functioning and barriers to care. This information can be used to develop unit-unique behavioral health interventions to improve individual and unit functioning. These technologies will be applicable in war and peace, in garrison, and in the field.

Laboratory/Developer

USAMRU-E
WRAIR





Aidman Vision Screener

Mission

The Aidman Vision Screener is used to evaluate possible injury to the eyes caused by laser.

Description

The Aidman Vision Screener is a set of charts for evaluating the effects of a potential laser exposure to the eye that includes a visual acuity chart, an Amsler Grid central visual field evaluation, and criteria for evacuating patients. The screener is included as part of a field evaluation kit. It provides a field assessment capability for determining the severity of a laser eye exposure and whether to evacuate a patient.

Laboratory/Developer

U.S. Army Medical Research Detachment
WRAIR
Brooks City-Base, Texas



Communications Earplug

Mission

The Communications Earplug (CEP) protects hearing and enhances communication.

Description

The CEP is an earplug that provides hearing protection while passing speech signals. The transducer is completely inside the external ear when properly inserted into the ear canal. It has a noise reduction rating of 29.5 decibels and is compatible with various helmets and personal equipment. The CEP protects the hearing of service members in high-noise operational environments and increases operational effectiveness by enhancing communication.

Laboratory/Developer

USAARL



Design Guidelines for Advanced Imaging and Display Technologies

Mission

Design guidelines for advanced imaging and display technologies aid in the development of new technology for military aircraft and vehicles.

Description

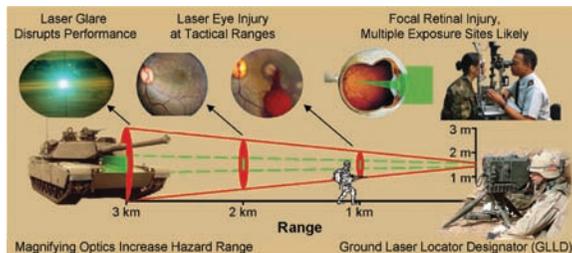
Design criteria and test methods for imaging and display systems based on visual performance capabilities were developed. This includes predictive models of visual performance with sensor and display systems in operational environments. These criteria and methods provide the means for evaluating new system designs and give developers the information necessary to develop effective imaging and display systems for rotary-wing aircraft and other military vehicles.

Laboratory/Developer

U.S. Army Aeromedical Research Laboratory



Laser Exposure Standards to Prevent Laser Eye Injury



Mission

Laser exposure standards were developed to prevent laser eye injuries. These standards impact the design of new military laser systems.

Description

The maximum permissible exposure limits for laser exposure conditions to prevent eye injury during the design, testing, and deployment of advanced military laser systems were updated and incorporated in the Army Radiation Safety Program described in Army Regulation 11-9 for laser radiation. The following key points were determined and published:

- ◆ Ocular injury thresholds for wavelengths in the 1–2 micrometer range resulted in the update of exposure guidelines impacting the Airborne Laser, the Airborne Tactical Laser, and other high-energy laser systems.
- ◆ Retinal injury thresholds as a function of retinal irradiance diameter were used to assess the hazards of particle cell suspension switches for military optical sites and for the update of exposure guidelines.
- ◆ Ocular aversion response (eye movement) impact on retinal-injury risk assessments and exposure guidelines for long duration exposures were determined. This impacts the deployment of laser dazzlers.

These standards impact the design of new military laser systems and protective equipment and provide the Army Medical Department with the tools necessary to assess field laser hazard when laser systems are used in testing, training, and operational environments.

Laboratory/Developer

U.S. Army Medical Research Detachment
WRAIR
Brooks City-Base, Texas

Intelligent Aquatic Biomonitor System

Mission

The Intelligent Aquatic Biomonitor System (iABS) monitors fish behavior as a way to detect toxic chemicals in water.

Description

The iABS rapidly detects a wide range of toxic chemicals or chemical mixtures in water sources by measuring changes in fish behavior. Fish are natural integrators of water quality conditions and respond to a wide range of chemicals and mixtures. The system can be used at water treatment plants or other water production facilities, and water can be monitored after it is dechlorinated. The system protects drinking water supplies by continuously monitoring water. The biomonitor responds within an hour to most chemicals at acutely toxic levels and is in use at military facilities and major metropolitan areas. The iABS is available through a commercial partner.

Laboratory/Developer

USACEHR



Motion Sickness Countermeasures in Army Aircraft

Mission

A study of four countermeasures against motion sickness was conducted to determine the one most effective.

Description

Airsickness remains an important problem for today's Army. A study of four airsickness countermeasures was conducted in a UH-60 Black Hawk helicopter. Sixty-four male subjects were randomly assigned to one treatment and placebo condition and exposed to a provocative flight profile. The four conditions were (1) promethazine (25 milligrams)/caffeine (200 milligrams), (2) meclizine (25 milligrams), (3) scopolamine (1.5 milligrams), and (4) an electronic acupressure device. Only the promethazine/caffeine combination produced a statistically significant reduction in nausea and motion sickness severity and an improvement in reaction time. Promethazine/caffeine was the most effective at reducing airsickness with the least side effects.

Laboratory/Developer

USAARL





Rapid Analysis of Water for Select Chemical Contamination

Mission

The Rapid Analysis of Water for Select Chemical Contamination method was developed to detect the levels of two insecticides in environmental water sources.

Description

Rapid Analysis of Water for Select Chemical Contamination is a solid-phase microextraction and gas chromatography-mass spectrometry sampling and analysis method developed for two insecticides, carbaryl and lindane. Minimum levels of detection in environmental water sources are 10 microgram/liter and 1.0 microgram/liter for carbaryl and lindane, respectively. The total analysis time using field-portable equipment is 30 minutes. This method avoids the use of complex sample preparation steps and enhances analyst safety by the elimination of handling solvents in field environments.

Laboratory/Developer

USACEHR





Refractive Surgery for Aircrew Accession

Mission

Refractive surgery for aircrew accession was implemented to increase the number of qualified applicants for flight training.

Description

Recruiting qualified applicants for flight training has become more difficult as the war on terror continues. Currently, 20 percent of applicants have had refractive surgery, which has been considered unacceptable for flight training. Research by USAMRMC scientists enabled the Army to change policy to safely allow certain types of refractive surgery for Army aircrew members.

Laboratory/Developer

U.S. Army Aeromedical Research Laboratory



Total Army Injury Health and Occupational Database

Mission

The Total Army Injury Health and Occupational Database (TAIHOD) is used to track and store the demographic, occupational, and health information of Army members over the course of their active duty careers.

Description

TAIHOD is a database for answering epidemiological questions of injury and health outcomes relevant to the Army. It contains information on individual service member demographic and occupational characteristics, health outcomes, and health behaviors collected over the course of an Army member's active duty career for all Army members who have served on active duty since 1971, approximately 5 million individuals. TAIHOD provides the data necessary for the development of military health and safety policies.

Laboratory/Developer

USARIEM

Hydration Management for Future Force Missions

Mission

Hydration management enhances service member capability to sustain performance and health in extreme environments, reduces logistical burden for water delivery, and reduces medical burden caused by environmental injury.

Currently, water needs for many modern future force-type missions cannot be accurately predicted. Neither water needs nor dehydration consequences in cold weather or high terrestrial altitude missions are understood, so the criticality of supplying water in such logistically difficult environments is also unknown. Countermeasures are needed to improve water and nutrient intake, increase consumption of chlorinated water, and minimize adverse performance consequences of dehydration.

Description

This research effort exploits new knowledge on water needs and adverse performance consequences from dehydration. New doctrine and sweat prediction software will improve the prediction of water needs while the Enhanced Fluid and Nutrition Delivery System will optimize fluid intakes. Both will reduce hydration-related heat injury incidence while also sustaining performance. The logistical water supply burden will be minimized by reducing water procurement error and increasing potable water consumption due to the presence of a flavoring agent but without water hygiene concerns. Nutritional supplements will minimize adverse performance outcomes of dehydration.

Laboratory/Developer

USARIEM



Thermal Models on a Personal Digital Assistant Format

Mission

Improvements in predicting heat casualty risk during operations will enhance service member performance and reduce both heat strain and injury.



Description

USARIEM has developed a Heat Strain Decision Aid model that runs on a personal digital assistant (PDA) for predicting the risk of heat casualties. This model is the best available, user-friendly predictor of endurance times in thermally challenging environments within the DoD. It is especially well adapted to military and first responders performing military or paramilitary activities in nuclear, biological, and chemical protective ensembles with or without body armor.

At present, the model requires separate input of clothing, work activity level, and environmental conditions; calculates maximum work time to 300 minutes; recommends work and rest cycles for sustained operations; and estimates water consumption requirements.

Laboratory/Developer

USARIEM



Design Guidelines for Head-Supported Devices

Mission

Developing head-supported devices (HSDs) requires design guidelines and health hazard assessment methods to enhance service member performance and provide protection from neck injury.

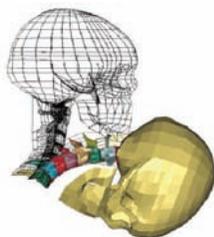
Description

Biomedically based design guidelines and assessment methods for HSDs, such as protective helmets, weapon sighting, and communication systems, are being developed. The development process uses epidemiological studies, biomechanics, injury studies with human cadavers and mannequins, and advanced biofidelic neck models to develop and validate neck injury criteria. The health risk assessment method includes the neck injury prediction model and algorithms that produce a risk assessment code based on the predicted injury severity and the probability of occurrence.

HSDs are critical components; however, they increase the amount of weight supported by the head and neck and may place service members at risk of degraded performance or neck injury. This project will provide guidelines and assessment methods for the assessment of HSDs used in current operations and the future development of safe and effective HSDs, including the Future Force Warrior helmet design.

Laboratory/Developer

USAARL



Injury Prevention and Restraint Technologies for Ground Vehicles and Helicopters (Conventional Restraint Systems)

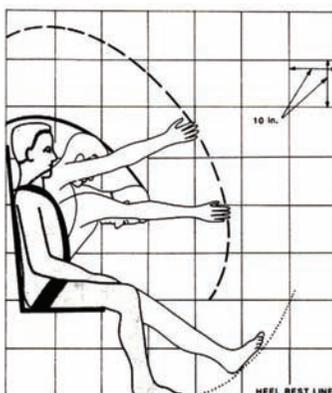


Mission

Biomedically based injury criteria and test methods for improved helicopter and ground vehicle occupant protection systems will provide system developers with the tools they need to design, develop, and field safer and more survivable air and ground vehicles for service members.

Description

Many injuries that routinely occur in tactical vehicle operations and crashes are preventable through the use of improved occupant restraint systems. Traditionally, military ground vehicles have not been equipped with state-of-the-art safety equipment, but significant improvement in occupant safety in tracked and wheeled tactical vehicles can be realized through the integration of commercial automotive technology and current military aviation restraint systems. Contact injuries account for more than 80 percent of injuries received in Army vehicle crashes. Biomedically based performance criteria and flail trajectories are needed during the design and development of occupant restraint systems. New generic test methods are being developed to ease comparative performance assessments among candidate restraint systems. Special considerations in the military vehicle environment include the need for urgent and unencumbered egress following enemy contact and survival in the post-crash (e.g., rollover) environment.



Laboratory/Developer

USAARL

Physiological and Operational Effects of Extended Mission Duration and Seat Design

Mission

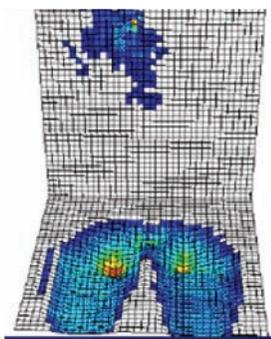
Reports from the Center for Army Lessons Learned and operational experience confirm that many deployed service members experience significant back pain due to long mission duration and uncomfortable seating. These symptoms could affect mission accomplishment. In some cases, unauthorized seat cushions have been introduced into the field as a countermeasure; the effects of these cushions on crash survival are largely unknown.

Description

The purpose of this research program is to develop a methodology to quantify seat cushion effects on seated endurance and pain and to develop a cost-effective methodology to assess seat cushion energy attenuation. The product will be a standardized evaluation methodology and performance requirements of seat cushions, increasing service member endurance.

Laboratory/Developer

USAARL



Warfighter Face and Eye Injury Protection

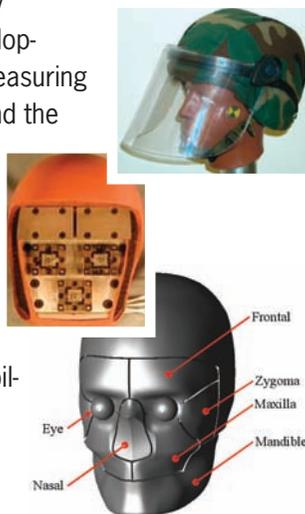
Mission

Researchers will provide Army materiel developers with an efficient, cost-effective means of assessing novel face and eye injury hazards, as well as the effectiveness of protection strategies.

Description

In recent conflicts, combat injuries to the head and neck outnumber torso injuries by nearly 4 to 1, reversing the historical trend. The most frequently injured regions of a warfighter's head and neck are the eyes and orbit, causing significant morbidity and mortality. Although combat helmets provide substantial cranial protection against penetrating trauma, the face and eyes are left exposed to shrapnel and other ballistic projectiles. Blunt injury to the face and eyes is an increasing problem due to the growing use of helmet-mounted displays by mounted and dismounted service members. Previous research has documented the risk of severe blunt injury in vehicular crashes as well as minor injury from tripping or falling when wearing helmet-mounted displays.

Operationally focused face and eye injury research conducted under the USAARL Cockpit Air Bag research program illustrated the need for biomedically relevant facial and ocular injury criteria, as well as a timely, low-cost alternative to cadaver-based testing. The primary research thrusts in this program include the development of a biofidelic test mannequin capable of measuring blunt impact forces acting on the face and eye and the promulgation of biomedically based facial and ocular injury criteria. Together, these tools will provide Army materiel developers an efficient, cost-effective means of evaluating the efficacy of novel face and eye protection devices. This research effort will lead to improved protective devices, enhancing the survivability and sustainability of the Future Force Warrior.



Laboratory/Developer

USAARL

Land Combat Study: Soldier and Family Behavioral Health Surveys

Mission

Researchers strive to improve the behavioral health care of service members and their families by using scientific survey methodologies to measure the effects of deployments and combat on the behavioral health of service members and their families.

Description

The Land Combat Study uses comprehensive anonymous surveys administered to large samples of military personnel to track the mental health status of the deploying force. To date, more than 50,000 surveys have been completed. Results from these surveys have demonstrated that more than 17 percent of service members report significant symptoms of anxiety, depression, or post-traumatic stress disorder up to 12 months after returning from a combat deployment. Besides establishing prevalence rates for both active duty and reserve component service members, the survey results have also identified problems related to stigma and barriers to care. Further, surveys of spouses have demonstrated that nearly 10 percent of spouses report significant mental health problems. By accurately measuring and better understanding the factors involved in service member and family mental health problems, mitigating policies and programs can be developed to improve service member and family behavioral health care.

Results of the Land Combat Study have contributed to the development of a deployment cycle system in which service members are placed on a half-day schedule with classes on reintegration for a week or more to provide a gradual readjustment to home and family. Other accomplishments include (1) educating service members and leaders about behavioral health care, (2) emphasizing the role of leaders at all levels in supporting access to behavioral health care, (3) integrating behavioral health services in primary care clinics for service members and spouses, (4) organically attaching behavioral health care personnel to battalion-level family readiness groups, and (5) improving the support of activated reserve component service members and their families.

Laboratory/Developer

WRAIR

Mental Health Advisory Teams

Mission

Mental Health Advisory Teams provide annual in-theater assessments of mental health problems and service delivery as reported by military personnel deployed to combat environments.



Description

Beginning in 2003, Mental Health Advisory Teams have deployed to Iraq at the request of the in-theater operational leadership. The teams are tasked with assessing the mental health status of the deployed force and identifying potential barriers to care. WRAIR scientists have deployed in support of Mental Health Advisory Teams and have provided expertise in survey methodology and analysis. Results and recommendations from this work have led to significant changes in combat and operational stress control doctrine and behavioral health care delivery in combat.

Laboratory/Developer

WRAIR

USAMRU-E



Design Guidelines for Auditory Displays

Mission

The MOMRP's auditory performance research program is developing biomedically based design guidelines for auditory displays to ensure their effective use by all Army aviators and Soldiers, regardless of their hearing profile or the noise level in the operational environment.

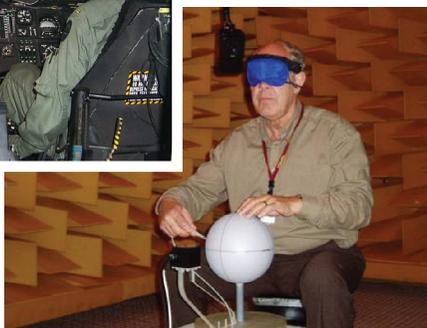
Description

New auditory display technologies, such as three-dimensional auditory displays, have not been tested in populations with hearing loss or in the noisy environments typical of rotary-wing aircraft and tactical vehicles. If service members do not correctly perceive these auditory displays, weapon system safety may be compromised, and weapon system effectiveness may be diminished.

Research couples advanced analytical and engineering techniques, such as dichotic speech analysis and virtual display engineering, with an understanding of how the brain processes spatial auditory cues and compensates for hearing impairment. Products of this research will include novel testing methods and performance criteria for auditory display technologies that enhance service member safety and operational performance.

Laboratory/Developer

USAARL



Noise Immune Stethoscope

Mission

Military medical personnel are compelled to evaluate and treat patients under the most difficult environmental conditions. Noise is always distracting and often prohibits any auscultation in the field environment or during evacuation, whether by air or ground ambulance. The goal of this research program is to develop an instrument that can be used to listen to heart and breath sounds in the challenging environment of medical evacuation vehicles and other noisy environments.

Description

In collaboration with a Small Business Innovation Research partner, a novel stethoscope has been developed that can be used in high-noise environments. The new stethoscope uses a traditional acoustic listening mode with the addition of ultrasound-based technology that is “noise immune.” Current research will assess the utility and durability of the new stethoscope under field conditions and in patients with cardiopulmonary pathology. If successful, this device could dramatically improve the diagnostic ability of medical personnel in both military and civilian settings.

Laboratory/Developer

USAARL



Biological Markers of Toxic Exposures and Effects for Deployment Health Surveillance

Mission

An increasingly important aspect of force health protection is operational risk management of toxic and hazardous chemical exposure during deployments. Service members routinely encounter toxic industrial chemicals and materials and other military relevant chemicals during deployments, training exercises, homeland defense situations as well as in occupational activities, such as vector control and vehicle maintenance. New risk assessment methods and tools are needed for managing these risks and for conducting health surveillance of military personnel.

Description

Biological markers, or biomarkers, are measurable molecular, biochemical, or cellular alterations in biological matrices, such as fluids, cells, or tissues, which occur in response to hazardous chemical exposure. Since individuals may vary in the extent of exposure, uptake, and response to chemicals, biological measures of toxicant exposure and effect—biomarkers—are needed for operational risk management. Since biomarkers can indicate the degree of exposure, biological effects, and susceptibility to disease from hazards that personnel may encounter, they have many potential applications in force health protection and health surveillance of DoD personnel.

This research program is identifying key biomarkers associated with hazardous chemicals encountered by military personnel. Taking advantage of genomic technologies and bioinformatics, experiments are being conducted using genome-sequenced animal models to identify novel biomarkers that are also highly conserved (homologous) in humans. Along with microarrays for gene expression, a proteomics approach (analysis of an organism's proteins or its proteome) is also being used to screen for biomarkers. The products of this effort include validated and measurable sets of biomarkers that can be used to evaluate the toxic exposures encountered by military personnel.

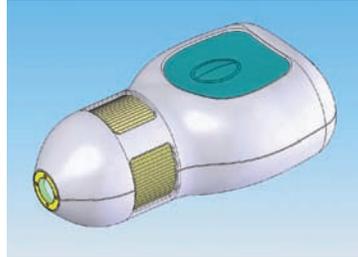
Laboratory/Developer

USACEHR

Light-based Self-treatment System for Pseudofolliculitis Barbae

Mission

Pseudofolliculitis Barbae (PFB), or shaving bumps, is an inflammatory condition diagnosed in dark-skinned men with thick, coarse hair who shave regularly. This condition currently has no permanent definitive treatment and significantly compromises a service member's ability to wear close-fitting protective facial gear, such as the Mission-Oriented Protective Posture head mask. The goal of this effort is to develop a lightweight, self-operated, and portable device for the treatment of PFB.

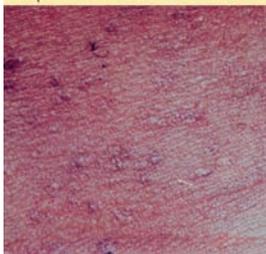


Description

Currently available depilatories, topical creams, and "PFB razors" do not offer a definitive answer for PFB and, at best, only temporarily ameliorate the condition. PFB can impact force readiness and affects a service member's quality of life. More than 50 percent of African American service members have this condition. This project is developing a self-operated, portable, low irradiance PFB treatment device that will reduce or eliminate the need for in-office medical visits suitable for use by military personnel in any deployment environment. Optimum treatment parameters and a protocol consistent with self-use device requirements have been established in independent studies. The first self-use prototype was completed in January 2007. Completion of clinical evaluation of this prototype is scheduled for April 2007.



*Treated side, 1 month after
3 monthly treatments*

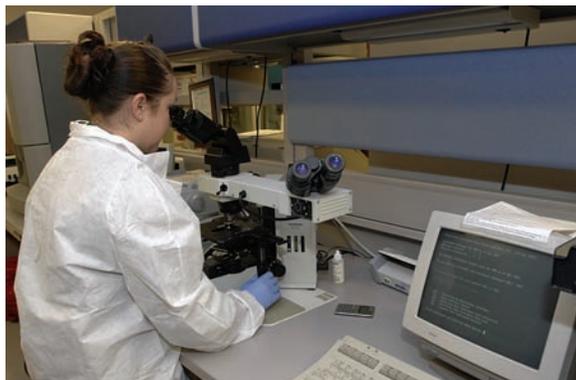


Laboratory/Developer

Congressionally Directed Medical Research
Programs (CDMRP)

Palomar Medical Technologies, Inc.

Radioprotectant Drug



Mission

A preventive medical countermeasure for high-risk military personnel will provide protection from lethal radiation exposures.

Description

Nuclear and radiological agents are a significant threat to the U.S. military. The chances of exposure or actual occurrence of exposure to ionizing radiation has the potential to significantly impact the planning and execution of military operations, making it essential that radiological therapeutics are available. This study is aimed at rapid development of a synthetic, small molecular weight, sulfur-containing organic compound, ON 01210, as a therapy for radioprotection. An investigator has shown that exposure of cells to ON 01210 before irradiation results in significant protection from DNA damage, whereas untreated cells experience significant DNA damage due to irradiation exposure. Toxicology studies have shown the drug to be pharmacologically safe, and no major differences have been observed in the behavior and physiological state of ON 01210-treated animals.

Laboratory/Developer

CDMRP

Armed Forces Radiobiology Research Institute

Safe and Effective Treatment of Depression in Warfighters

Mission

In the United States, about 10 percent of the population (7 percent women and 3 percent men) meet the criteria for major depression, and another 4 or 5 percent undergo a depressive experience that is not sufficient to be officially classified as clinical depression. In the 1998 DoD Survey of Health Related Behaviors Among Military Personnel, 18.9 percent of the Army members surveyed screened positively for depressive symptoms. The aviator community is not immune to these psychiatric problems. One commonly prescribed treatment for mild depression is selective serotonin reuptake inhibitors. The effects of these inhibitors on service member performance and cognition are unknown.

Description

Research is planned to determine any effects, beneficial or detrimental, of administration of selected serotonin reuptake inhibitor substances upon subsequent aviator flight performance and cognition.

Laboratory/Developer

USAARL



Test System for Evaluating Environmental Endocrine Disrupting Chemicals and Developing Candidate Biological Markers for Deployment Health Surveillance

Mission

Researchers hope to develop an amphibian growth and reproduction assay to detect endocrine disrupting chemicals while optimizing a model organism test system for identifying biological markers of toxic exposures and effects for deployment health surveillance.

Description

Biomarkers (molecular, biochemical, or cellular alterations) can provide valuable information on exposure of troops to hazardous chemicals. The western clawed frog (*Xenopus tropicalis*) shows promise as a nonmammalian model organism for efficiently identifying candidate human biomarkers. The same frog model is being considered for use by the U.S. Environmental Protection Agency (EPA) to screen for endocrine-disrupting chemicals in the environment. This EPA-funded project will provide EPA with an amphibian growth and reproduction test protocol while refining methods that will facilitate the use of *Xenopus tropicalis* for the development of biomarkers for use in evaluating toxic chemical exposures encountered by military personnel.

Laboratory/Developer

USACEHR



Thermal Warning Algorithm

Mission

An effective tool to provide real-time prediction of future body core temperature in humans is necessary so that protective measures can be implemented in time to prevent heat injury.

Description

Heat injury is a serious problem for the armed forces, especially during deployments to localities with very hot climates. An early warning of the likelihood of a person's body core temperature rising beyond healthy limits is paramount to alleviating or avoiding different heat-related illnesses. The early warning algorithm combines recent advances in core temperature telemetry with data-driven prediction techniques to forecast an individual's core temperature for up to 20 minutes ahead of current time. The algorithm is based on linear predictive techniques, which make it very stable and easy to implement in real time. Although temperature prediction is based on an individual's recently collected temperature data, the algorithm is robust enough that it is "portable" from person to person. The algorithm requires only modest memory and processing power and can be incorporated into systems that will be used to provide real-time physiological status monitoring of personnel.

Laboratory/Developer

BIC/Telemedicine and Advanced Technology Research Center



Biomedical Guidance for Optimization of Lightweight, Restricted-Energy Rations

Mission

Random selection, or “field stripping,” of components from Meals, Ready-to-Eat by service members attempting to reduce the weight and volume of food to be carried is likely to result in suboptimal performance. To remedy such shortfalls, lightweight individual assault rations have been fielded, such as the First Strike Ration, but design factors constrain nutritional content. Developers require new biomedical research information to optimize nutrient content and maximize nutrient bioavailability to sustain service member health and performance.

Description

Biomedical experiments and modeling will help determine energy and specific nutrient cost of combat missions and identify nutritional strategies to better sustain cognitive and physical performance during periods of energy deficit and heavy work. Novel nutrient delivery systems, food formulations, and feeding plans incorporating eat-on-the-move ration components and evaluated in laboratory and field tests will improve on-demand bioavailability of specific, performance-sensitive nutrients during combat missions. This will assist the ration developer in leveraging the science and technology

information derived from these biomedical studies against parallel advances in emerging food science and packaging technology and fielding solutions during the continuous product improvement for rations to enhance energy and nutrient intake during combat missions while reducing ration weight, source material, and discarded food.



Laboratory/Developer

USARIEM

Design Guidelines for Effective Microclimate Cooling Systems

Mission

Improvements in the design and implementation of microclimate cooling (MCC) systems will enhance service member performance and reduce both heat strain and injury.

Description

The efficacy of MCC systems will improve through the implementation of physiologically driven designs. Engineering attempts to enhance liquid MCC capabilities include reducing the coolant temperature and increasing flow, both of which increase power requirements. However, over cooling the skin produces skin vasoconstriction, increases thermal resistance, and decreases conductive heat transfer. As the skin-to-MCC garment interface gradient narrows, the amount of cooling per unit of power consumed declines and cooling efficiency decreases. This project examines the use of intermittent MCC to reduce vasoconstriction, maximize heat flux, and conserve battery power requirements.

Future Force operational requirements will accentuate heat strain, increase the incidence of heat casualties, and reduce work performance by demanding sustained work rates and rapid deployment with minimal time for heat acclimatization. Traditional MCC technologies have been successfully used to alleviate heat strain in mounted service members, but cooling limitations and power and weight restrictions do not currently make this technology applicable to dismounted individuals.

This project will maintain performance capabilities of a service member by improving heat flux thus reducing heat strain and water requirements. Intermittent MCC will also decrease cooling power requirements by 45 percent.

Laboratory/Developer

USARIEM



Effective Army Weight Management Strategies

Mission

The Army weight control program is intended to prevent obesity and optimize combat readiness of service members through motivation of good fitness and nutrition habits.



Description

Biomedical research is being conducted to identify components of effective weight loss programs for service members exceeding body fat standards. The effectiveness of currently enforced standards and programs is being compared to best practices in the civilian community, and these approaches are being evaluated for suitability in the unique military environment. Factors governing success in weight maintenance through a military career are being evaluated. Studies of the importance of relative fat and protein content of diets will contribute to garrison and field feeding guidance. Candidate weight loss program strategies being evaluated for efficacy among military personnel include meal replacement diets, use of over-the-counter weight loss pharmaceuticals, subsistence on structured energy-restricted meals served in garrison dining facilities, and Internet or PDA-based weight loss and maintenance interventions applicable to Army Reserve and National Guard personnel as well as active duty personnel.

Laboratory/Developer

Pennington Biomedical Research Center
USARIEM

High-Altitude Warfighter Readiness Strategies

Mission

New products and strategies will mitigate the effects of high altitudes on warfighter readiness and performance and increase deployability to these areas.

Description

The Future Force must be able to rapidly deploy and effectively fight in any environment, including high-altitude environments; however, rapid deployment of unacclimatized troops to high altitudes can cause debilitating effects on performance and health. Current acclimatization techniques can take 6–14 days of continuous exposure to high altitudes, and available medications that reduce Acute Mountain Sickness impair work performance and have other adverse effects. Advances in the understanding of altitude acclimatization and Acute Mountain Sickness pathophysiology will help develop strategies to protect and sustain warfighter performance and decrease Acute Mountain Sickness susceptibility during rapid deployments to altitude.

The deployability, readiness, and sustainability of operations under high-altitude conditions will increase with the products from this effort. These research products will include performance-enhancing nutritional supplements for high-altitude rations, procedures to induce and time compress altitude acclimatization prior to deployment, prediction models of military work performance and altitude illness, and a decision aid to plan and manage unit task performance, altitude illness, and logistical needs.

Laboratory/Developer

USARIEM



Pathology of Heat and Cold Injury

Mission

Rapid deployment and sustained operations of the warfighter at thermal extremes can compromise performance, prevent mission goals, and increase noncombat casualties. Prevention of noncombat casualties can only be realized with knowledge-based enhancement of the complex mechanisms that mediate thermal injury. During the past 20 years, the U.S. Army has seen an eight-fold increase in heat stroke hospitalization rates while the hospitalization rate for heat illness has decreased markedly.

Description

The development of cellular and animal models of heat injury and exertional hypothermia permits the study of militarily relevant issues associated with environmental extremes under thermal conditions that are too dangerous to study in human volunteers. Elucidation of the mechanisms of thermal injury will lead to novel strategies to enhance and sustain warfighter performance and health in hot and cold environments.



Laboratory/Developer

USARIEM





Sleep Watch

Mission

The Sleep Watch noninvasively measures sleep and predicts service member performance. When integrated into the Warfighter Physiological Status Monitor (WPSM) and Future Force Warrior, it will provide commanders with online, real-time predictions of cognitive readiness and enable effective management of sleep to sustain operational performance.

Description

The Sleep Watch actigraph is a wrist-worn, wear-and-forget, digital signal-processing device that provides real-time quantitative estimates of individual performance capacity (cognitive readiness) based on sleep/wake history derived from wrist movements. The Sleep Watch generates performance estimates from the built-in Fatigue Intervention and Recovery Model (FIRM). These estimates are available to the individual service member on the face of the Sleep Watch and can be telemetered to commanders, providing commanders with individual performance estimates for mission planning using the Fatigue Performance Prediction Tool.

An application-specific integrated circuit for micro-electro-mechanical system activity sensor, the built-in sleep-scoring algorithm, and the FIRM form an “intelligent sensor” that will be integrated into the WPSM, Future Force Warrior, and other future systems. Additional sensors are monitoring for field (life signs, vital signs, and live/dead estimation) and clinical (shivering and tremor) applications.

The Sleep Watch integrated into the WPSM and associated telemetry systems provides remote monitoring capabilities needed to predict service member performance at a low cost in terms of power, weight, volume, and computational capacity.

Laboratory/Developer

WRAIR
CDMRP

Strategies to Optimize Bone Health and Eliminate Stress Fractures in New Recruits

Mission



Stress fracture of the lower extremities is a common and potentially debilitating overuse injury and is one of the major contributors to lost training time for new recruits. The rise in disability discharge rates is primarily attributed to bone and joint problems. The ways young men and women entering the military are fed, trained, and treated can play a significant role in decreasing risk for stress fracture in the short

term and osteoporosis and other bone diseases, such as osteoarthritis, in the long term.

Description

Current research, supported in part through special congressional funding, includes nearly 40 major studies centered around physical training and other factors that influence the normal bone remodeling and repair process. In addition to identification of modifiable risk factors for stress fractures that result from changes in physical training load, these studies seek to identify interventions that might improve bone quality through biomechanical forces (including vibration and exercise), nutrition (including protein, vitamin D, and calcium intake), and hormonal influences (including low-dose estrogens, DHEA, and androgens). Combined with the results of additional studies investigating the role of genetics and personal health, dietary, and fitness habits, this bone health research program will lead to innovative approaches to prevent stress fracture injury in new recruits, provide early diagnosis and treatment of stress fractures, and favorably affect disability discharge rates. The ultimate goal of this program is to eliminate stress fracture injuries, improve overall bone health of the warfighter, and ensure continued quality of life beyond a service member's military career.

Laboratory/Developer

USARIEM

Warfighter Physiological Status Monitoring-Initial Capability

Mission

The Warfighter Physiological Status Monitoring (WPSM)-Initial Capability system assesses warfighter health and well-being remotely. When interfaced to a communications system, this situational awareness information will be sent to both commanders and medics. The system will provide continuous health monitoring remotely.

Description

The WPSM system is a tailorable integrated suite of warfighter wearable sensors with a total weight of less than 1 pound. The baseline system will consist of the following monitoring devices: Vital sign detection system, including heart rate, respiration rate, body orientation, activity, and skin temperature; fluid intake monitor; sleep/performance watch; and core temperature pill used as indicated by a medic or operational environment.

Information from the sensors is transmitted over a low-power personal area network to a medical hub. The hub provides both storage for medical records (electronic information carrier) and can readily interface to a number of off-body warfighter communication systems. Algorithms, running on both sensors and hub, provide indicators of the following physiologic and health states: Vital sign detection, thermal, hydration, and sleep/performance. The hub also tracks events such as the warfighter-activated medic call button. State and event information is forwarded via warfighter radio to medics or commanders.



Laboratory/Developer

USARIEM
WRAIR

Biomechanical Design Guidelines for Personal Equipment

Mission

Biomechanics, as applied to the military, is the process of analyzing a service member's physical activity and equipment from the point of view of physics and mechanical engineering. The goal is to improve military equipment and training to enhance effectiveness and reduce injuries. A state-of-the-art biomechanics laboratory, including a high-speed, multicamera video motion analysis system, a custom-built, dual-force platform treadmill (patent pending), a custom-built, force-sensing backpack, in-shoe force sensors, and a telemetry system for monitoring muscle electrical activity, is used to analyze service member physical activity and equipment.

Description

Biomechanical analyses involving load carriage are made in conjunction with the determination of metabolic rate or energy cost. This includes evaluation of prototype military load carriage systems and footwear to assist in making equipment development and procurement decisions. Physical training programs are being evaluated for improving service member physical performance and quantification of the effects of load carried on the speed of over ground foot travel and the negotiation of obstacles on the battlefield.

Laboratory/Developer

USARIEM



Effects of Prolonged Deployment on Physical Performance, Body Composition, and Injury Potential

Mission

The physiological effects of prolonged deployment, especially in harsh environments, can have significant deleterious long-term effects on muscle mass and performance capabilities and can increase the likelihood of injury. The goal is to conduct a complete assessment of body composition, physical work capacity, and fitness in combat service members prior to and after prolonged (e.g., 1 year) overseas deployment.



Description

Anecdotal reports have raised concerns that prolonged deployment to Iraq and Afghanistan may be associated with significant loss of body weight and muscle mass and a reduced capability to carry out physical tasks such as load carriage. If these changes are occurring, there is also the possibility that these service members may be at greater risk for musculoskeletal injury. A series of studies have been initiated involving a complete assessment of body composition, strength, and metabolic aerobic capacity in several hundred service members before and immediately after approximately 1 year of deployment to Afghanistan or Iraq. In addition, information will be obtained to determine the relative importance or impact of nutritional factors, energy expenditure related to mission demands, and the ability of service members to continue their physical training on these physiological measures. An epidemiological analysis will also quantify the prevalence of musculoskeletal injuries associated with prolonged deployment.

Laboratory/Developer

USARIEM

Physical Training and Injury Prevention Monitoring Strategies for Improved Military Task Performance

Mission

In addition to physical preparedness, appropriate physical training combined with careful monitoring of training status has the potential to reduce the incidence of occupational injuries as well as injuries due to physical training.



Description

The high physical demands of Army military occupational specialties combined with the lack of emphasis on strength training often result in a physical mismatch between a service member and the military occupational specialty. To decrease this physical disparity and improve Soldier performance, laboratory studies will be used to demonstrate the effectiveness of new biomechanics- and physiology-based physical training programs. Recommendations have been developed to control the quantity and speed of running training during Basic Combat Training, and researchers are investigating the specific effects of training programs to improve load carriage performance.

Physical training programs can be objectively evaluated in terms of improvements in basic physical capacities or in terms of physical performance tests; however, the translation of improvement on these measures into improvement in service member performance is not well defined. A battery of militarily relevant, common-soldiering tasks are being developed that will provide greater insight into the benefits of physical training programs.

Laboratory/Developer

USARIEM

Training, Overuse Injury, and Performance Modeling

Mission

The physical demands of basic training, while designed to enable recruits to pass the Army fitness and body composition standards, are associated with a high prevalence of musculoskeletal injury. These injuries result in lost duty time, medical costs, loss of manpower, and even separation from the service. A large number of empirical studies have been conducted to evaluate the effects of various physical training programs, as well as other factors, on the development of fitness and the occurrence of musculoskeletal injury. The goal is to develop a statistical mathematical “computational” model that can be used to predict the physical performance capabilities and the potential for musculoskeletal injury for a given individual based on medical history and the physical training program being applied.

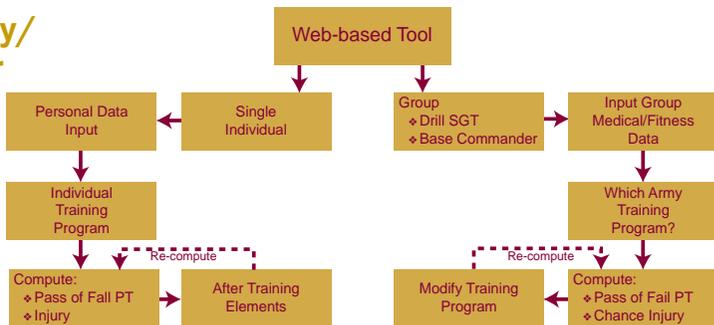
Description

An alpha version of the Training, Overuse Injury, and Performance (TOP) computational model has been developed and cross-validated against performance and injury data from standardized Army training programs. Web-based software for this model has also been developed. Clinical prediction rules have been applied, and the prognostic accuracy for the TOP model is 80 percent to 90 percent. The TOP model has the potential to identify individuals who either are at extreme risk for musculoskeletal injury or unlikely to pass the Army fitness standards. The model will also allow elements of the physical training program, such as running mileage, to be varied to minimize injury while at the same time enable an individual to attain the required performance standards.

Laboratory/ Developer

USARIEM

TOP MODEL



Fatigue and Performance Models

- ◆ **Fatigue Intervention and Recovery Model**
- ◆ **Fatigue Performance Prediction Tool**

Mission

Mission planners require tools to estimate degradation in service member effectiveness during continuous or sustained operations, estimate the degree to which countermeasures, such as naps and stimulants, restore or sustain performance, and plan and optimize individual and unit work/sleep scheduling in real time.

Description

The Fatigue Intervention and Recovery Model (FIRM) predicts cognitive readiness for particular tasks or categories of tasks based on factors accounting for the greatest amounts of variability in cognitive performance: Sleep/wake history, mental workload, time on task (fatigue), individual difference factors, and pharmacological countermeasures. The FIRM is integrated into both the Sleep Watch and the Fatigue Performance Prediction Tool for mission planning and is a component of the WPSM and Future Force Warrior.

The Fatigue Performance Prediction Tool is a flexible, laptop-based software program that allows for (1) prospective forecasting of cognitive performance based on any hypothetical sleep/wake schedule; (2) when needed, the real-time optimization of personnel work/sleep scheduling; and (3) reconstruction of probable cognitive performance level based on a known or estimated sleep/wake schedule associated with an event (e.g., accident reconstruction).

Laboratory/Developer

WRAIR



Guidance on Using Modafinil, Dextroamphetamine, or Other Controlled Substances

Mission

Guidelines are needed regarding the use of controlled pharmacologic products to enhance performance and alertness during continuous or sustained operations.

Description

Research is under way addressing the use of prescription-only pharmacologic products to enhance performance and alertness during unavoidable sleep loss. Two prescription-only stimulants are currently being tested: Dextroamphetamine (Dexedrine®) and modafinil (Provigil®). Issues addressed include (1) comparative performance among products during extended sleep loss (particularly for restoring planning, decision making, and situational awareness), (2) duration of effect across different dosing levels, (3) potential development of tolerance to product effects, and (4) operationally relevant side effects to include potential impairment of recovery sleep. Of specific interest is whether these products offer any advantages over caffeine, a readily available over-the-counter stimulant that is safe and effective.

Laboratory/Developer

USAARL

WRAIR



PDA-Based Psychomotor Vigilance Task

Mission

The PDA-Based Psychomotor Vigilance Task (PVT) will determine the cognitive readiness levels of sleep-restricted/deprived service members in the field. Knowing each individual's cognitive readiness level will allow commanders to plan intelligently for the re-supply of adequate sleep to sustain performance and personnel recycling over the life of the mission.



Description

The PVT is a simple psychomotor response task run on a PDA that provides the capability to reliably assess cognitive functioning and alertness of individual service members in the operational environment. The PVT can be used to gauge the extent of cognitive restoration following short sleep opportunities or stimulant administration. Laboratory and field studies show that the PVT is the most sensitive and reliable metric for detecting and quantifying impairments due to even mild amounts of sleep restriction—and in advance of frank errors and accidents. PVT output can be input to the FIRM to individualize the model to yield highly accurate, real-time individual performance status predictions. Future work will link PVT metrics to cognitive abilities affecting situational awareness and the capacity for rapid, correct decision making that enables a service member to recognize and capitalize on emergent battlefield opportunities.

Laboratory/Developer

WRAIR

Warfighter Physiological Status Monitoring–Commander

Mission

WPSM-Commander is a translational field research program that uses a network-centric approach to translate life science and engineering knowledge into products that address recognized warfighter needs for real-time medical awareness. This work effort is characterized by austerity (focused requirements), specificity (spin-off products actually needed by warfighters), and adaptability (technology that can easily be modified to meet new needs).

Description

State-of-the-art wireless squad and personal area networks will enable existing physiological sensors, algorithms, and predictive models and will interface to form a series of real-time medical and situational awareness products for warfighters. Medical awareness will include knowledge of both physiological state and mental status, for example, cognitive, psychomotor, and emotional states. This is critical information when service members operate in situations that are difficult to monitor—remote areas away from other team members, encapsulation in chemical protective equipment, low visibility operations, and varying levels of cognitive load.

WPSM-Commander builds on the WPSM–Initial Capability system and seeks to address the need to perform more difficult predictions of physiological states such as real-time predictions of thermal strain, extreme fatigue, and early markers of cognitive degradation. Commanders will be able to use this type of information to assess fitness for duty and real-time probabilities of judgment or decision-making impairments.

Product specifications will include the minimum sensor set, predictive models and algorithms, and the human factors guidance needed to provide information that a commander wants to have to ensure the health and performance of individual service members performing critical missions.



Laboratory/Developer

USARIEM

Laser Eye Injury Field Therapy Kit

Mission

Researchers are developing a field therapy kit for the treatment of laser-induced eye injury.

Description

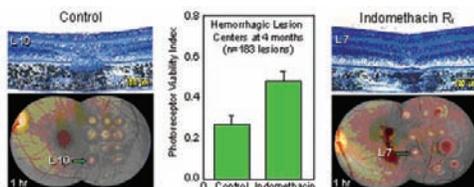
The Laser Eye Injury Field Therapy Kit will contain comprehensive diagnostic tools and treatment strategies for laser-induced eye injury. Military lasers can produce eye injuries at tactical ranges resulting in immediate visual impairment or blindness. The Laser Eye Injury Field Therapy Kit will provide the combat medic with the tools to rapidly diagnose and treat laser eye injuries to minimize vision loss.

Current research has characterized the relative efficacy of selected steroids and nonsteroidal anti-inflammatory drugs for specific retinal injury taxonomies for both highly localized thermal and thermal-mechanical injury to the retina. Other neuroprotective agents are being investigated to minimize secondary effects of laser-induced retinal trauma. Advanced ocular imaging technologies and assessments of visual function (such as the multifocal electroretinogram) are used to characterize the efficacy of the intervention.

Depending on the taxonomy of the injury (laser dose, location within the retina, proximity to other lesions, etc.), primary and secondary effects include retinal burn, retinal and vitreous hemorrhage, retinal hole formation, inter-retinal scar formation, choroidal neovascularization, retinal nerve fiber degeneration remote from the lesion site, and retinal traction. Treatment strategies based on the injury taxonomy provided by the Laser Eye Injury Field Therapy Kit will minimize visual impairment from laser-induced injury.

Laboratory/Developer

U.S. Army Medical Research Detachment
WRAIR



Photoreceptor survival was enhanced (by \approx 2 times) in NHP treated with indomethacin. Taxonomy-based treatment regimens for the warfighter – enhance recovery, conserve vision. Neodymium YAG Laser (1064 nm, 20 ns, 2.0-6.0 mJ).

Virtual Reality Stress Research Program for Combat Medics

Mission

Combat is violent, unpredictable, and cognitively challenging. Some battlefield stressors have proved to affect health and performance. Any abnormal reaction to these stressors can easily escalate to further psychological decompensation (such as Post-Traumatic Stress Disorder). Incidentally, many warfighters are currently being medically evacuated for stress-related reasons. While deployed to fight for our country and save fellow comrades, medics are among some of the warfighters experiencing battlefield stress.

Description

The goal of USAARL's Stress Research Program is to study medics' stress levels and teach them how to manage stress. With this in mind, the program includes repeated sessions where medics practice selected tasks (e.g., triage) in a simulated (e.g., with mannequins or through virtual reality) but stressful (e.g., timed and/or noisy) manner. The result of this research is that medics not only practice job skills but also learn to manage their stress. Decidedly suitable for embedded training, preliminary data on this approach are proving not only to improve performance on real-world tasks practiced in the virtual world but also to increase warfighters' stress resilience.

Laboratory/Developer

USAARL



Environmental Sentinel Biomonitor System

Mission

Researchers hope to provide a device to rapidly identify toxicity from a wide range of chemicals in water.



Description

Providing drinking water to deployed troops can use a large fraction of available transportation assets. Although decentralized water production could reduce the transportation burden, it will be difficult to ensure that water produced in many diverse locations is safe to drink in view of the many toxic industrial contaminants that may be present in water and the limited number of such chemicals that can be rapidly detected in the field.

Evaluating the overall toxicity of a water sample provides an alternative to identifying a large number of individual chemicals. The Environmental Sentinel Biomonitor (ESB) system uses biologically based sensors to rapidly identify the toxicity associated with many different classes of chemicals, thus providing a warning of potential harm that can trigger appropriate risk management actions.

Potential ESB system applications include in rear areas and at garrison facilities, such as water treatment plants, at field water production facilities that use equipment including the Tactical Water Purification System, in Future Combat Systems manned ground vehicles to evaluate water produced by onboard water generation equipment, and by individual service members in the field (e.g., Special Forces).

A prototype ESB system for use in rear areas and at garrison facilities is scheduled for delivery in fiscal year 2008.

Laboratory/Developer

USACEHR



Epidemiology and Protection from Injury in Combat

Mission

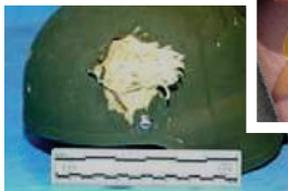
There is an urgent need to assess the performance of personal protective equipment (PPE) in current combat operations. Current trauma databases lack exposure and PPE data necessary for reliable analyses. USAMRMC has a long-standing capability to analyze damaged protective equipment, correlate the analysis with scenario and injury data, and produce recommendations for improved equipment, tactics, procedures, and requirements. In the future, this capability, historically based in aviation, will expand to include mounted Army service members who are injured in combat. This initiative will allow Army decision makers to assess the performance of current combat protective equipment.

Description

A multidisciplinary team of physicians, engineers, safety experts, and operational service members will conduct analyses of damaged protective equipment, correlate those analyses with scenario and injury data, and make recommendations regarding deficiencies, improvements, and future equipment requirements. Specific analyses of protective helmets from aviation and ground service members will allow determination of impact forces and system performance. The result will be a seamless record of a service member's wounding event, risk factors, diagnoses, treatment, and outcome and will lead to enhanced warfighter survivability through wound pattern detection and optimized PPE.

Laboratory/Developer

USAARL



Health Risk Communication Strategies for New Recruits

Mission

Young men and women enter the Army with a diverse health educational backgrounds. Alcohol abuse, tobacco use, unintended pregnancy, acquisition of sexually transmitted diseases (STDs), and sexual violence and harassment are significant but modifiable risks that have important impacts on individual and unit readiness.



Description

Biobehavioral programs to reduce health-damaging behaviors are being developed and tested for use in populations in initial entry training. These are based on health risk communication research and other psychosocial approaches to effectively reach young men and women. In a randomized controlled trial, one program designed for the military reduced the rates of STD infection by greater than 30 percent and reduced unintended pregnancy in a vulnerable population of female Marines up to 18 months after their initial entry training. A new program is being developed to explore the effectiveness of mixed gender training on interrelated health risks including alcohol abuse, STDs, unintended pregnancy, and sexual violence. The product of this research will be proven methods to effectively communicate with young service members on personal health risk behaviors.

Laboratory/Developer

Department of Adolescent Medicine, University of California, San Francisco

USARIEM – Fort Bragg Medical Research Unit

Health Risk Surveillance Tools – Neurocognitive Assessment

Mission

Following the Gulf War, it became evident that the DoD lacked routine test methods to determine changes in the neuropsychological status of service members resulting from occupational or environmental exposures. Surveillance methods are essential to the early detection of neurocognitive changes that indicate near-term threats to performance and long-term health risks, including neurodegenerative diseases.

Description

Research is currently under way to understand the potential neurocognitive health and performance risks associated with deployment operations and military service in general. This includes prospective epidemiological field studies of service members deploying to Bosnia and Iraq. Current and planned research also focuses on identification of practical and valid bioindicators of neurotoxic exposures, effective doses, and use of appropriate test batteries for field assessment of neurocognitive changes in military personnel over time. The products of this research will be valid, reliable, field-tested methods that can be integrated into epidemiological study designs for the real-world, real-time assessment of neurocognitive health and performance with potential occupational and environmental chemical exposures.

Laboratory/Developer

Boston University School of Public Health
Department of Veterans Affairs
USARIEM



Rapid Analysis of Water for Microbial Contamination

Mission

Researchers will provide rapid identification and semiquantification of *Escherichia coli* and total coliform bacteria in 8 hours or less instead of the current 18–24 hours.

Description

The assurance of safe water is paramount to the health and performance of the warfighter. Any technology to assess the microbial purity of water under field conditions must meet rigorous criteria: It must be readily portable, provide timely results, have adequate sensitivity (1 colony forming unit per 100 milliliter), be compatible with military power sources, and be of a complexity appropriate for operation by a preventive medicine specialist.



Pacific Technologies developed the “Coliform Analyzer” that combines classical membrane filtration with innovative computer electronics for the selective growth and semiquantification of both total coliform bacteria and *E. coli* in the presence of other water heterotrophic bacteria.

Pacific Technologies has been awarded another contract to continue development and commercialize the “Coliform Analyzer” with the purpose that this detector will replace the coliform tests currently used by the Army.

Laboratory/Developer

Pacific Technologies

USACEHR



Medical Chemical and Biological Defense



Overview

Future battlefields are expected to be at least as dangerous as any of the past, or any that were anticipated during the Cold War. Although treaties and agreements forbidding the use of chemical and biological weapons were milestones in arms control, such weapons remain significant threats to U.S. and allied forces. Stockpiles of chemical weapons found in Iraq after the 1990–91 Gulf War, the use of these weapons in the Iran-Iraq War, the 1995 nerve gas attack in the Tokyo subway, and the anthrax letter attacks of 2001 are vivid reminders of the potential risk and threat to both service members and civilians from these weapons.

Medical Chemical Defense Research

The mission of the Medical Chemical Defense Research Program is to preserve combat effectiveness by timely provision of medical countermeasures in response to joint chemical warfare (CW) defense requirements. This program executes Department of Defense (DoD) medical chemical defense science and technology research programs assigned to U.S. Army Medical Research and Materiel Command (USAMRMC) laboratories by the Defense Threat Reduction Agency's (DTRA's) Joint Science and Technology Office for Chemical and Biological Defense.

Nerve agents can be fatal to the unprotected warfighter. Survivors may have recurring seizures and long-term brain damage. Through joint research and development, the nerve agent threat has been substantially reduced by the fielding of numerous products:

- ◆ Soman Nerve Agent Pretreatment Pyridostigmine, a pretreatment drug, can be administered orally to troops under risk of CW attack without degrading their performance.
- ◆ Mark I Nerve Agent Antidote Kit (NAAK) provides a service member with the nerve agent antidote atropine and an oxime, 2-pralidoxime chloride.

- ◆ Antidote Treatment Nerve Agent Autoinjector is an improvement over the Mark I NAAK.
- ◆ Convulsant Antidote for Nerve Agent—diazepam in an autoinjector—is used as an adjunct therapy for nerve agent poisoning to protect against seizure-induced brain injury and to enhance survival.
- ◆ Medical Aerosolized Nerve Agent Antidote is an aerosolized atropine that can be rapidly administered far forward to casualties for the control of respiratory effects of nerve agents.
- ◆ Skin Exposure Reduction Paste against Chemical Warfare Agents is a topical pretreatment that forms a film barrier on the skin and augments Mission-Oriented Protective Posture gear by preventing or delaying the penetration of a wide variety of CW agents including the blistering agent sulfur mustard.

Research and product development supporting pretreatment, treatment, diagnostics, and clinical management of the chemical casualty are the keys to continuing discovery and fielding of medical countermeasures to CW agents. Successful ongoing programs in or nearing acquisition status include an Advanced Anticonvulsant System, an Improved Nerve Agent Treatment System with an improved oxime for treatment of nerve agent exposure, and nerve agent bioscavenger (plasma-derived human butyrylcholinesterase) pretreatment, which transitioned to the U.S. Department of Health and Human Services for advanced development for U.S. Food and Drug Administration licensure. This is a stoichiometric bioscavenger, meaning that one molecule of bioscavenger binds and neutralizes one molecule of nerve agent.



Active programs in the USAMRMC technology base include research to investigate the effects of low-level exposure to CW agents, research to develop medical countermeasures against vesicants and nontraditional agents, and research on nerve agent neuroprotection, a recombinant bioscavenger (Increment II), and a catalytic bioscavenger pretreatment (Increment III) that enhances efficacy by degrading multiple molecules of nerve agents in vivo.

The Medical Chemical Defense Research Program also provides education and training to officers and enlisted persons from all of the Services who will be the doctors, nurses, and medics who will treat a warfighter exposed to CW agents. Depending on the availability of funding, the capability exists to broadcast this information around the world via satellite to first responders who would likely be tending to casualties exposed to CW agents in the event of a terrorist action.

Medical Biological Defense Research

The mission of the Medical Biological Defense Research Program is to ensure the sustained effectiveness of U.S. forces in a biological warfare (BW) environment and to deter the use of these weapons by maintaining a strong medical defensive posture. This USAMRMC program executes DoD medical biological defense science and technology research programs assigned to USAMRMC laboratories by DTRA's Joint Science and Technology Office for Chemical and Biological Defense.

Vaccines and drugs for biological threat agents and toxins are designed to prevent casualties in a BW attack. Diagnostic tests and reagents are developed to diagnose disease in the event of actual exposure to biological agents. Antitoxins and drugs are designed to treat casualties, prevent deaths, and expedite return to duty after exposure.

Technologies in advanced development include a recombinant plague vaccine, a vaccine against botulinum toxin (subtypes A and B), a vaccine against Venezuelan equine encephalitis (VEE), and an improved anthrax vaccine. The improved anthrax vaccine is being developed by the U.S. Department of Health and Human Services under Project BioShield. Diagnostic assays developed in the technology base that meet requirements for application to the Joint Biological Agent Identification and Diagnostic System have also transitioned to advanced developers. Technologies maturing to the point where they can be considered for transition to advanced development include

additional diagnostic assays and protocols, a combined VEE, eastern and western equine encephalitis vaccine, and vaccines against staphylococcal enterotoxin and ricin toxin exposure.

Research is ongoing to develop multiagent vaccines that would provide the capability for immunizing the warfighter against multiple biological threats with a single vaccine, to develop vaccines against Marburg and Ebola viruses, to pursue needle-free delivery methods for recombinant protein vaccines, and to develop a comprehensive, integrated diagnostic system that combines nucleic acid-based and immunodiagnostic-based platforms. Ongoing research efforts are also directed toward identifying and fully characterizing therapeutics against viral, bacterial, and toxin threats.

The most likely route of dissemination of a BW agent on the battlefield is through small-particle aerosols; therefore, researchers continue to develop, refine, and validate equipment and experimental models used to study airborne infection and disease prevention. If exposure and illness occur, rapid diagnosis is essential for proper treatment and medical management. Field-deployable, rapid assays are being developed for diagnosis of BW agent exposure.

In addition to research and development, training military and civilian health care professionals in the diagnosis and treatment of BW agent exposure is a Command priority. USAMRMC experts also provide technical support to law enforcement agencies and counterterrorism initiatives.

The products in this section are divided into medical chemical defense products and medical biological defense products, and then subcategorized appropriately.



Case Studies

Automated Inhalation Toxicology Exposure System

Challenge

Researchers at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) recognized the need in the national biodefense infrastructure for a comprehensive aerosol control platform suitable for a variety of agents. The most likely route of exposure in a bioterror attack is through an aerosol; therefore, USAMRIID was challenged with finding a way to expose animals by the aerosol method. The 2001 anthrax mail attacks further validated the need for this technology to become commercially available.



Finding a suitable method for inducing experimental infection by inhalation is the means to developing effective medical countermeasures for biological threats. Two scientists at USAMRIID recognized the need for a complete

aerosol control platform that would be suitable for a variety of agents, animal species, and aerosol forms. They applied for and were awarded funding through USAMRMC to develop this platform at USAMRIID. They designed, built, tested, and validated this technology and were issued the first patent in June 2005.

Contribution

Dr. Justin Hartings and Dr. Chad Roy created the Automated Inhalation Toxicology Exposure System to better prepare against bioterrorism threats. Benefiting both the civilian and military communities, the patented technology later named AeroMP upon commercialization allows scientists to challenge animals by aerosol methods. This method of infection creates an environment in a small chamber so animals inhale particles similar to what would be found in a real bioterror event. This type of environment increases the chances for accuracy in replicating what may happen in a real-world scenario when humans are exposed to harmful pathogens.

Hartings and Roy later formed a company, Biaera Technologies, LLC, in Frederick, Maryland, and licensed the technology from the USAMRMC. In addition to receiving grants, they also applied for and received tenancy at the Frederick Innovative Technology Center, Inc., Frederick County's first business incubator. In 2005, they began distributing this product to non-federal entities, placing AeroMP in non-DoD laboratories. The companies that purchased AeroMP are working with influenza, poxvirus, tularemia, and anthrax using a variety of animal models, including rodents, rabbits, ferrets, and primates.

Benefit

This technology transfer provides three benefits. First, AeroMP is the only automated inhalation toxicology exposure system with full computer control over all pertinent aspects of aerosol exposures. Second, AeroMP offers standardization because all aerosol-related parameters are under the control of a single software platform, allowing data to be in the same format and located in the same file. This standardization allows for fast and efficient electronic data submission to the FDA. Last, AeroMP is easy to use, allowing users to perform high-quality aerosol research without extensive training in aerosol physics. This technology is not limited to the military; it can be used by pharmaceutical companies to conduct animal testing against different types of drugs.

Case Study

Joint Biological Agent Identification and Diagnostic System



Challenge

Following the anthrax mail attacks in 2001, the U.S. military focused its search for a faster method to detect BW agents. At the time, available methods of detection involved growing, isolating, and identifying a culture, and results could take as long as several days. The Joint Program Executive Office for Chemical and Biological Defense found such a technology in 2002 from a company called Idaho Technology, Inc., in Salt Lake City, Utah.

Contribution

Idaho Technology competed in the Joint Program Executive Office for Chemical and Biological Defense's innovative, four-step acquisition process: Presolicitation, Commercial Submission, "Fly-Off," and Request for Proposal. This model was designed for faster fielding of advanced technologies to the warfighter while streamlining the acquisition of new equipment. Military requirements included a rapid, positive identification and diagnostic confirmation of BW agents and other pathogens of operational concern for the U.S. Military. On September 23, 2003, Idaho Technology was awarded a contract for the Joint Biological Agent Identification and Diagnostic System (JBAIDS) as a reusable, portable, modifiable system capable of simultaneous, reliable identification of multiple BW agents and pathogens. The goal of JBAIDS was to draw from the existing technology to deliver a commercial off-the-shelf system requiring little modification and development. The joint project involved all branches of the DoD. On December 1, 2005, the FDA reviewed Idaho Technology's 510(k) application and cleared JBAIDS for use as an aid in the laboratory diagnosis of anthrax.

Benefit

The JBAIDS anthrax detection system can detect the gene components of the deadly organism *Bacillus anthracis* in a variety of environmental sample types and also in clinical blood samples as well as cultured organisms. JBAIDS was selected by the DoD as the platform for use in the rapid identification of more than 10 deadly pathogens associated with bioterrorism and diseases of military interest. The FDA clearance allows the testing of blood and laboratory culture samples to aid in the laboratory identification of *B. anthracis*, with results in less than 1 hour.

The approval of this product is a great example of how private industry and the government can work as partners to protect the nation and those who defend it. Working closely with the FDA's Office of In Vitro Diagnostic Evaluation and Safety, the team consisted of the Joint Program Executive Office for Chemical and Biological Defense (specifically the Chemical Biological Medical Systems Joint Project Management Office), and the scientists and staff at Idaho Technology.





Skin Exposure Reduction Paste against Chemical Warfare Agents

Mission

Skin Exposure Reduction Paste against Chemical Warfare Agents (SERPACWA) enhances the survival and sustainability of U.S. forces in need of prophylaxis to nerve agent and sulfur mustard exposure.

Description

SERPACWA is an FDA-approved paste containing chemically inert perfluorinated polymers that delay or prevent penetration of nerve agents and sulfur mustard. Completed in 2003, it is used as a pretreatment in conjunction with Mission-Oriented Protective Posture (MOPP) gear to prevent or reduce the toxicity resulting from CW agents on the skin.

Laboratory/Developer

U.S. Army Medical Materiel Development Activity (USAMMDA)

U.S. Army Medical Research Institute of Chemical Defense (USAMRICD)



Soman Nerve Agent Pretreatment Pyridostigmine

Mission

Soman Nerve Agent Pretreatment Pyridostigmine (SNAPP) protects U.S. forces by providing a pretreatment for nerve agent (soman) exposure.

Description

SNAPP is a drug that was previously used to treat a chronic neuromuscular disease known as myasthenia gravis. It is now FDA approved as a prophylaxis against the lethal effects of the nerve agent soman. It is the first such drug to be approved under the FDA's Animal Efficacy Rule. Completed in 2003, SNAPP is used in conjunction with current antidotes.

Laboratory/Developer

USAMRICD

USAMMDA



Antidote Treatment Nerve Agent Autoinjector

Mission

Antidote Treatment Nerve Agent Autoinjector (ATNAA) provides treatment for nerve agent exposure of U.S. forces.

Description

ATNAA contains atropine and 2-pralidoxime chloride in a single autoinjector and is the replacement for the Mark I Nerve Agent Antidote Kit (NAAK). Completed in 2003, it is smaller and less expensive than the Mark I NAAK.

Laboratory/Developer

USAMRICD

USAMMDA



Convulsant Antidote for Nerve Agents

Mission

Convulsant Antidote for Nerve Agents (CANA) offers U.S. forces additional protection from nerve agent poisoning.

Description

CANA is a diazepam 10 milligram autoinjector used for the prevention or abatement of convulsions and the prevention or reduction of brain injury associated with nerve agent poisoning. Completed in 1991, CANA is an FDA-approved, service member-carried item used with the Mark I NAAK.

Laboratory/Developer

USAMRICD

USAMMDA



M291 Skin Decontamination Kit

Mission

Emergency decontamination products are intended to remove and neutralize potentially lethal CW and BW agents following agent exposure.

Description

The M291 Skin Decontamination Kit is a superior, safe, and effective system for use against multiple percutaneous CW agents. The wallet-like, flexible pouch contains six individually sealed foil packets and is carried in the pocket of protective suits. This kit was completed in 1990.

Laboratory/Developer

USAMRICD

USAMMDA



Mark I Nerve Agent Antidote Kit

Mission

The Mark I NAAK provides treatment for nerve agent exposure of U.S. forces.

Description

The Mark I NAAK is administered when personnel are exposed to nerve agents, such as sarin, soman, tabun, and VX, and have signs and symptoms of exposure. The kit contains two multichamber autoinjectors containing 2 milligrams of atropine and 600 milligrams of 2-pralidoxime chloride each. The Mark I NAAK was completed in 1983 and replaced by the Antidote Treatment Nerve Agent Autoinjector.

Laboratory/Developer

USAMRICD

USAMMDA



Medical Aerosolized Nerve Agent Antidote

Mission

Medical Aerosolized Nerve Agent Antidote (MANAA) increases the survival and sustainability of U.S. forces by supplying treatment for nerve agent exposure.

Description

MANAA is packaged as a pressurized inhaler device containing aerosolized atropine to counteract the effects of nerve agents, such as tabun, sarin, soman, cyclosarin, and VX. This antidote was completed in 1994.

Laboratory/Developer

USAMRICD

USAMMDA



Automated Inhalation Toxicology Exposure System

Mission

The Automated Inhalation Toxicology Exposure System (patented as AeroMP) is used to induce experimental inhalation for the development of effective medical countermeasures against biological threats.

Description

AeroMP allows scientists to challenge animals by aerosol method. This method of infection creates an environment in a small chamber so that particles are inhaled, simulating a real bioterrorism event. This type of environment increases the chances for accuracy in replicating what may happen in a real-world scenario when humans are exposed to harmful pathogens.

Laboratory/Developer

USAMRIID



Test-Mate Cholinesterase Kit

Mission

The Test-Mate Cholinesterase Kit provides U.S. forces with superior protection against nerve agent exposure with the ability to detect the presence of acetylcholinesterase.

Description

The Test-Mate Cholinesterase Kit measures blood enzyme erythrocyte AChE and plasma cholinesterase, providing detection of nerve agent exposure in less than 4 minutes. The kit contains a battery-operated colorimeter, a photometric analyzer, and all equipment and reagents necessary for performing up to 96 tests. Blood for each test is easily obtained from a finger stick. This kit was completed in 1997.

Laboratory/Developer

USAMRICD

USAMMDA

Advanced Anticonvulsant System

Mission

Nerve agent exposure can cause seizures and convulsions in warfighters. The use of an anticonvulsant provides an effective treatment for service members against nerve agent-induced seizures and subsequent brain damage caused by nerve agent exposure.

Description

The Advanced Anticonvulsant System (AAS) will provide an intramuscular administration of the drug midazolam to protect against seizures and subsequent neurologic damage. Midazolam is more water soluble than diazepam (the currently fielded medication) and, in animal models, terminates nerve agent-induced seizures more quickly. The AAS will not eliminate the need for other protective and therapeutic systems. It will serve as a replacement for the currently fielded CANA, which uses diazepam.

Laboratory/Developer

Medical Identification and Treatment Systems (MITS) Joint Product Management Office (JPMO)

USAMRICD



Chemical Agent Prophylaxes (Bioscavenger)



Mission

An effective prophylaxis for CW nerve agents will increase the ability of U.S. forces and allies to sustain operational tempo, provide full-dimension protection, reduce reliance on MOPP gear, and discourage the use of nerve agents by an enemy.

Description

The current therapeutic approach to nerve agent exposure is successful. However, if at all possible, prevention of the effects of nerve agents is preferred over treatment.

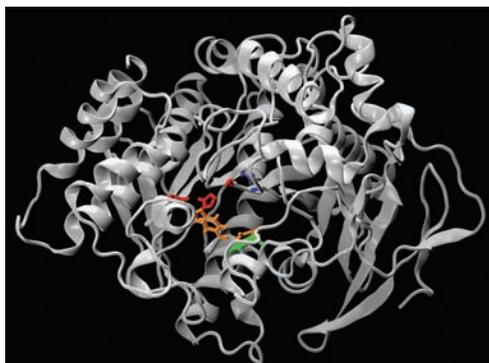
This research effort is intended to yield a pretreatment that can detoxify nerve agents at a rate sufficient to protect U.S. forces from nerve agent intoxication. To date, the effort has developed a first-generation bioscavenger (Increment I) made from expired human blood—plasma human butyrylcholinesterase. Enhancements to this approach include a recombinant bioscavenger (Increment II) and a catalytic bioscavenger (Increment III). Nerve agent bioscavengers will provide extended protection against a wide spectrum of nerve agents without causing side effects, behavioral effects, or the need for extensive postexposure therapy.

Laboratory/Developer

MITS JPMO

USAMRICD

Walter Reed Army Institute
of Research



Improved Oximes

Mission

The use of improved oximes will provide more effective emergency treatment of nerve agent exposure on the battlefield.

Description

Nerve agents attack and inhibit the cholinesterase enzymes in the body. The inhibited enzymes are then reactivated by the oximes, breaking the agent-enzyme bond and restoring normal enzyme activity to the body. Currently, military personnel are issued an autoinjector containing 2-pralidoxime chloride for emergency treatment of nerve agent intoxication that provides adequate protection against the conventional nerve agents sarin and VX but is less effective against other conventional agents (i.e., tabun, soman, and cyclosarin) and emerging threats, such as Russian V-agent.

The result of this research program will be an improved, broad-spectrum oxime that is significantly more effective than 2-PAM against conventional agents and emerging threats. The oxime MMB4 was transitioned to advanced development and is expected to be granted Investigational New Drug status by the end of fiscal year 2008. The advanced developer has established the Improved Nerve Agent Treatment System acquisition program, which includes an improved oxime. The new oxime component of the Improved Nerve Agent Treatment System will be a replacement of the currently fielded oxime (2-PAM) in the ATNAA. It will not eliminate the need for other protective and therapeutic systems.

Laboratory/Developer

MITS JPMO

USAMRICD



Cyanide Medical Countermeasures

Mission

Medical countermeasures against cyanide intoxication and the development of more accurate and reliable methodologies to assay for cyanide from biological samples will provide additional protection to service members on the battlefield.

Description

Cyanide is a fast-acting inhibitor of cellular respiration. No pretreatment against cyanide is presently available, and modern cyanide treatments accessible to DoD personnel have serious limitations. Pharmaceutical countermeasures against cyanide (i.e., pretreatments and treatments) must act rapidly, have relatively long half- and shelf-lives, and present no or minimal side effects. Efforts are ongoing to identify pretreatment compounds that will protect service members from cyanide. In addition, scavengers for cyanide are being evaluated as treatments and pretreatments.

Laboratory/Developer

USAMRICD



Chemical Diagnostics

Mission

The Chemical Diagnostics area seeks to develop screening procedures and definitive analytical methods for testing biomedical samples for individual exposure to CW agents.

Description

Medical chemical diagnostics research is focused on developing assays and evaluating technologies that meet FDA standards for clinical testing. Specifically, the goal is to employ FDA-approved systems to verify quickly exposure to CW agents or identify subclinical indicators that may result from low-level chemical exposure. Identification and confirmation of exposure to CW threat agents should be accomplished as soon as possible after exposure and ideally before symptoms develop to allow early initiation of the appropriate countermeasure and rapid return to duty. This capability area evaluates both new and existing technologies to discover, identify, and monitor biomarkers of exposure. A forensics verification assay that identifies metabolites of mustard and nerve agents after low-level exposure is under evaluation.

Laboratory/Developer

USAMRICD





Medical Countermeasures for Vesicant Agents

Mission

Medical countermeasures will demonstrate a safe and effective pharmacological pre-treatment to decrease the severity of injuries caused by sulfur mustard.

Description

Vesicant chemical agents such as sulfur mustard are a significant threat to U.S. forces, and there is currently no vesicant agent treatment available. This work will yield a vesicant agent countermeasure that will substantially reduce the number of casualties or degree of injury, reduce the medical logistical burden, deter use of sulfur mustard, and enhance the ability of U.S. forces to sustain operational tempo.

Research efforts validated countermeasure approaches using anti-inflammatories and chemical scavengers.

Research efforts are also exploring the use of debridement techniques combined with treatment adjuncts, to include dressings, growth factors, and skin substitutes, to facilitate the healing of vesicant-induced skin injuries. In addition, the technologies of an injectable, FDA-approved fluorescence dye and a wearable, portable diagnostic instrument that uses night vision technology were combined to create a method for evaluating the depth of burn injuries caused by exposure to sulfur mustard.

Laboratory/ Developer

USAMRICD



Skin and Wound Decontamination

Mission

A method for skin and wound decontamination will enhance survival and sustainability of U.S. forces in need of emergency decontamination products following nerve agent exposure.



Description

Current techniques of decontamination include activated charcoal that is rubbed over the body to absorb the chemical agent. One technology being explored is a cotton sponge impregnated with enzymes, including acetylcholinesterase, which bind organophosphorus compounds or nerve agents and inactivate them before they can do harm. The additives in the sponge remove, contain, and destroy organophosphorus compounds and vesicants, preventing further contamination. The decontamination product is also being evaluated for decontamination and detoxification of biological agents and removal of radiologicals from skin.

The sponge reacts to a nerve agent by changing color. Because it is made of polyurethane, it is inexpensive and sturdy and should not require any special training for its use. It has already been shown to be stable when stored at 45°C. Decontamination is currently being tested in animals.

The FDA approved the Reactive Skin Decontamination Lotion (RSDL) as a medical device on March 25, 2003. Testing indicates that the lotion is superior to the currently fielded activated charcoal decontaminant, the M291 Skin Decontamination Kit, in the removal and neutralization of chemical agents. The primary capability increase of the Joint Service Personnel Decontamination System using RSDL lies within its ability to actually neutralize chemical agents rather than simply to remove them as the M291 Kit does. The M291 Kit will be replaced by the Joint Service Personnel Decontamination System using RSDL. Production starts in 2007.

Laboratory/Developer

USAMRICD

Walter Reed Army Institute of Research



Anthrax Vaccine Adsorbed (Biothrax™)

Mission

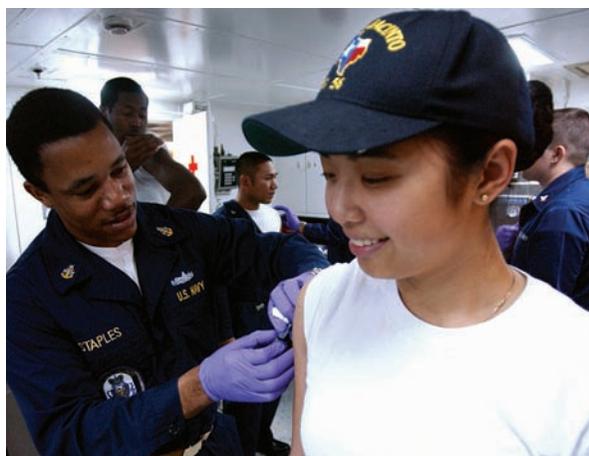
Anthrax Vaccine Adsorbed (Biothrax™) protects U.S. forces against all forms of anthrax, decreases the threat of a biological attack, and enhances strategic mobility.

Description

Anthrax Vaccine Adsorbed (Biothrax™) is a sterile, cell-free filtrate containing proteins made from an avirulent strain of *B. anthracis*. This FDA-licensed vaccine meets requirements for safety, efficacy, purity, and potency. It is marketed as a sterile, injectable suspension in 10-dose vials and is delivered by subcutaneous injection of 0.5 milliliters.

Laboratory/Developer

Anthrax Vaccine Adsorbed (Biothrax) is produced for the Joint Program Executive Office for Chemical and Biological Defense under contract with Emergent Biosolutions (formerly BioPort Corporation).



Comprehensive Educational Tools and Resources

Mission

Comprehensive educational tools and resources provide additional learning materials to service members to enrich the overall learning experience of managing chemical agent casualties.

Description

An example of a comprehensive educational tool is the Medical Management of Chemical Casualties Supplemental Training Materials V. 4.00 CD-ROM. In addition, the Chemical Casualty Care Division web site at <https://ccc.apgea.army.mil> provides access to educational videos, an article database, a student tracking database, and a chemical agent symptoms and treatments bookmark.

Laboratory/Developer

USAMRICD



Computer-based Training

Mission

Computer-based Training (CBT) offers service members a variety of interactive, multimedia learning courses both online and in compact disk format.

Description

Many of the CBT modules listed below are accredited for continuing medical education and continuing education unit credits for physicians, nurses, and paramedics.

- ◆ Medical Management of Nerve Agent Casualties
- ◆ Medical Management of Chemical Casualties Course
- ◆ Triage of Chemical Agent Casualties Course
- ◆ Virtual Field Training Exercise Course
- ◆ Patient Decontamination Station Small Group Exercise
- ◆ M40A1 Chemical-Biological Mask Function and Operation
- ◆ Nerve Agent Virtual Casualty Assessment

Laboratory/Developer

USAMRICD



Field Identification of Biological Warfare Agents Course

Mission

The Field Identification of Biological Warfare Agents (FIBWA) course was designed to allow students to set up, maintain, and operate a deployable laboratory under field conditions.

Description

The 4-week FIBWA course includes classroom instruction, extensive hands-on laboratory training in diagnostic techniques, and a field exercise that integrates course material with real-world scenarios. Concepts of operations and diagnostic materials, equipment, and technology are continually evaluated and transitioned into the field to ensure that training is cutting edge. Six student courses and three manager courses for laboratory officers and commanders are offered each year. While FIBWA is designed for organizations within the DoD, course material can be tailored to meet the specific needs of other government agencies.

Laboratory/Developer

USAMRICD

Field Management of Chemical and Biological Casualties Course

Mission

The Field Management of Chemical and Biological Casualties (FCBC) course is designed for medical and chemical noncommissioned officers, Chemical and Medical Service Corps officers, and civilian first responders.

Description

Course instruction focuses on emergency treatment, triage, decontamination, and evacuation of casualties. Pre- and postcourse tests are administered to each class to evaluate student learning progress.

Laboratory/Developer

USAMRICD
USAMRIID

Hospital Management of Chemical, Biological, Radiological/Nuclear, and Explosive Incident Course

Mission

The Hospital Management of Chemical, Biological, Radiological/Nuclear, and Explosive (CBRNE) Incident course is designed to equip military and civilian hospital-based medical and management professionals with skills, knowledge, and information resources to carry out the full spectrum of health care facility responsibilities required by a CBRNE incident or mass casualty event.

Description

Classroom and practical application instruction focuses on diagnosis, treatment, and incident management in response to mass casualty events of all types, including incidents involving weapons of mass destruction. The course is also offered as a modified, exportable 2- to 5-day course to meet specific audience needs. Pre- and postcourse tests are administered to evaluate student progress.

Laboratory/Developer

USAMRICD

USAMRIID

Medical Management of Chemical and Biological Casualties Course

Mission

The Medical Management of Chemical and Biological Casualties (MCBC) course is designed for medical professionals.

Description

Instruction focuses on pathophysiology, diagnosis, and treatment of chemical and biological casualties. The MCBC course is also offered as an exportable 2-day course to meet specific audience needs. The exportable 2-day version does not include laboratory and field instruction.

Laboratory/Developer

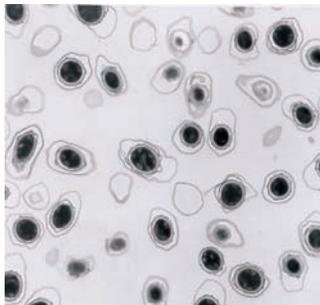
USAMRICD

USAMRIID

Next-Generation Anthrax Vaccine

Mission

An anthrax vaccine will protect U.S. forces, decrease the threat of a biological attack, and enhance strategic mobility.



Description

Anthrax is caused by spores and most commonly occurs in wild and domestic mammals, although it has been manufactured as a BW agent. Symptoms vary depending on the route of exposure; however, sore throat, mild fever, and muscle aches usually begin within 7 days of exposure. Severe breathing difficulty, shock, and meningitis follow, and as the bacteria multiply in the lymph nodes, toxemia progresses and the potential for widespread tissue destruction and organ failure increases. Up to 90 percent of untreated cases result in death. Currently, ciprofloxacin is the only antibiotic approved by the FDA to treat anthrax exposure.

Obtaining an alternative for the currently licensed anthrax vaccine would provide the DoD with additional options in protecting the force against this serious BW threat. An improved anthrax vaccine is being developed by the U.S. Department of Health and Human Services under Project BioShield. Recombinant protective antigen anthrax vaccine candidates developed by the United States at USAMRIID and by the United Kingdom have been considered as part of this effort.

Laboratory/Developer

U.S. Department of Health and Human Services/National Institute of Allergy and Infectious Diseases (NIAID)

USAMRIID

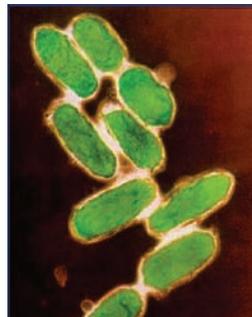
United Kingdom



Plague Vaccine (Recombinant Plague Vaccine)

Mission

An effective FDA-licensed vaccine against aerosolized plague will enhance force protection and strategic mobility.



Description

Infection induced by inhalation of *Yersinia pestis* represents a serious BW threat. The resultant disease, pneumonic plague, has an incubation period of 2 to 5 days and an untreated mortality rate of nearly 100 percent within 1 to 3 days after the onset of illness. The disease can be transmitted through flea bites and is characterized by high fever, chills, headache, malaise, myalgias, cough with blood-tinged sputum, and tender, swollen lymph nodes.

The disease progresses rapidly, resulting in epigastric discomfort, noisy respiration, and a bluish discoloration of the skin followed rapidly by respiratory failure, circulatory collapse, and bleeding tendencies if left untreated.

Preclinical studies for the safety and efficacy of a recombinant F1-V fusion antigen vaccine candidate developed at USAMRIID have been completed in animals, and the advanced developer (Joint Vaccine Acquisition Program [JVAP]) has established a plague vaccine acquisition program. The USAMRIID-developed vaccine candidate and a plague vaccine candidate developed by the United Kingdom are both being considered by the advanced developer. The plague vaccine advanced development program achieved Milestone B in 2006.

Laboratory/Developer

Program Manager (PM),
JVAP
USAMRIID



Project Argus: A National Biosurveillance Priming System

Mission

For the United States to meet present and future biothreats that span agricultural, animal, and human considerations, an integrative strategy for information discovery, exploitation, and effective proactive use by the response community is critical. Indications and Warnings (I&Ws) provide a key component for integration within the U.S. biosurveillance portfolio, enabling earlier warning potential. Project Argus is the first attempt to integrate I&Ws in an effort to detect catastrophic bioevents on an international scale.

Description

I&Ws alert U.S. responders of an imminent bioevent weeks to months in advance. I&Ws are markers occurring globally, outside of U.S. borders, before an outbreak can affect U.S. interests, forces, citizens, or territory, thus allowing the U.S. time to respond. In effect, I&Ws can prime the national response infrastructure by alerting agencies of an evolving threat that could ultimately be catastrophic. Retrospective analyses of major bioevents have demonstrated the presence of multiple I&Ws present in multiple data sources weeks to months in advance, which were not recognized and used properly by the national response community. In addition to funding provided by USAMRMC-Telemedicine and Advanced Technology Research Center, the project has also benefited from financial support from the Intelligence Technology Innovation Center and the Department of Homeland Security National Biodefense Analysis and Countermeasures Center.

Laboratory/Developer

Imaging Science and Information Systems Center-Georgetown University
in partnership with the MITRE Corporation
Telemedicine and Advanced Technology Research Center

Recombinant Multivalent Botulinum (A and B) Vaccine

Mission

An effective FDA-licensed vaccine against aerosolized botulinum toxins A and B will enhance force protection and strategic mobility.

Description

The paralytic neurotoxins elaborated by *Clostridium botulinum* are the most potent, naturally occurring toxins known. Botulism is acquired naturally by oral ingestion of the organism or infection of a preexisting wound. Direct intoxication of humans can be accomplished by aerosolizing the toxin, leading to intoxication by inhalation. Botulism symptoms appear within hours to days following exposure to botulinum toxin. All symptoms are the result of irreversible binding of the toxin to neurons. Typical symptoms include nausea, vomiting, headache, dry mouth, urinary retention, intestinal obstruction, and general neurologic disorder characterized by weakness and dizziness. Eventually, the illness results in weakness in descending extremities and respiratory muscles. Respiratory paralysis is most often the immediate cause of death.

Recombinant Multivalent Botulinum (A and B) Vaccine will provide protection against botulinum neurotoxin serotypes A and B. The candidate vaccine, currently in advanced development, will replace Botulinum Pentavalent Toxoid Vaccine Adsorbed, which has not been licensed by the FDA and remains in Investigational New Drug status. The recombinant multivalent botulinum vaccine candidate is easier to manufacture, requires fewer doses, and provides better immunogenicity than the Investigational New Drug product.

Laboratory/Developer

PM JVAP

USAMRIID



Smallpox Vaccine

Mission

A smallpox vaccine will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.



Description

Smallpox is a viral disease that was declared eradicated by the World Health Organization. Consequently, the general public is no longer routinely vaccinated. This leaves a highly vulnerable population, especially when smallpox is considered to be a prime candidate for use as a biological weapon. The case fatality rate of smallpox disease among unvaccinated individuals is between 15 percent and 40 percent. The disease can be transmitted through casual contact.

An improved vaccine to protect against this BW threat is highly desirable. Only limited doses of the currently licensed smallpox vaccine are available, and there are significant reservations about mass inoculation due to its known side effects. There is a limited supply of the Investigational New Drug product, vaccinia immune globulin (VIG), which is used to treat smallpox vaccine adverse reactions. The Investigational New Drug VIG product is delivered intramuscularly. The JVAP Prime Systems Contractor, DynPort Vaccine Company, obtained FDA licensure in February 2005 for a new VIG product for intravenous administration instead of intramuscular.

The smallpox vaccine development effort is designed to produce a more consistent and more easily manufactured vaccine using better defined and controllable cell culture production techniques. DoD smallpox vaccine development has been terminated due to removal of funding; however, there is an effort within the U.S. Department of Health and Human Services under Project BioShield to license and procure a new smallpox vaccine.

Laboratory/Developer

Smallpox Vaccine: U.S.
Department of Health and
Human Services/NIAID
PM JVAP, VIG Intravenous
USAMRIID



Tularemia Vaccine

Mission

A tularemia vaccine will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.



Description

Tularemia is an incapacitating and occasionally fatal infection transmitted to humans by fly and tick bites. Clinical symptoms are often confused with those of plague; therefore, tularemia can be very difficult to diagnose. Infection induced by inhalation or ingestion of *Francisella tularensis* organisms represents a serious BW threat because only a small amount is necessary to cause infection. Antibiotics may not be a viable option in the theater of operations, and there is no U.S.-licensed tularemia vaccine.

The DoD's advanced development program for a tularemia vaccine has been terminated due to removal of funding; however, the U.S. Department of Health and Human Services plans to continue tularemia vaccine development through submission of an Investigational New Drug application to FDA.

Laboratory/Developer

U.S. Department of Health and Human Services/NIAID
USAMRIID



Venezuelan Equine Encephalitis Infectious Clone Vaccine

Mission

A vaccine to protect against VEE threat agents will decrease the susceptibility of U.S. forces and may deter potential BW attacks.

Description

The VEE virus is a highly infectious agent that is easily manufactured in large quantities, stable in storage, and efficiently transmitted by aerosol. The alpha viruses are amenable to genetic manipulations, thereby increasing their potential as BW weapons.

Clinical manifestations include a sudden onset of a nonspecific febrile illness that consists of malaise, fever, chills, headache, retro-orbital pain, nausea, vomiting, and sore throat. The acute phase of the illness lasts 4–6 days, with total recovery taking 2–3 weeks. There is no antiviral with recognized efficacy against VEE infection, and medical intervention remains limited to supportive care.

The VEE Infectious Clone Vaccine, designated V3526, is a genetically engineered, live, attenuated virus that will be administered subcutaneously. Because this is a live viral product, only one vaccination will be required. The vaccine will elicit an immune response within 30 days, provide 80 percent protection for 1 year, and have a shelf-life of at least 3 years. The advanced development program for VEE vaccine was terminated in 2006 due to reallocation of program funding to the DoD's Transformational Medical Technologies Initiative program.

Laboratory/Developer

PM JVAP

USAMRIID



Continuous Product Improvement to the Joint Biological Agent Identification and Diagnostic System



Mission

Joint Biological Agent Identification and Diagnostic System (JBAIDS) will decrease the severity of a biological attack and enhance the strategic mobility of U.S. forces by giving commanders the ability to rapidly identify exposure to BW and infectious disease agents.

Description

JBAIDS is a reusable, portable, modifiable biological agent identification and diagnostic system capable of reliable identification of multiple biological agents of operational concern and other pathogens of clinical significance.

It will be used in both fixed and field military medical facilities and will augment and integrate with existing medical biological identification systems (such as those in use at gold standard commercial laboratories or emerging systems like the Joint Biological Point Detection System) to provide a comprehensive identification and diagnostic capability. Compact and portable, JBAIDS can reliably identify multiple BW agents and other important pathogens that affect military operations and homeland security. The system is capable of analyzing clinical as well as environmental samples. JBAIDS is in advanced development and procurement and represents the first DoD developmental effort for a common identification and diagnostics platform.

USAMRIID develops state-of-the-art technologies, critical diagnostic reagents, and protocols to support rapid and confirmatory identification of biological threat agents. Diagnostic assays developed at USAMRIID are standardized, optimized, and transitioned to the advanced developer for application with JBAIDS. In 2005, the FDA approved an assay to detect anthrax in blood and blood cultures that was developed by USAMRIID. This assay has been incorporated into the JBAIDS platform.



Laboratory/Developer

MITS JPMO

USAMRIID

Field-deployable Ultra-sensitive Assay System for Biological Toxins

Mission

The objective of this project is to develop a simple and reliable field-deployable assay system for the detection of biotoxins with high specificity and with a level of sensitivity sufficient to detect ≤ 1 attomolar concentrations of biotoxin.



Description

The early and rapid detection of biological toxins is critically important to the protection of military personnel deployed in combat situations. However, current methods for detecting biotoxins are not well suited to the development of highly specific assay systems for detecting biotoxins down to the level of 1 attomolar (10^{-18} M) in combat deployment situations. Investigators have developed assays to detect Cholera toxin B subunit in deionized water, human urine, and farm run-off water. The detection limits achieved with this immunoassay were all well below 1 attomolar. Assays have also been developed for botulinum neurotoxin serotype A and tetanus toxoid using trisialoganglioside GT1b-labeled immunoliposomes. The detection limits of these assays were also well below 1 attomolar. A prototype field-deployable version of the assays has been developed based on the Roche LightCycler®. These efforts have resulted in the development of a simple immunoassay system that is easily field deployable but is also more sensitive than any previous technology for the detection of biological toxins. Efforts are under way to develop a more portable “lab-chip” format for the assay and assays for the detection of human diseases, such as HIV, amyloid disorders (prion disease), and cancer. A patent covering this technology is pending.

Laboratory/Developer

Congressionally Directed Medical Research Programs
Armed Forces Institute of Pathology

Recombinant Ricin Vaccine Candidate

Mission

A ricin vaccine will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

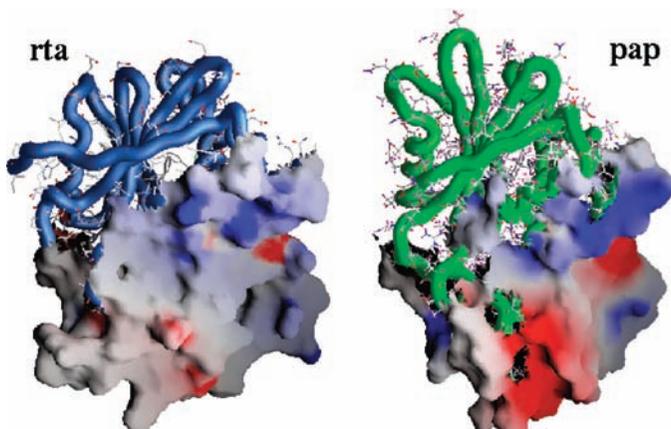
Ricin is a toxin derived from the castor plant, which is grown throughout the world for commercial purposes. Approximately one million pounds of castor beans are used each year in the process of manufacturing castor oil. Given its ready availability and its high level of toxicity—particularly when delivered as an aerosol—ricin is a significant potential agent of BW or terrorism. Currently, there is no vaccine or therapy available for human use.

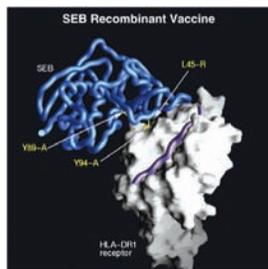
The new vaccine candidate, called RTA 1-33/44-198, is a fragment of the ricin toxin A-chain that has been modified to eliminate the toxic enzymatic property of RTA, increase protein stability, and maintain its ability to elicit a protective immune response. The vaccine fully protected mice from a whole-body aerosol challenge with lethal doses of ricin.

Next steps include testing in nonhuman primates and refinement of a scaled-up production method that is robust and reproducible.

Laboratory/Developer

USAMRIID





Staphylococcal Enterotoxin A/B Multivalent Vaccine Candidate

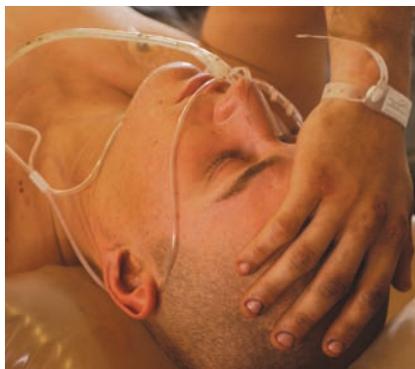
Mission

Recombinant staphylococcal enterotoxin serotypes A and B (SEA/B) multivalent vaccines will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.

Description

Staphylococcus aureus produces a number of toxic proteins, including SEA/B. These are part of a larger group of superantigen toxins capable of directly stimulating a large population of immune cells and inducing an intense inflammatory response that injures host tissues. Symptoms begin approximately 3 to 12 hours after aerosol infection and include flu-like and respiratory signs, which may persist for weeks. Severe exposures can result in acute pulmonary edema and respiratory failure. These toxins are easily manufactured and very stable. There are currently no FDA-licensed vaccines or therapeutics for protection from SEA/B.

The recombinant SEA and SEB vaccine components are expressed in *Escherichia coli*. Preclinical safety, efficacy, and long-term immunity have been demonstrated in rodents and nonhuman primates. Furthermore, scalable manufacturing and purification processes, formulation studies, and lot release criteria have been developed. These accomplishments serve as a basis for considering the SEA/SEB vaccine candidates of sufficient maturity to transition out of the technology base.



Laboratory/Developer

USAMRIID

Transdermal and Intranasal Vaccination Technology for Protection against Biological Threats

Mission

A new method of mass vaccination to prevent infections from biological threat agents will decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.



Description

A collaborative study between USAMRIID and Becton Dickinson Technologies demonstrated that administration of recombinant protective antigen of *B. anthracis* to the skin or nasal mucosa using novel, inexpensive, and disposable medical devices provides a high level of protection against aerosol challenge of rabbits with anthrax-causing spores. These studies were also facilitated by the development of a new recombinant protective antigen powder formulation intended to reduce the requirement for cold storage of the vaccine and to target nasal vaccination.

Pulmonary anthrax is an acute infectious disease caused by inhalation of spores from the bacterium *B. anthracis*. Antibiotic treatment is effective during the early stage of disease but is difficult once the bacteria have reached a more advanced stage, and death often ensues. The current licensed vaccine in the United States is Anthrax Vaccine Adsorbed. A new anthrax vaccine candidate based on a recombinant form of *B. anthracis* protective antigen was developed by USAMRIID. Protective antigen is nontoxic and is the protective component of Anthrax Vaccine Adsorbed. Transdermal and intranasal delivery devices are also being studied for use with vaccines against other BW agents.

DTRA's Joint Science and Technology Office for Chemical and Biological Defense continues to support research directed toward transdermal and intranasal vaccine as part of its Molecular Vaccine Development thrust area, a component of its Pretreatment Capability Area research program.

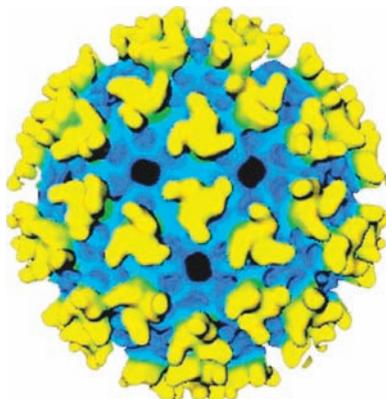
Laboratory/Developer

USAMRIID

Vaccine Constructs for a Combined Equine Encephalitis Vaccine

Mission

A multivalent vaccine that protects against Venezuelan, eastern, and western equine encephalitis (VEE/EEE/WEE) would decrease the threat of a biological attack and enhance strategic mobility of U.S. forces.



Description

In addition to developing a new candidate vaccine for VEE, USAMRIID research is focused on developing safe and efficacious vaccines for EEE and WEE. Like VEE, these viruses are highly infectious and easily transmitted by the aerosol route. Current vaccines for EEE and WEE are available for Investigational New Drug use only and have been found to be relatively ineffective in a significant portion of the recipients. Three approaches are being pursued: naked DNA vaccines; replicon-vectored vaccines; and live, attenuated vaccines derived by genetic engineering.

USAMRIID scientists are also working to confirm cross-protection among various strains of VEE, EEE, and WEE with the ultimate goal of developing a multivalent vaccine that would protect against all three viruses.

Laboratory/Developer

USAMRIID

Vaccine Technologies for Protection against Filovirus Exposure

Mission

Vaccines against the filoviruses Ebola and Marburg would protect military populations at risk of exposure and also decrease the associated hazard to medical and laboratory personnel.



Description

The filoviruses Ebola and Marburg cause hemorrhagic fevers with human case fatality rates up to 80 percent. They are a global health concern and are potential BW agents. Currently, there are no available vaccines or therapies.

USAMRIID scientists have made and patented several potential vaccines against Ebola and Marburg viruses

using different vaccine strategies, including gene based (DNA), replication-defective viral vectors (alphavirus replicons), and virus-like particles using two filovirus proteins. These have all been tested successfully in rodents, and some have demonstrated efficacy in nonhuman primates. In addition, USAMRIID investigators are collaborating with scientists in other government agencies, industry, and academia to test experimental adenovirus-vectored and rhabdovirus-vectored vaccines for Ebola and Marburg viruses. At least one of these candidate vaccines successfully protected nonhuman primates from Ebola virus.

USAMRIID is also investigating the pathogenesis of disease and the acquired immune responses that are necessary to fight Ebola and Marburg virus infections and are vital to developing and licensing vaccines and treatments. Institute scientists have identified protective roles for both cytotoxic T cells and antibodies.

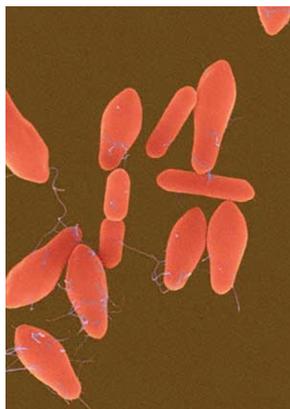
Laboratory/Developer

USAMRIID

Therapeutic Strategies for Botulinum Neurotoxins

Mission

An FDA-licensed treatment for botulinum intoxication will reduce warfighter morbidity and mortality by reducing the toxin burden in the system prior to the onset of severe symptoms.



Description

Botulinum neurotoxins are the most toxic biological substances known. These toxins bind to peripheral cholinergic nerve cells, rendering them inactive and causing neuromuscular paralysis, respiratory failure, and death. Current treatment for botulinum intoxication involves weeks of intensive care.

USAMRIID has worked closely with the University of California, San Francisco, to develop monoclonal antibodies to treat all seven serotypes of botulinum neurotoxin.

These efforts resulted in a combination of three human-compatible monoclonal antibodies that bind to the toxin, rendering it harmless.

NIAID has awarded a contract to XOMA Ltd. and SRI International to produce three human monoclonal antibodies against botulinum neurotoxin A.

Laboratory/Developer

University of California, San Francisco
USAMRIID



Therapeutic Strategies for Treating Filovirus Infection



Mission

Drugs to treat infection with the filoviruses Ebola and Marburg would reduce warfighter morbidity and mortality and also decrease the associated hazard to medical and laboratory personnel.

Description

USAMRIID scientists are identifying viral targets as well as strategies for the treatment of clinical symptoms and are evaluating an extensive array of drugs and antibodies for their potential in therapeutic and prophylactic treatments of filovirus infections. USAMRIID has identified new targets as well as lead compounds and small molecules for further exploration. One drug, recombinant nematode anticoagulant protein c2 (rNAPC2), successfully protected some monkeys from challenge with Ebola virus, apparently by blocking the abnormal blood clotting that is characteristic of Ebola infection.

Monoclonal antibodies to Ebola virus isolated from vaccinated mice by USAMRIID protected mice from challenge when administered as late as 2 days after infection, and other monoclonal antibodies have protected guinea pigs from lethal Marburg virus infection. USAMRIID researchers are collaborating with Arizona State University, Biovation, and The Dow Chemical Company in evaluating these antibodies as potential treatments.

Laboratory/Developer

Arizona Sate University

Biovation

The Dow Chemical
Company

USAMRIID



Therapeutics for Smallpox and Other Orthopoxviruses

Mission

An FDA-licensed treatment for smallpox and other pathogenic orthopoxviruses will reduce warfighter morbidity and mortality and control the spread of disease.

Description

Smallpox was eradicated in 1979 through the efforts of the World Health Organization. Currently, the virus is known to exist only in two World Health Organization-sanctioned repositories. However, there is concern that undisclosed reference stocks may exist, and the U.S. population is no longer routinely immunized against smallpox. Due to the potential for the virus to be used as a BW agent or for bioterrorism, antiviral drugs are urgently needed.

Because smallpox no longer occurs naturally, vaccine and drug candidates cannot be tested for their ability to prevent or treat the disease in humans. Licensing of future medical countermeasures for smallpox will depend on animal studies. The FDA has established an Animal Efficacy Rule to facilitate the approval of vaccines and drugs for biological agents in cases where efficacy data in humans cannot be obtained.

Cidofovir, sold under the trade name Vistide™, is approved by the FDA for the treatment of cytomegalovirus retinitis in AIDS patients. Research at USAMRIID supported by the DTRA Joint Science and Technology Office and NIAID has established that intravenous cidofovir, which inhibits the viral DNA polymerase, is able to stop the replication of smallpox and other pathogenic orthopoxviruses and disease progression in primate models. Additional studies are aimed at the development of an oral formulation that can be more readily administered.

Laboratory/Developer

U.S. Department of Health and Human
Services/NIAID
USAMRIID





Advanced Technologies and IM/IT

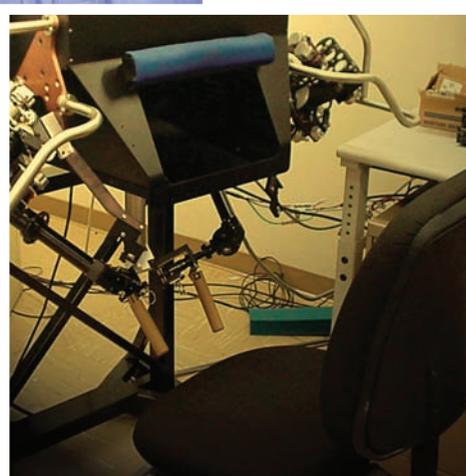


Overview

Advanced Medical Technologies

The U.S. Army Medical Research and Materiel Command's (USAMRMC's) Telemedicine and Advanced Technology Research Center (TATRC) manages congressionally mandated advanced technology projects including identification, exploration, and demonstration of key technologies that will reduce the medical "footprint" and increase medical mobility while ensuring warfighters have access to essential medical expertise and support wherever they deploy. Through partnerships with industry and academia, resulting products help make medical care and services more accessible to warfighters, reduce costs, and enhance the overall quality of health care in wartime and peacetime. Current projects focus on:





- ◆ Advanced prosthetics, orthotics, and other orthopedic assistive devices, treatments, and interventions for patients with major limb amputations, fractures, and other orthopedic-related injuries
- ◆ Chronic disease management that highlights the use of telemedicine, home care monitoring, evolving biosensor development, and advanced immunologic testing in vulnerable populations
- ◆ Computational biology or bioinformatics, which involves the development and application of methods for analysis, interpretation, prediction, and modeling of biological data

- ◆ Health information technologies
- ◆ Advanced medical-imaging technologies, which is divided into four distinct research areas: portable imaging and image-guided therapeutics, advanced high-performance imaging, computational methods and decision support in imaging, and optical/para-optical imaging techniques
- ◆ Medical logistics of state-of-the-art prototype devices
- ◆ Robotic technologies to locate, identify, assess, treat, and rescue battlefield casualties
- ◆ Mobile computing and remote monitoring that focus on identifying and developing point-of-care medical technologies and support architectures to improve military health care
- ◆ Nanotechnology and biomaterials to improve drugs and devices for diagnosis and therapy
- ◆ Neuroscience projects that leverage the latest technologies in prevention, diagnosis, treatment, and therapy to prevent injury or improve warfighter outcomes from traumatic brain, spinal cord, and peripheral nerve injury as well as the neuropsychologic effects of war
- ◆ Regenerative medicine, created in response to the current military medical needs to treat traumatically injured tissues resulting from combat or battlefield wounds





Information Management/Information Technology

The U.S. Army Medical Information Technology Center (USAMITC) is the U.S. Army Medical Department's Information Management/Information Technology (IM/IT) materiel developer and IT service provider. The USAMITC provides IM/IT products and services to support the U.S. Army Medical Department, the Military Health System, the Department of Defense (DoD), and other government customers.

As the operational arm for the U.S. Army Surgeon General in executing corporate IM/IT strategy and managing corporate IM/IT infrastructure, the USAMITC:

- ◆ Provides the infrastructure for a single Army medical network operating environment that enables corporate information sharing and centralized management
- ◆ Designs, develops, deploys, and sustains IM/IT systems, including integrating military health systems, such as the Armed Forces Health Longitudinal Technology Application (AHLTA) (the DoD's electronic health record), into Army health care facilities
- ◆ Provides IM/IT operations and support to include network security, electronic messaging services, help desk services, videoconferencing services and support, information assurance, and data center operations

Case Studies

Battlefield Medical Information System-Tactical

Challenge

In the field, combat medics once tracked all patient information, medical supplies, and reference data on paper. The Battlefield Medical Information System-Tactical (BMIST) was born out of the frustration of a combat medic who experienced the need for a more efficient way to collect health data on the battlefield. During the early 1990s, the Army Medical Command was expanding its use of telemedicine and exploring new ways to use technology in health care, both on and off the battlefield. Early technology development was focused on the Personal Information Carrier, which eventually became a key component of the BMIST.

The BMIST is a handheld, point-of-care diagnostic tool that allows health-care providers to record, retrieve, and transmit the essential elements of clinical encounters. It generates an electronic health record at the point of care. It is a multiplatform software system that allows for the collection of medical data, the standardization of that data, and it functions as a medic's handheld repository of clinical information and medical references. It functions both as a tool for the individual medic or as part of an integrated server-dependent health care system.

Contribution

Development of the BMIST actually started in 1999 with the concept work and background research on how to best meet the need. It was developed in-house at TATRC. Funding was not received directly from the military as there were competing projects, not specifically like the BMIST, but with similar components. The inventor, Tommy Morris, submitted a proposal for congressional funding to the National Medical Technology Testbed in 2001 requesting \$325,000. He built the first prototype in July 2001 and received \$225,000 in funding in October 2001. The Defense Health Program contributed an additional \$20,000 in 2002, bringing the total research and development investment up to \$245,000.



The Battlefield Medical Information System Tactical-Joint (BMIST-J) transitioned as a program of record in 2003 under the Theater Medical Information Program and was also picked up as an Army MC4 (Medical Communications for Combat Casualty Care) program of record. As the program of record, TATRC receives funding for maintenance sustainment and upgrades. In fiscal year 2005, \$580,000 was received, in fiscal year 2006 \$580,000 was received, and \$1.4 million was projected in fiscal year 2007 to develop AHLTA-Mobile on a tablet and continue maintenance, sustainment, and upgrades.

Morris is the inventor/patent holder of the BMIST application and has U.S. and international patents pending. He has assigned use rights to the DoD and is currently the program manager for the BMIST-J (AHLTA) program of record.

The technology transfer lead for BMIST is Dr. Paul Mele of the USAMRMC's Office of Research and Technology Applications in collaboration with Sean Patten, Techlink. The product has been licensed to the United Kingdom and a number of U.S. companies.

Benefit

The BMIST arose as a technical solution to a problem: The requirement for electronic medical records during deployment. Although it does not solve the larger problem with electronic health records, it has become part of the overarching solution. This product was developed to provide a step forward in realizing the enterprise solution currently under development. The BMIST will be compatible with the U.S. Department of Veterans Affairs' (VA's) computerized patient record system so that it will be possible for medical data to follow patients from DoD care into VA care with no lapses in information.

Case Study

Digital X-rays

Challenge

Digital technology has become a standard of care in the health care industry, and the military is also embracing that trend. The Digital Imaging Network-Picture Archiving and Communication System (DIN-PACS) has evolved from a less known technology to the integral backbone of many Army and civilian hospitals. DIN-PACS is the military's solution for creating a virtual radiology environment with a global network system comprised of digital devices to acquire, transmit, display, and manage diagnostic images. For each medical facility, DIN-PACS eliminates imaging film to allow simultaneous real-time access to images by radiologists and clinicians at any time and any place within the facility and beyond. The Army PACS Program Management Office was established at Fort Detrick in 2001.

Contribution

The DoD awarded the DIN-PACS contract worth a total value of \$225 million for a 5-year period (\$45 million a year). The review process was a stringent three-part process with a request for proposal, a systematic clarification process, and a requirement for providing detailed technical updates. There were several companies awarded the multivendor contract, which essentially became approved suppliers of advanced medical imaging and information systems to federal government agencies.

DIN-PACS and digital radiology technology allow the Army Medical Department (AMEDD) several advantages previously tied to nondigital technologies. The use of film and chemical processing is no longer needed, lost or misplaced films are no longer an issue, and most importantly, access to medical images is a much more efficient process. The system is composed of several components: Reusable phosphorous plates (in various sizes), a computerized radiography scanner that uses a laser to pull images from the plates then wipes the plates clean for future use, and a workstation to view the captured image. The information data transport works much like a wide area network, digital subscriber line, or cable modem allowing a technician to send images to an off-site radiologist for diagnostic reading as well as to an intermediate archive for storage and retrieval.

Benefit

DIN-PACS provides much more flexibility in health care by allowing users the ability to view images at the same time at workstations around a hospital or around the world. The system offers time savings—conventional film takes 5 to 7 minutes to process, a DIN-PACS image is available in 30 seconds. These benefits are not only provided to a service member but also to the family of a service member as well. The AMEDD has become a national leader in using digital technology to bring advanced health care delivery to Army medical treatment facilities.



Digital Imaging Network-Picture Archiving and Communications System

Mission

The Digital Imaging Network-Picture Archiving and Communications System (DIN-PACS) provides service members and their families with faster and better images to enhance quality of care.

Description

DIN-PACS is made up of several components, including reusable phosphorus plates that work with a normal x-ray machine, a computerized radiography scanner, and a workstation to view captured images. Images can be lightened or darkened, leveled to find the best quality, sent off-site to a radiologist for diagnostic reading, and archived immediately. DIN-PACS was completed in 1991.

Laboratory/Developer

Army PACS Program Management Office



Teleconsultation/ Teledermatology

Mission

Facilitates readiness and promotes health protection of the force.

Description

Teleconsultation/teledermatology facilitates delivery of medical treatment through information and telecommunication technologies and was completed in 2001.

Laboratory/Developer

TATRC

Web-Enabled Refractive Surgery Information System

Mission

Collection and management of refractive surgery information will protect patients, improve care, and reduce costs by providing an electronic medical record that is accessible at any facility a patient visits.

Description

The Warfighter Refractive Eye Surgery Program (WRESP) provides service members with refractive eye surgery to increase their mobility in combat.

WRESP was initiated to support service members as well as track the long-term effects and benefits of refractive surgery. It was developed and adopted in cooperation with the ophthalmology consultant for the Surgeon General.

The Web-Enabled Refractive Surgery Information System (WebRSIS) was developed to capture refractive surgery clinical data and to conduct outcome analysis. This program was developed by doctors for doctors to meet the business needs and clinical environment found at regional medical centers.

Current technology provides audit trails, provider tracking, digital signatures, and privilege management; data consolidation, real-time and historical reporting, and a questionnaire; pre-operative exam, treatment plan, operation notes, and post-operative exam; and a deployment questionnaire.

To date, about 4,100 patients have been entered into the existing RSIS program with more than 3,900 patients entered into the new WebRSIS. Next year, about 12,000 new records are anticipated. These numbers will be used in the Standard Refractive-Surgery Data Report, which automatically summarizes outcomes from multiple surgeries. The Standard Refractive-Surgery Data Report benefits the patient, surgeon, and the Military Health System (MHS) by reporting the data in a concise and meaningful way.

Laboratory/Developer

TATRC

Armed Forces Health Longitudinal Technology Application Deployment

Mission

USAMITC helps facilitate the integration of AHLTA, the DoD's electronic medical record, into Army health care facilities to optimize the benefits of this tool and improve patient care and business practices.

Description

AHLTA will enable authorized users at any DoD health care facility secure, electronic, and immediate access to medical and dental records for 9.2 million DoD beneficiaries. This comprehensive health record includes data on preventive care, illnesses, injuries, and exposures treated at any medical treatment facility. AHLTA is designed to create the patient record as part of the process of providing care during treatment, thus reducing duplicative tasks such as documentation, order entry, and consults. When complete, it will provide detailed in- and outpatient records with appointment, order entry, and consult capabilities; easy navigation; worldwide access to all medical data; integrated clinical practice guidelines; population health capabilities (at the provider, clinic, medical treatment facility, and corporate levels); preventive medicine capabilities, such as patient-specific health reminders and alerts; automated coding; and patient safety information. The development of AHLTA is ongoing. Outpatient deployment was completed at all U.S. Army Medical Command (MEDCOM) facilities, dental and Spectacle Request Transmission System II are being deployed, and inpatient is being developed.

Laboratory/Developer

USAMITC



GLOBAL INFORMATION
for **QUALITY CARE**



Digital Information and Communications System

Mission

The Digital Information and Communications System (SMART/MC3T) enables service members to establish communications (e.g., self-sufficient Internet and telephone coverage) in remote areas and provides local authorities with medical situational awareness and telemedicine services.

Description

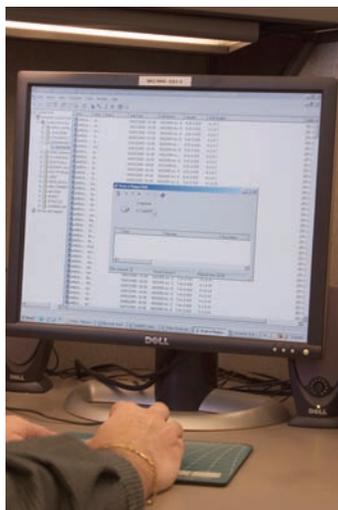
SMART/MC3T implements commercially available technologies through a modular solution that is heterogenous, multiplatform, open standards based, and upward compatible in both capacity and technology. The system was completed in 2003.

Laboratory/Developer

TATRC



Information Assurance Vulnerability Management



Mission

The DoD faces the ongoing challenge of securing its networks and computer systems from external threats such as viruses and hackers. USAMITC is responsible for facilitating the management of these risks and vulnerabilities for the MEDCOM through Information Assurance Vulnerability Management (IAVM).

Description

Through this process, the USAMITC Information Assurance office ensures that computers, applications, and networks run unabated. Vulnerability management includes notifying system administrators, Information Assurance security officers, and all appropriate staff of vulnerabilities. In addition, the office informs the responsible parties to access the Army Asset and Vulnerability Tracking Resource to acknowledge the receipt of the notification and report the number of systems affected.

IAVM also ensures that administrators assess the impact of a vulnerability, apply the corrective system patch or required fix or submit a Plan of Action and Milestones if corrective actions cannot be implemented within the specified time frame, and report the status for each vulnerability notice as it applies to every applicable asset within its area of responsibility.

The USAMITC Information Assurance office provides weekly updates to the MEDCOM. IAVM is ongoing.

Laboratory/Developer

USAMITC

Medical Network Operations and Security Center

Mission

The USAMITC Medical Network Operations and Security Center (MEDNOSC) executes critical network operations, defense, and information assurance duties for Army military treatment facilities (MTFs), clinics, medical directors of information management, and research facilities.

Description

The USAMITC MEDNOSC performs integrated ongoing operations with related agencies (Army and Tri-Service) to maintain and defend the Army MEDCOM's enterprise network. Network security support and incident response are provided 24/7. Technical support includes firewall audits; wireless surveys, design, and installation; configuration guidance; and network engineering support. MEDNOSC centrally manages and monitors the AMEDD's virtual private network and the applications that enable secure messaging across 44 facilities worldwide and allow MTFs to conduct business with approved third-party/business partners securely. Services provided by the USAMITC MEDNOSC are ongoing.

Laboratory/Developer

USAMITC



Network Operating System/Electronic Messaging

Mission

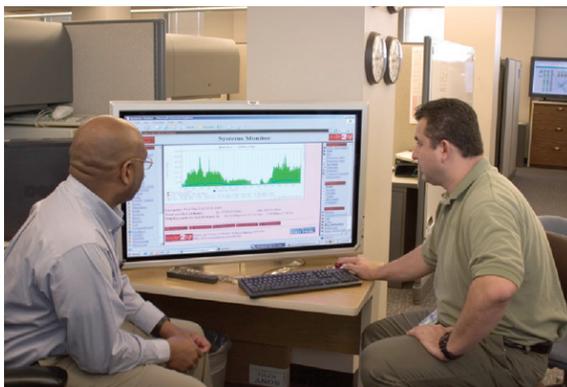
Network Operating System/Electronic Messaging (NOS/EM) provides the AMEDD with a secure, reliable, and predictable network operating system and electronic messaging environment using Windows 2003 with Active Directory and Exchange 2003.

Description

The Active Directory Architecture consolidates directory services into three centrally managed domains with decentralized administration, providing local system administrators the ability to effectively manage and monitor their environment. Electronic messaging services have been consolidated into six regionalized messaging centers located around the world. The support, monitoring, and management of the message centers are accomplished remotely by USAMITC. Today's messaging environment processes approximately 2.5 million messages per day while providing multilevel anti-virus and antispam protection to AMEDD users. NOS/EM is ongoing.

Laboratory/Developer

USAMITC





Pre/Post-Deployment Health Assessment – Automated

Mission

Pre/Post-Deployment Health Assessment (P/PDHA) – Automated ensures that health problems emerging during deployment are properly documented and addressed by electronically capturing and storing health information of military personnel before, during, and after major deployments.

Description

The automated P/PDHA supplies health providers with better and more targeted patient information; reduces the former 6–8 month, paper-based method of patient information transmission to only 48 hours; and reduces form errors and inconsistencies, lost records and delays, shipping costs, and process duplication. In addition, it incorporates five modes of operation (wireless, Internet, Intranet, stand-alone, and medical personal digital assistant [PDA]) with a secure log in and password protection. It can be run on PDAs, tablets, desktops, and laptops. P/PDHA–Automated is ongoing.

Laboratory/Developer

USAMITC





Surgery Scheduling System

Mission

The Surgery Scheduling System (S3) is a web-based system that improves overall operating room utilization efficiency for military hospitals.

Description

S3 is a web-based operating room scheduling tool that manages surgical cases from beginning to end, is easy to learn and use, implements security access at various levels, and lends itself easily to expandability. S3 is common access card enabled and permits access from any location within a hospital. It allows for the scheduling of anesthesia and nursing staff, storage of default values for procedures, retrieval of Composite Health Care System patient demographic data, audit tracking, metrics reporting, use of preference cards, use of ICD-9 and current procedural terminology codes, and more. S3 is an interim solution now used by 24 Army and 6 Navy medical facilities until the Enterprise-Wide Scheduling-Registration system is fielded. The Navy's Bureau of Medicine and Surgery announced that its IT Management Control Board selected S3 as the program of choice for the operating room management of surgical case scheduling for all Navy hospitals. USAMITC is preparing to deploy it Navy wide. S3 is an ongoing system, and deployments are by request.



Laboratory/Developer

USAMITC

Theater Enterprise-Wide Logistics System

Mission

The Theater Enterprise-Wide Logistics System (TEWLS) transforms current acquisition and procurement processes from the long-term prepositioning of medical material to the industry best practices model of just-in-time delivery of unique medical equipment sets.

Description

TEWLS will replace the Theater Army Medical Management Information System (TAMMIS). It also will support critical medical logistics and service member requirements in a net-centric environment by managing the entire medical supply chain from the industrial base to the end user. It ties national, regional, and deployed units into a single business environment and creates the necessary links for planners, commercial partners, and AMEDD logisticians to accomplish essential care in the theater through a single customer interface. TEWLS is ongoing.

Laboratory/Developer

USAMITC



USAMITC Data Center

Mission

USAMITC operates and sustains a secure and centrally managed data center for the AMEDD and MHS systems.

Description

The USAMITC Data Center provides technical support to the AMEDD and MHS systems. The Data Center's state-of-the-art storage and network infrastructure has robust data management and storage capabilities. A physically secure, environmentally monitored data environment enables the AMEDD to operate its business and systems with assurance. Developmental test and evaluation staff ensure that new technologies and applications are tested in a simulated environment for the AMEDD's future growth. New technology upgrades are being implemented. Architectural improvements of redundant network paths and centralized fiber channel data storage give the Data Center the capability to meet customer requirements for uptime, bandwidth, scalability, and fast data access. The new configuration implements multiple redundancies, extreme scalability, and simpler management procedures; eliminates any single point of failure; and reduces resources required to back up each application. Services provided by the USAMITC Data Center are ongoing.

Laboratory/Developer

USAMITC



USAMITC Video Network Center

Mission

The USAMITC Video Network Center (VNC) provides videoconferencing support to the DoD.

Description

The USAMITC VNC provides more than 1,500 customer sites from various DoD and civilian communities worldwide with more than 5,800 hours of videoconferencing support each month. This includes live monitoring of videoconferences to ensure audiovisual technical quality. The center provides more than 7,000 hours of audio conference support each month. In addition, the center assists with the design and installation of videoconferencing facilities for customers. The center maintains 12 general officer and command conference rooms. The center enables real-time medical consulting capabilities, distance learning, collaboration among medical facilities, and communications with the field. This increases communication throughout medical agencies worldwide, decreasing the need for travel and saving costs. Services provided by the USAMITC VNC are ongoing.

Laboratory/Developer

USAMITC



Advanced Surgical Technologies

Mission

Advanced Surgical Technologies (AST) will use progressive advanced technologies in communication and patient care to improve the efficiency and safety of military and civilian operating rooms.

Description

The operating room is a highly complex environment of startling isolation in real time. Staff teamwork is fragmented and requires an inordinate amount of voice communication resulting in negative unplanned events occurring frequently and in clusters. In addition, valuable time is wasted; quality indicators, including patient safety, are assessed only in retrospect, and too much energy is expended on making the operating room function instead of directing patient care.

AST will integrate existing pockets of research through collaboration to implement advanced medical technologies in both the federal and civilian health care systems and stimulate new research and development focused specifically within the following topical research areas: Patient safety, advanced devices, medical informatics, telesurgery, and perioperative systems design.

Laboratory/Developer

TATRC





AHLTA-Mobile

Mission

On the battlefield, it is crucial for first responders to have current medical information at the point of care. AHLTA-Mobile is a diagnostic tool that provides useful medical informatics and telemedicine support across the spectrum of the military health care operations and continuum of support levels of care.

Description

AHLTA-Mobile, a wireless handheld device that is used throughout the DoD to capture electronic health records for more than 9 million U.S. service members, retirees, and their families, enables first responders and other health care staff to quickly and accurately capture, integrate, transmit, and display data from medical histories and physical examinations, medical reference libraries, diagnostic and treatment decision aids, medical sustainment training, and medical mission planning. The PDA can be used by military health care providers at all levels of care from the foxhole to the medical center. AHLTA-Mobile, also called BMIST-J, supports a user interface that includes help windows and decision rationale. The system is easily adaptable to evolving medical procedures and protocols in addition to new medical databases and mission requirements. Under adequate conditions, AHLTA-Mobile is capable of supporting real-time “teleconsultation” between the first responder and expert medical staff in different locations. AHLTA-Mobile was named as one of the Army’s 10 Greatest Inventions for 2003 and 2004.

Laboratory/Developer

TATRC



Center for Military Biomaterials Research

Mission

The Center for Military Biomaterials Research (CeMBR), located at Rutgers University in Piscataway, New Jersey, will become the military's scientific resource in the field of biomaterials science and engineering. CeMBR will facilitate the research and development of new biomaterials technologies and improve the control of cell-material interactions with applications for improving both preventive and combat casualty care.

Description

CeMBR was specifically designed to address the shortcomings and needs of the military as outlined in a 2001 Board on Army Science and Technology Report, "Opportunities in Biotechnology for Future Army Applications." CeMBR has implemented a roadmap process in which the military's requirements for new biomaterials are delineated and targeted. Specifically, the center will address the process by which the military incorporates biotechnology developments and specific applications of biomaterials for improving both preventive and combat casualty care.

CeMBR will create a unique industrial-academic-government network with a core faculty and a panel of nationally renowned scientific advisors for project selection and outcomes evaluation. The major focus of the center is to help the military negotiate an environment of rapidly changing science and assist in the translation of science from the bench to the field and bedside using the most efficient technology translation mechanisms available. Some of the scientific investigations supported at the center include sprayable wound dressings, scaffolds for bone regeneration, a model for a human skin equivalent, and stem cell technologies for tissue regeneration. New technologies are added to the center's portfolio of projects as determined by a scientific advisory panel.

Laboratory/Developer

TATRC

High Altitude Platforms Mobile Robotic Telesurgery

Mission

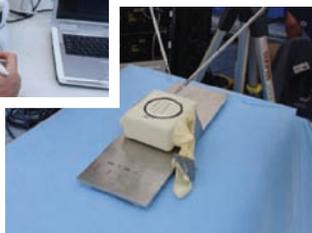
The use of an unmanned aerial vehicle (UAV) containing communication platforms has the capability to address communication deficiencies for successful telesurgery.

Description

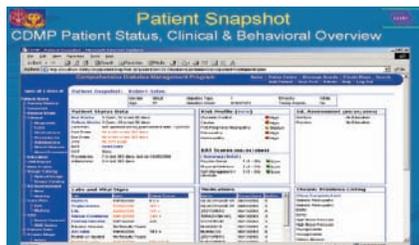
A surgeon from the University of Cincinnati operated the telerobotic surgical arm from the University of Washington by manipulating the master unit several miles from the simulated patient. Communication signals were provided to and from a master unit and a surgical arm by the PUMA Programmable Universal Manipulation Arm UAV on a wireless 802.11g system. The PUMA was also employed to establish a link between Simi Valley, California, and Seattle, Washington. This research demonstrated the potential of using UAVs for scalable wireless communication with reduced latency. Additional research is planned.

Laboratory/Developer

TATRC



Joslin Comprehensive Diabetes Management Project



Mission

Providing state-of-the-art diabetes and endocrine medical care within a team setting, Joslin uses a telemedicine system for comprehensive diabetes management and the assessment of diabetic retinopathy

that provides increased access for diabetic patients to appropriate care, centralizes patients in the care process, empowers patients to better manage their disease, can be performed in a cost-effective manner, and maintains the high standard of care required for the appropriate management of diabetic patients.

Description

The Comprehensive Diabetes Management Project (CDMP) is a web-based diabetes health care delivery system that provides connected care for patients and providers based on clinical guideline decision support and alerting. It was developed to provide an optimal design for needed comprehensive care. This is a patient-entered, care manager-driven, customizable program that interacts with the electronic medical record and other diverse clinical data sources, such as laboratory systems, to aggregate data and present them in a medically appropriate manner to increase the efficiency of the physician-patient encounter. The system is built on available technologies and tools, uses open source tools when appropriate, and has a Health Insurance Portability and Accountability Act-compliant, secure Internet patient portal component for patients to access their results, participate in educational modules, and observe trends in their own illnesses. In addition, the system facilitates more continuous communication between patients and their care teams. This diabetes-specific patient information system stratifies patients into risk categories that include systemic and comorbid risks as well as behavioral risks, tracks outcomes, and stimulates physicians to improve care.

Laboratory/Developer

TATRC



Medical Surveillance Network

Mission

The Medical Surveillance Network will facilitate data exchange and support all levels of care with an integrated joint medical information system, thereby linking system communications and promoting situational awareness.

Description

The Medical Communications for Combat Casualty Care (MC4)/Theater Medical Information Program (TMIP) is a defense medical surveillance system. The MC4/TMIP conducts medical trend analyses based on data from multiple sources (i.e., environmental survey data; nuclear, biological, and chemical data; patient encounter data; and medical sensor data). This system links to worldwide surveillance resources to include the command and control system for warfighter situational understanding updates.



Laboratory/Developer

MC4
TATRC
TMIP



Nanofabricated Bioartificial Kidney

Mission

Many combat casualties result in substantial blood loss and shock, along with traumatic organ injury. When service members with such injuries are successfully resuscitated and transported to MTFs, acute renal failure can develop secondary to shock and

traumatic injury. In Operation Iraqi Freedom, in-hospital mortality from acute renal failure approaches 40 percent.

Description

Advances in the treatment of renal failure will involve the tissue engineering of kidney nephronal units. For this technology to be generally applicable, devices must be compact, inexpensive, and self-monitoring. The advent of microelectromechanical systems technology has produced practical surface and bulk micromachining techniques with the ability to manufacture mechanical devices (pores, valves, gears, etc.) with feature sizes on the same order of magnitude as subcellular organelles, in combination with on-chip electronics and sensors. This combination allows the development of microelectromechanical devices that can be engineered to interact intelligently with their environment.

The current project will result in the development of a bioartificial kidney consisting of synthetic membranes and living cells that can be deployed quickly to the bedside of a wounded service member to treat acute renal failure and improve the unacceptably high mortality rates associated with it.

Laboratory/Developer

Innovative BioTherapies, Inc.

University of Michigan

Cleveland Clinic Foundation

TATRC

OASIS

Mission

OASIS provides an IM/IT environment for the developmental test and evaluation of patient health care hardware and software architectures, thus replicating the flow of information from levels I–IV. The platform also serves to integrate emerging and innovative technologies that have yet to interface with MC4 equipment to ensure interoperability.



Description

OASIS, formerly known as the Forward Deployable Digital Medical Treatment Facility, was developed as a research, development, and testing platform. It provides a rapidly deployable MTF used for showcasing, evaluating, and training advanced medical technologies and information systems developed through collaborations with government, industry, and academia. OASIS also emphasizes modular configurations comprised of lightweight and rugged equipment packages engineered to reduce weight, cube, and airframe requirements while providing essential care in theater and reach-back capabilities from any deployed location. Successful products that have transitioned through this platform include the BMIST-J and the Alaska Structure shelter system.

Follow-on actions include the integration of medical programs of record into the architecture, such as the Joint Medical Workstation, Theater Medical Database System, and the Joint Patient Tracking System, and the formulation of a Joint Developmental Test plan along with the associated program offices and service representatives outlining the acceleration of the test, evaluation, and acquisition of emerging technologies. To determine form, fit, and functionality, OASIS may be deployed in support of the Army Medical Department Board and its operational test and evaluation functions, the Stryker Brigade National Training Center rotations, the Uniformed Services University of the Health Sciences, Bushmaster field training exercise, or to support the Regional Training Site-Medical.

Laboratory/Developer

TATRC

Periscopic Spine: Georgetown University

Mission

Georgetown University's Periscopic Spine project is aimed at improving the state of the art of image-guided and minimally invasive spine procedures by developing new clinical techniques along with the computer-based hardware and software needed for their use.

Description

The focus of the project is the development of new techniques for precision minimally invasive procedures. While techniques for the spine will continue to be investigated, the focus has broadened into other anatomical regimes, in particular thoraco-abdominal procedures. On the scientific side, the characterization of respiratory motion and compensation for this motion has become one of the focal points of the work, including the use of electromagnetic tracking for this purpose. New initiatives in precision radiosurgery have been developed with Radiation Medicine, and there are two new collaborations, one with the University of Maryland in exoskeleton robotics and another with the Department of Physics at Georgetown University in nanotechnology. A new phase of the project, to develop an integrated interventional suite of the 21st century based on rotational angiography and electromagnetic tracking, is anticipated.

Laboratory/Developer

TATRC



Wear-and-Forget Physiological Sensing System for Combat Casualty Care

Mission

The objective of the program is a wearable physiological sensor platform that is comfortable enough to ensure the compliance of a service member while producing and reporting highly reliable vital sign data, including heart rate, respiration rate, and skin temperature, as well as the wearer's activity level and body posture.

Description

Physiological monitoring of individual warfighters would provide the Army with an unprecedented capability to assess the health state of warfighters and rapidly identify and respond to critical cases. A uniquely qualified team of Foster-Miller and Malden Mills Industries, in continuing collaboration with USAMRMC and TATRC, proposes to apply electronic textile technologies to develop robust and reliable wear-and-forget physiological sensing platforms. These intelligent textile technologies would allow sensing systems to be manufactured as minimally constrictive garments. Furthermore, these systems must tolerate physical activity, minimize motion artifacts, and generate clinical quality data.

The ultimate objective of the program is a wearable physiological sensor platform that is comfortable enough to ensure the compliance of a service member while producing and reporting highly reliable vital sign data, including heart rate, respiration rate, and skin temperature, as well as the wearer's activity level and body posture. This data will then be tied to algorithms that generate valuable information about the health status of a warfighter to either a medic or a commander. A medic would use this information to assess and triage an injured person. Such information could allow for immediate notification of an injury or warn a medic not to risk his or her own life because the person is already dead. A commander who has knowledge about the physical state of multiple warfighters or squads could choose those most fit for a mission.

Laboratory/Developer

TATRC/Research Area Directorate II
Foster-Miller
Malden Mills

Wireless Electronic Information Carrier/Personal Information Carrier



Mission

The Electronic Information Carrier (EIC) is integral to “patient-centered” medical data flow on the battlefield. It is intended for issue to each service member prior to deployment and is pre-loaded with each individual’s medical history, master problem list, immunizations, etc.

It will then serve as a personal medical data storage device for any care provided to the patient from point of injury to CONUS-based medical centers and beyond.

Description

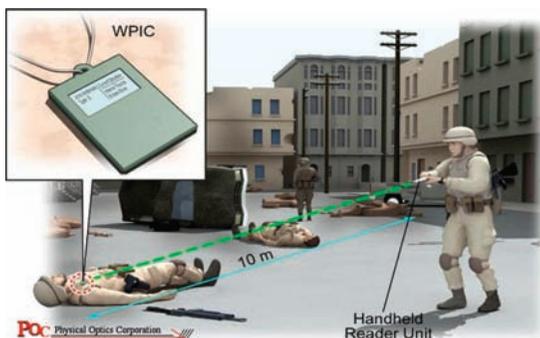
The EIC is a wireless data storage device the size of a dogtag that is capable of storing up to 4 gigabytes of data; however, the real power of the EIC is its ability to securely and wirelessly read and write data within a range of 10 meters of a medical device such as the BMIST and the Composite Health Care System II-T. It also has a universal physical interface that ensures compatibility with any commercial or government off-the-shelf IT products and can be used when wireless communications are not available.

The Personal Information Carrier (PIC) is an earlier nonwireless version with storage capacities up to 1 GB. Like the EIC, it is a rugged, low-power consumption, flash memory device that is hardware and operating system independent.

The EIC allows individual medical data to be accessed and updated by medical personnel when real-time connectivity to a database is unavailable. The EIC was chosen as one of the Army’s 10 Greatest Inventions for 2004.

Laboratory/ Developer

TATRC



Common Development Environment Initiative

Mission

The Common Development Environment (CDE) Initiative will organize and facilitate local and regional innovations in health informatics and technology, as well as steer the IM/IT research agenda toward the rapid enhancement of the Enterprise-Wide Electronic Health Record solution, AHLTA.

Description

Promising health information technologies are being developed in military research settings and at local MTFs across the Military Health System. However, these efforts are not well coordinated and yield few benefits to mainstream military health information systems. The lack of an agile process or methodology for the coordinated development, testing, and hand off of health IT products to the enterprise has resulted in a failure to capitalize on emerging technology innovations and financial investments in IM/IT.

The CDE Initiative seeks to align IM/IT research and prototyping activities with mainstream IM/IT acquisition strategies and business processes to improve the quality and availability of candidate solutions for AHLTA. To achieve this goal, the CDE Initiative will design and test a management model that coordinates research and business practice, sets standards and guidelines, and offers a representative AHLTA development environment for government, academia, and industry partners to use when designing, developing, or testing IM/IT solutions.

Laboratory/ Developer

TATRC



MEDCOM Enterprise Wireless

Mission

USAMITC is partnering with the Tri-Service Infrastructure Management Program Office to deploy a secure wireless local area network at 11 MTFs in fiscal year 2007. USAMITC provides electronic equipment surveys and installations while the Tri-Service Infrastructure Management Program Office provides cabling surveys, cable installations, and access point installations.



Description

This project was initiated in fiscal year 2006 with USAMITC's installation of a wireless local area network at three MTFs to optimize the use of wireless technology applications for broad point-of-care support for medical treatment. The successful implementation identified the following benefits to the AMEDD:

- ◆ Enables secure wireless applications to enhance productivity and improve patient care
- ◆ Extends local area network accessibility
- ◆ Reduces infrastructure cost
- ◆ Provides a turnkey package to the local information management officer



The architecture comprises Foundry and Nortel wireless infrastructure equipment, Air Fortress (security controller, system management software, policy server software, and secure client software) for layer 2 data encryption, Credant Mobile Guardian Enterprise Edition Server and Shield client software for policy settings, and Symantec Client Firewall. The architecture is in compliance with the IEEE 802.11a/b/g standard, Army information assurance, Health Insurance Portability and Accountability Act, and wireless best business practice standards.

Laboratory/Developer

USAMITC

New Clinical Data Mart Prototype and Research Data Cube Initiatives

Mission

The New Clinical Data Mart (CDM) Prototype and Research Data Cube will exploit cutting-edge data warehousing technologies to support improved clinical decision making, impacting the lives of 9.2 million military beneficiaries.

Description

New CDM Prototype: This is a new data-warehousing model that will receive feeds from the AHLTA Clinical Data Repository. The Clinical Data Repository contains detailed clinical encounter information that can be used to improve clinical decision making. Execution is through a Cooperative Research and Development Agreement (CRADA) that requires TATRC to collect metrics on the performance of the prototype and compare it to the existing CDM. The prototype will be designed to support queries by up to 50,000 users.

Research Data Cube: This project will build a set of de-identified clinical encounters and other data that can be used to support Small Business Innovative Research and congressional initiatives aimed at improving access to care, health care delivery, and population health. The ultimate concept is to provide Health Insurance Portability and Accountability Act-compliant, public use files containing large, longitudinal patient data sets to support random clinical trials and observational data studies. The data can also support a variety of specialized studies, such as post-marketing surveillance of the safety of drugs or cohort studies involving chronic disease conditions. The Research Data Cube will also support true data mining to discover relationships in clinical data through pattern recognition and clustering techniques. These techniques can help researchers and health care personnel better understand the disease causation process and can influence patient interventions.

Laboratory/Developer

CDM: Microsoft Corporation; Hewlett Packard, Inc.; Intel, Inc.; and Solid Quality Learning, Inc.

Research Data Cube: Will leverage past work of KBSI, Inc.; Windber Research Institute; Emerging Health, Inc.; Montefiore Medical Center; and Lincoln Technologies. May be supported by a new CRADA with Oracle.

Digital Emergency Medical Services

Mission

Telementoring and telemedicine capabilities will allow earlier interventions in recording patient data and give medics access to medical information.



Description

The digital emergency medical services (EMS) system, a component of the Disaster Relief and Emergency Medical Services project, integrates diagnostic medical equipment, medical informatics software systems, and communications systems. The digital EMS system provides a common user interface, integrated medical equipment, and remote video cameras. A unique and vital aspect is the system's capability to provide real-time patient information, such as vital signs, to a remote physician and, in turn, communicate instructions back to personnel onsite. This also allows medics to refer to treatment protocols or refresher training for any situation.

Laboratory/Developer

TATRC



Robotic Medic Assistant, Patient Evacuator

Mission

The Robotic Medic Assistant is to be used by combat medics and warfighter-buddy first responders to assist in combat casualty location, assessment, treatment, extraction, and evacuation.

Description

This robotic device can be used in urban terrain and in hazardous or contaminated environments. The device supports Future Combat Systems concepts of mobility, agility, survivability, and sustainment. A vehicle crew can recover a casualty, either manually or mechanically, without the need to dismount and without driving to the casualty.

This robotic patient recovery technology performs multiple missions in hazardous areas, thereby reducing risk to first responders. The greatest benefit of this technology is that it allows providers to focus on patients.

Laboratory/Developer

TATRC



Speech-Capable Personal Digital Assistant

Mission

The Speech-Capable PDA will allow military health care providers to enter data hands-free, allowing focus to be on the patient.

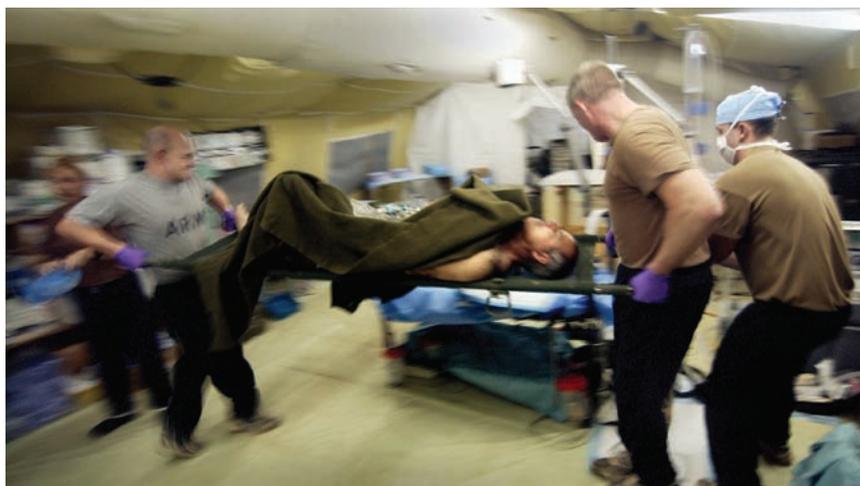


Description

The PDA is equipped with a directional-array miniature microphone system and speech recognition software. Health care providers can perform hands-on medical and surgical procedures at all echelons of care, ranging from combat medic first responders to physicians in tertiary care medical centers.

Laboratory/Developer

TATRC



Virtual Retinal Laser Display

Mission

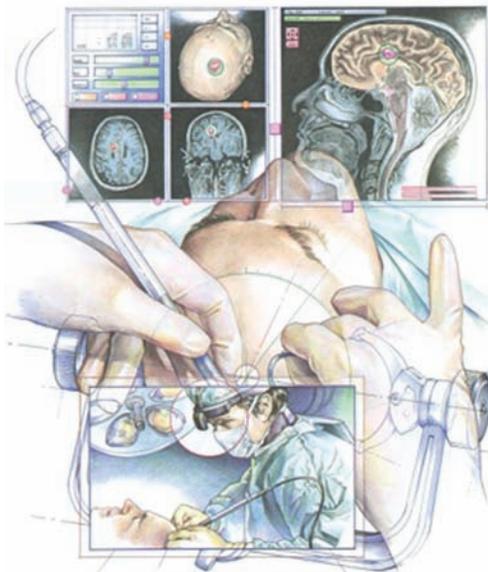
An unobstructed full field of vision of the computer screen for health care providers while performing hands-on medical and surgical procedures is vital for patient treatment.

Description

The Virtual Retinal Laser Display technology provides head-, helmet-, head-gear-, or eyeglasses-mounted, hands-free, daylight readable computer color display by directing a laser beam containing a computer image directly onto the retina of the eye. This projects vital medical information on a health care provider's retina while treating a patient.

Laboratory/Developer

TATRC



Data Encryption at Rest

Mission

USAMITC will enable customers to encrypt data at rest for all mobile devices with a FIPS 140-2 approved Advanced Encryption Standard cryptographic algorithm in accordance with the Army's Chief Information Officer/G-6, Data-At-Rest Protection Strategy memo.

Description

USAMITC will centrally manage security policies for MEDCOM using the Army-approved Credant Mobile Guardian Enterprise Edition (CMGEE) Server and Shield Client for Windows software. USAMITC will use System Management Server software to package and push the CMGEE client software to CMGEE Gatekeeper remote servers at six geographical messaging centers for distribution to MEDCOM clients. Customer sites will manage the direct installation of Data Encryption at Rest capabilities. CMGEE provides the following:

- ◆ Prevents unauthorized access to sensitive data on mobile devices and desktops
- ◆ Enforces policies set on the server for folders and method of encryption
- ◆ Enforces mobile security through data encryption by common encryption of shared folders or a user or machine key.

DAR Phases

- ◆ Phase I – Tablets and laptops
- ◆ Phase II – Thumb drives, personal digital assistants, and desktops

AMEDD Benefits

- ◆ Standardizes and enforces security policy for data encryption at rest
- ◆ Ensures that data are encrypted in the event a mobile device is lost or stolen



Laboratory/Developer

USAMITC

Enterprise Service Desk Pilot

Mission

USAMITC is assisting the enterprise in determining the feasibility of an integrated, virtual help desk environment that partners local support resources with USAMITC and leverages the centrally funded MHS help desk.



Description

With so many disparate help desk technologies across the AMEDD, there is no standardized process to manage work tickets, resolve problems, and capture enterprise-wide views.

In May 2006, USAMITC launched an Enterprise Service Desk (ESD) pilot with the Carl R. Darnall Army Medical Center to study the people, processes, and technologies of help desk activities.

Users are calling a single number (1-800-USAMITC) for 24/7 support, to include remote assistance, and staff at Darnall have been able to concentrate on resolving problems requiring desk-side support instead of answering phones.

The pilot is helping synchronize efforts while eliminating redundant processes, and customer satisfaction has increased.

The MEDCOM desires to integrate more than 30 service desk teams by standardizing processes and software across the MEDCOM. The enhanced services and capabilities will deliver a high-quality, consistent level of IT support to all AMEDD customers regardless of facility size or location.

Laboratory/Developer

USAMITC

Enterprise Web AMEDD E-Forms System Support

Mission

The Enterprise Web AMEDD (EWA) project will allow AMEDD members around the world to access local, MEDCOM, and Joint forms from their desktops. These forms are critical for the accurate and timely delivery of patient services in MTFs. The project will enable the production, approval, and electronic dissemination of E-Forms directly into patient records throughout the Army medical enterprise.

Description

EWA is a web-enabled system that merges the unique capabilities of two commercial off-the-shelf software products, PureEdge™ and FormFinder for the Web™. The first is the Army standard for form development; the latter is a world-class enterprise form management package. EWA will be deployed in two phases. Phase I will deploy the servers, help desk services, and all other enterprise support at USAMITC. Phase II will deploy EWA servers to Europe and the Pacific to provide robust, responsive E-Forms support to all AMEDD personnel.

Supported by USAMITC, EWA is a result of the successful Web-AMEDD Electronic Forms Support System pilot program at 14 MTFs. The pilot program will eventually comprise all AMEDD facilities by leveraging their existing Active Directory and MS Exchange enterprise capabilities. USAMITC will also contribute its expertise in project direction, information assurance, enterprise architecture, help desk and data center support, advanced core technologies, and network engineering to complete the project. EWA promises to be the enabling information technology for the efficient delivery of E-Forms support required by AMEDD to provide effective patient care for the future.

Laboratory/Developer

USAMITC

MEDCOM Enterprise Management

Mission

The MEDCOM Enterprise Management (MEM) project provides systems and software that (1) monitor and manage the operability of servers, desktops, networks, security devices, and other components of the AMEDD health care systems and (2) provide the capability to remotely support end users and deploy software, upgrades, and Information Assurance Vulnerability Alert (IAVA) patches to servers and desktops.



Description

MEM provides the systems and tools necessary to monitor, manage, support, and secure the IT environment that provides patient care for the AMEDD and offers senior leadership a real-time view of the status of critical IT health care systems. The MEM team employs an all-encompassing suite of management tools for information gathering from MEDCOM assets to strengthen network security, manage and upgrade systems, consolidate resources, centralize administrative functions, and lower the cost of ownership for IT services.

The MEM project uses a broad portfolio of tools to deploy IAVA patches to assets throughout the AMEDD environment, reducing the time and resources required to upgrade and secure systems. All critical applications and health care systems are monitored continuously, ensuring the highest level of patient care and response. Additionally, the tools provide meaningful information on the status of the systems in accordance with the AMEDD mission.

Laboratory/Developer

USAMITC

SharePoint 2007 Pilot

Mission

Collaboration and communication are key factors in improving organizational performance and productivity. As a partner in the Microsoft Technical Adoption Program, USAMITC is testing SharePoint as a collaboration and communications tool.

Description

SharePoint allows teams to create sites for information sharing and document collaboration that help increase individual and team productivity. SharePoint's team-based web sites provide small teams or ad hoc work-groups an informal means to work together, share documents, and communicate with one another. SharePoint also provides automated tools that can implement and maintain business processes organization wide.

The SharePoint portal offers a centralized access point, and users can collaborate on documents and access information without switching applications. The portal allows users to browse information by categories, search for information, subscribe to new or changing information, check documents in and out for editing, review a document's version history, approve documents for publication, and publish documents. By specifying security settings, storage policies, auditing policies, and expiration actions for information in accordance with policy and regulations, SharePoint supports effective information management and controls. The portal's home page can be customized to display organizational news and other important information.

SharePoint is an easy-to-use, flexible, and expandable tool that can facilitate organization-wide collaboration needs. It enables better informed decisions by presenting mission-critical information in one central location.

Laboratory/Developer

USAMITC



Thin Client Architecture Initiative

Mission

USAMITC is testing three broad categories of thin client architecture to determine if they can support the diversified needs of MEDCOM applications and users.

Server-based computing solutions, operating system and software streaming, and application virtualization are all being considered as a possible standard solution. Managers will see the advantages and disadvantages of each thin client solution once research and testing data are collected and published.

Description

Thin client technology promises greater security, simpler desktop maintenance, and a reduced IT footprint and is gaining popularity in commercial and government applications.

Citrix® is a server-based computing solution for hosting applications and providing remote access capabilities. Applications are centrally managed with application processing offloaded from the client's desktop to a centrally accessible and managed server. Microsoft® SoftGrid®, an operating system and software streaming solution, downloads applications from network servers on demand, and the application is processed on a user's desktop. Both Citrix and SoftGrid offer application virtualization as an additional capability where the applications are again centrally managed on a server and are isolated from the operating system and other applications. If a single application fails, it cannot affect or be affected by other running applications.

USAMITC currently has evaluation and pilot initiatives with SoftGrid and has planned a pilot study with several distinctly diverse facilities to evaluate SoftGrid's viability and sustainability.

Laboratory/Developer

USAMITC





Logistics and Facilities

Overview

Medical Logistics

The U.S. Army Medical Research and Materiel Command's (USAMRMC's) responsibilities in the medical materiel arena include medical materiel acquisition and logistics functions, strategic medical logistics readiness, and critical health care programs. The U.S. Army Medical Materiel Agency (USAMMA) and the U.S. Army Medical Materiel Center, Europe (USAMMCE), the Command's logistics organizations, provide direction and resources, acquire and manage assets, provide capabilities and distribute materiel, and support the national military strategy of power projection. Key programs include the acquisition, storage, distribution, and transfer of prepositioned stocks located ashore and afloat, medical chemical defense packages, short shelf-life pharmaceuticals, and other materiel. Integral to this support are partnerships with defense organizations and inventory-management contracts with industry. The Command also supports deployable medical logistics support teams.

Both USAMMA and USAMMCE explore and employ innovative methods to bring best business practices and new information technologies to the medical logistics system. Such focused logistics initiatives provide more efficient and accurate ways to deliver and manage precision packages and biomedical maintenance capabilities.





Health Care Facilities

The U.S. Army Health Facility Planning Agency (USAHFPA), Falls Church, Virginia, is the USAMRMC's operational command that supports planning and execution of Army Medical Department (AMEDD) facility life-cycle management worldwide. As the Army Medical Command's (MEDCOM's) deployable experts in research, planning, programming, design, construction, and transition of facilities, the USAHFPA assists the AMEDD and other customers in assessing and refining facility requirements and then executing design and construction investments whenever and wherever needed. The USAHFPA plans, programs, and delivers new health, dental, and research facilities for the AMEDD. It is the consultant and contractor interface with the Army Corps of Engineers. The agency also deploys its expertise globally as one of the MEDCOM's Special Medical Augmentation Response Teams-Health Support in support of security, stabilization, transition, and reconstruction operations.

Case Studies

Operating Room Table

Challenge

Combat operations in recent conflicts have stretched military forces both in terms of physical demands on service members and their equipment. Approximately 90 percent of medical equipment for field use is commercially available, and medical technology advances every 18 to 24 months; most items are replaced because they become obsolete. In the case of a newly introduced item, the combat developer must draft a capabilities document, and this process can take several years.

Contribution

The operating room table is a good example of a long-term approach to replacing a product that has been used in combat support hospitals for about 17 years. When it was determined that this item was clinically obsolete (parts were no longer available), the AMEDD required that a new product be procured. USAMMA determined the availability of potential vendors, conducted a market analysis, and identified two vendors that could address military requirements for a product that was sustainable and clinically viable. This was conducted within a 6-month time period.

Clinical evaluations of both products were conducted by surgeons and operating room nurses at Walter Reed Army Medical Center. Additional testing was conducted at the Aberdeen Test Center at Aberdeen Proving Ground, Maryland, where both products were tested under harsh physical and environmental conditions. Although both products passed environmental and operational testing, USAMMA's source selection board chose the one that met both clinical and supportability requirements.

Benefit

USAMMA employed a team approach to include engineers, clinicians, logisticians, and the maintainers of the product. Both deployed clinicians and warfighters ultimately benefit from getting an interim solution to the field while USAMMA selects the best commercial product. Through USAMMA's dual-path process, the clinician may assist in the product selection as well as use this product in the field the very next year.



Case Study

Pain Control Pump



Challenge

Treating severe pain is challenging and when coupled with evacuation time in theater, leads to prolonged discomfort for wounded service members. Anesthesia providers from three Armed Services branches identified a new pain-control technique known as a patient-controlled analgesia (PCA) pump, for treating wounded service members being evacuated from the U.S. Central Command area of responsibility. Because the requirement for this capability originated in the theater, the Coalition Forces Land Component Command Surgeon's Office developed an operational needs statement that was quickly approved and passed up the chain of command.

Contribution

Based on the ambIT® pump's use in Iraq, the military contacted Sorenson Medical Inc. and sole-sourced a contract to supply pumps for 2 years. Sorenson sent an engineer to work with military researchers to make sure that pumps would function in vibrating helicopters and in evacuation aircraft. USAMMA staff conferred with clinicians; quickly assessed all required consumable support items, accessories, and repair parts needed to support this interim technology; and pushed this information to the theater for rapid procurement through a separate Army funding source. USAMMA also coordinated with the Defense Medical Standardization Board to expedite

the needed items through the national stock number request process so the pumps could be supported and reordered within the automated theater logistics system. The national stock number process, which normally takes 30 to 45 days, was accomplished in less than 7 days. The national stock numbers of these items were immediately provided for inclusion in theater stock record catalogs. Theater headquarters then purchased the PCA technology and distributed it to combat support hospitals in November 2005. This process required only a month when it normally can take several months depending on the complexity of the equipment. Because the requirement was generated in theater on the recommendations of clinicians from three Service branches, service logistics agencies worked with the Defense Medical Standardization Board to complete a comprehensive survey of PCA technology in the marketplace and evaluate available products for multiservice application.

Benefit

The innovative ambIT infusion pump provides a simple yet sophisticated solution for many types of postoperative local pain management and traditional intravenous delivery of PCA narcotics and regional nerve blocks. The programmable operation delivers technology that is easy to use for clinicians, reduces patient training time, and adds versatility to meet a patient's pain management needs. It is currently being used with great success and is working to relieve patients' pain on long air evacuation flights to Europe and the United States.



Army PACS Program Management Office



Mission

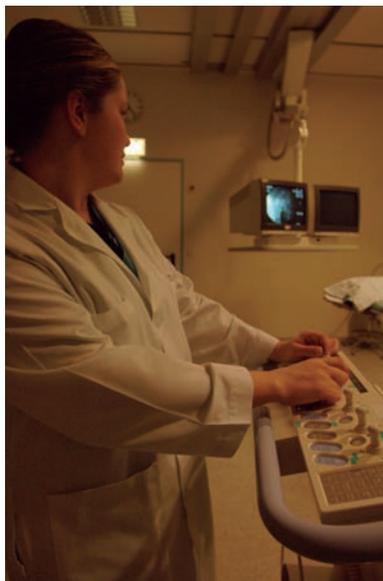
The Army PACS Program Management Office (APPMO) is responsible for developing medical imaging systems.

Description

The APPMO develops Picture Archive and Communications Systems (PACS), teleradiology, and other medical imaging systems as they evolve. This office continuously assesses the state of fielded PACS imaging systems, modernizes and upgrades new clinical features for customers, and enhances the security of the products. In addition, it manages configuration control, ensures successful integration and interoperability, and works closely with other Services and the Military Health Service to synergize and leverage acquisition and maintenance savings for these products. The tasks of this office are currently ongoing.

Laboratory/Developer

APPMO





Cold Chain Management

Mission

Cold Chain Management is a system that is used to distribute medical supplies to first-level users.

Description

Cold Chain Management protects service members by managing and coordinating the distribution of temperature-sensitive medical products in critically short supply from manufacturers to first-level users. Supplies are shipped in validated containers, which include temperature-monitoring devices, and are moved rapidly to users. Cold Chain Management is ongoing.

Laboratory/Developer

USAMMA



Combat Support Equipment Assessment

Mission

The Combat Support Equipment Assessment (CSEA) provides information for the evaluation of equipment and technology.

Description

CSEA provides information to senior decision makers regarding new equipment and technology in field medical treatment facilities. In addition, it provides quality assurance of the acquisition and sustainment process and provides guidance to help eliminate equipment obsolescence. CSEA is ongoing.

Laboratory/Developer

USAMMA



Equipment Maintenance and Repair

Mission

Equipment Maintenance and Repair ensures that medical materiel being used by service members is maintained.

Description

Equipment Maintenance and Repair maintains and repairs equipment used by U.S. forces. It manages and operates the repair parts program for field medical units, develops doctrine and policies for maintaining medical materiel, and publishes interactive electronic technical manuals. This process is ongoing.

Laboratory/Developer

USAMMA

Sample Data Collection Program



Mission

The Sample Data Collection (SDC) Program monitors the state of medical technology through data collection and analysis.

Description

The SDC Program responds to changes in medical technology in a timely manner and identifies significant trends in the maintenance of medical equipment through a comprehensive data collection and analysis program. In addition, it maintains a database of targeted medical equipment used in Level I treatment (on the battlefield) through Level III treatment (Combat Support Hospital) environments. This program is ongoing.

Laboratory/Developer

USAMMA



Technology Assessment and Requirements Analysis

Mission

The Technology Assessment and Requirements Analysis (TARA) provides information and analyses to ensure that clinical outcomes for service members are optimized.

Description

TARA provides information via database analyses to senior decision makers at Army military treatment facilities and the MEDCOM for accomplishing missions and developing acquisition strategies to optimize clinical outcomes. TARA allows 5-year budget requirements to be aggressively managed with front-loading of medical care support equipment and super capital expense equipment program requirements for the routine replacement of diagnostic, imaging, laboratory, and patient-monitoring systems. Resulting process improvements through the generation of requirements and delivery of services have generated a cost avoidance of about \$1.6 million per facility since 1995. TARA is ongoing.

Laboratory/Developer

USAMMA



USAMMA Revolution in Logistics

Mission

The USAMMA Revolution in Logistics (URL) supports the medical mission and enables the optimization of business practices.

Description

URL improves business practices through employment of an enterprise resource planning system based on the same software product as the Army's Logistics Modernization Program and DoD's Business Systems Modernization Program. This system employs an integrated business information warehouse capability to provide USAMMA and stakeholders with highly detailed reports to support the dynamic changing medical mission. The system optimizes and modernizes medical logistics business practices. Employment of the URL has achieved a \$13 million cost avoidance and reduced customer wait time for medical assemblages from 18 months to an average of 2 months. URL is ongoing.



Laboratory/Developer

USAMMA

Special Medical Augmentation and Response Teams, Health Systems

Mission

The Special Medical Augmentation and Response Teams, Health Systems (SMART-HS) support the AMEDD's health care mission.

Description

SMART-HS provide deployable health facilities expertise worldwide to support the AMEDD's health care mission. These teams augment medical forces with health facilities expertise across the full spectrum of operations, providing medical facility assessments and assistance; engineering, architectural, equipment, and health care infrastructure consulting; and project design, construction, and management. They develop the medical infrastructure in the maturing theater, support the reestablishment of civilian medical infrastructure, and act as the liaison with engineering units and staffs.

Laboratory/Developer

USAHFPA



Active Component Hospital Decrement

Mission

The Active Component Hospital Decrement (ACHD) will provide the deploying medical force with the latest available technology while mitigating the fiscal impact associated with obsolescence.

Description

The ACHD addresses the management and maintenance of selected items of modernized medical equipment and special purpose test, measurement, and diagnostic equipment. USAMMA has acquired and fielded a number of these items to the deploying force for both Operation Iraqi Freedom and Operation Enduring Freedom. This equipment was selected by an AMEDD clinical team during the planning for Operation Iraqi Freedom.

The goal of the program is to ensure that appropriate equipment is ready for deployment to meet the requirements of the force. ACHD serves as an umbrella program, encompassing equipment authorized by units and as a part of programs such as the Reserve Component Hospital Decrement, Hospital Optimization Standardization Program, and Army Pre-positioned Stocks.

Laboratory/Developer

USAMMA



Clinical and Technical Support to MEDCOM's Facility Sustainment, Restoration, and Modernization and Military Construction Programs

Mission

Clinical and Technical Support (CaTS) provides programming, planning, design review, and consultative services to the combatant commanders and the Military Construction and Sustainment, Restoration, and Modernization programs.

Description

The CaTS team provides clinical, equipment, information technology, interior design, mechanical engineering, and architectural expertise to the combatant commanders, medical Military Construction, and Sustainment, Restoration, and Modernization programs in facility planning, design, construction, transition, and commissioning. CaTS teams directly support the DoD space and equipment standardization program. The level of effort of CaTS teams for Sustainment, Restoration, and Modernization includes 57 projects worth more than \$90 million in the continental United States.

Laboratory/Developer

USAHFPA



Emerging Facility Markets/Enhanced Use Lease

Mission

Enhanced Use Leases (EULs) will leverage underused Army assets to provide world-class medical and medical research facilities for the AMEDD.

Description

In fiscal year 2001, the DoD obtained expanded EUL authority, established by the National Defense Authorization Act, which gives individual military base commanders greater ability to lease unused or underused real estate for cash or in-kind services. Specifically, installations can (among other activities):

- ◆ Enter into long-term or short-term leases, providing greater flexibility for facility use and reuse; and
- ◆ Receive cash or in-kind consideration for income on leased property, which can be used for alteration, repair, improvement of property or facilities; construction or acquisition of new facilities; lease of facilities; or facilities operation support.

The EUL concept offers base commanders and the DoD numerous benefits: It enhances mission performance through cooperative efforts with public or private partners, improves property use, reduces base operating costs through improved business practices, stimulates the local job market, fosters cooperation between the military services and the private sector, and introduces valuable federal property into the local job market.

Laboratory/Developer

USAHFPA

Emerging Facility Markets, Technologies, and Acquisition

Mission

The Emerging Facility Markets, Technologies, and Acquisition effort will operationalize health facility planning to recapitalize medical direct care and research facilities, applying alternative business and acquisition processes and emerging facility technologies.

Description

These lead initiatives will recapitalize the existing Army medical direct care, research, and biodefense laboratory inventory, shaping and improving facilities to best deliver health care, leveraging new technology and updated clinical guidelines, and linking the built environment to patient, staff, and resource outcomes. In addition, the goal of using and studying innovations in the research building environment is to enable science to respond quickly and efficiently to the ever-changing face of military medical research.

The efforts will identify and use alternative business practices to leverage private industry capital in the development of Army facility projects (EUL, private and federal partnerships, philanthropy, and conjunctive funding). In addition, USAHFPA will focus on transforming the planning, acquisition, design, and construction methodologies to improve investment decision making, streamline the design and construction phases, and incorporate best business practices to develop a facility solution. These emerging facility technologies are researched and incorporated into the Army health care facility life-cycle management process.

Laboratory/Developer

USAHFPA



Facility Master Planning and Programming

Mission

The Facility Master Planning and Programming capability will determine the right health care delivery platform solution, resourcing strategy, and acquisition methodologies to provide the right facility, at the right place, at the right time for the AMEDD.

Description

Facility Master Planning and Programming assists medical organizations in developing their strategic business plans through market analyses, research, and on-site consulting. Planning and programming bring a unique corporate view: AMEDD-wide best practice insight, system-wide assessment and evaluation, private industry collaboration, and space management to assist organizations with successful planning. In addition, facility requirements are prepared, justified, and vetted through the Department of the Army, the Office of the Secretary of Defense, the Office of Management and Budget, and finally to Congress for resource programming and funding.

Laboratory/Developer

USAHFPA



Medical Facility Military Construction Program

Mission

The Medical Facility Military Construction Program replaces or recapitalizes AMEDD facilities to provide world-class platforms for health care delivery, medical research, and support operations.

Description

The USAHFPA partners with the U.S. Army Corps of Engineers, supported medical staff, architecture and engineering firms, construction contractors, and other stakeholders to design and construct medical facilities that are appropriately sized for the current mission yet flexible enough to adapt to future change.

The following medical construction projects were completed for fiscal year 2007: Bassett Army Community Hospital Replacement, Fort Wainwright, Alaska; Military Amputee and Training Center, Walter Reed Army Medical Center, Washington, DC; 121 General Hospital Addition and Alteration, Yongsan, Korea (Phase I completed); Darnall Army Medical Center Emergency Department Addition and Alteration, Fort Hood, Texas;



Consolidated Troop Medical Clinic, Fort Benning, Georgia; Health Clinic Addition and Alteration, Wiesbaden, Germany; and Bio-Safety Level III Laboratories, Fort Bragg, North Carolina and Fort Hood, Texas.

The following medical construction projects were started in fiscal year 2007: U.S. Army Medical Research Institute of Infectious Diseases Phase I, Fort Detrick, Maryland; Consolidated Troop and Family Medical Clinic #10, Fort Hood, Texas; Dental Clinic, Fort Irwin, California; Dental Clinic, Fort Bliss, Texas; Consolidated Health/Dental Clinic, Fort Riley, Kansas; Enhanced Health Service Center, Vicenza, Italy; Battlefield Health and Trauma Center, Fort Sam Houston, Texas; and Hospital Replacement, Fort Belvoir, Virginia.

For fiscal year 2007, USAHFPA has 26 projects currently under design (the greatest number in the history of the organization) with additional projects developing based on continuing CONUS/OCONUS mission requirements through fiscal year 2013.

Laboratory/Developer

USAHFPA



Medical Facility Renewal Program

Mission

The Medical Facility Renewal Program optimizes resources by renewing existing facility infrastructure to provide world-class medical facilities for the AMEDD.

Description

The program leverages integrated design and construction methodologies and operational funding to restore obsolete infrastructure systems and modernize the functionality of the facility while updating to current codes, standards, and modern health care operations. The project integrator leads a team of members from the USAHFPA, Corps of Engineers, and civilian contractors through the planning, design, and restoration of the facility as part of the MEDCOM Facility Capital Investment strategy.

Laboratory/Developer

USAHFPA



Medical Materiel Readiness Program



Mission

The Medical Materiel Readiness Program (MMRP) will support medical units transitioning through their operational readiness cycles. This program will allow commanders to easily manage their training and maintenance requirements, which will prove to be a better solution for deployment.

Description

USAMMA is currently developing a concept known as the MMRP to support the Army Force Generation (ARFORGEN) model and the Army Campaign Plan, which are designed to improve Joint Force readiness. One tenant of the AMEDD's transformation is to develop an equipping solution that supports units once they are designated Deployment, Ready, and Contingency Expeditionary Forces and transitioned to the Reset/Train, Ready, and Available force pools. The equipping solution must encompass the three ARFORGEN equipment sets: (1) Baseline Equipment Set, (2) Training Equipment Set, and (3) Deployment Equipment Set, which are designed to support training and mission requirements of units transitioning between the force pools.

The goal of the program is to ensure that appropriate equipment items are ready for training and deployment to meet the requirements of the Joint Force. The MMRP serves as the umbrella program, encompassing equipment authorized by units and as part of other programs, such as the Reserve Component Hospital Decrement Program, Hospital Optimization Standardization Program, and the Army Pre-positioned Stocks Program.

Laboratory/Developer

USAMMA



Appendix A

Licensed Technologies and Patents



Provided in this appendix are two lists regarding USAMRMC-developed technologies. The first is a summary of patent license agreements, and the second is a listing of patents issued to the laboratories. All expired licenses are indicated with an asterisk (*).

Patent License Agreements with USAMRMC Laboratories¹

The following list highlights technologies developed in USAMRMC laboratories that have been licensed to commercial entities for further development or production.

Execution Date	Title of Patent [and/or licensed technology]	Patent Number
1/21/1983	Licensed a Non-patented Compound [Halofantrine]	Not patented*
9/8/1986	Immunologically Active Peptides Capable of Inducing Immunization against Malaria and Genes Encoding Therefor	4,707,357*
1/5/1995	Absorbable Tissue Adhesives	5,350,789
5/1/1995	Immuno-potentiating Systems for Preparation of Immunogenic Materials [Nasal Vaccine Delivery System]	5,726,292 & 5,350,789
12/8/1995	4-Methyl-5 (Unsubstituted and Substituted) Phenoxy-2,6-Dimethoxy-8-(Aminoalkylamino) [Tafenoquine]	4,617,394
12/8/1995	4-Methyl-5 (Unsubstituted and Substituted) Phenoxy-2,6-Dimethoxy-8-(Aminoalkylamino) Quinolines [Sitamaquine-Antimalarial Drug]	4,431,807
3/1/1996	Drug Releasing Surgical Implant or Dressing Material	5,972,366*
12/14/1996	4-Methyl-5 (Unsubstituted and Substituted) Phenoxy-2,6-Dimethoxy-8-(Aminoalkylamino) Quinolines Sitamiquine	4,431,807*
6/20/1997	Improved Liposome Formulations	5,820,880*
8/27/1997	Composition and Methods of Treating Hepatitis C	5,849,696

Execution Date	Title of Patent [and/or licensed technology]	Patent Number
9/8/1997	Immunological Compositions	6,110,492*
9/24/1998	Attenuated Japanese Encephalitis Virus Adapted to Vero Cell and a Japanese Encephalitis Vaccine	6,309,650
12/21/1998	Alphavirus RNA Replicon Systems [Replicon Vaccine Delivery System]	4 patents
10/26/1999	Methods for Treating Antibiotic-resistant Infections	5,965,572*
4/19/2000	Method of Lysing Thrombi [Blood Clot Lysis Device]	5,399,158
4/19/2000	Advanced Surgical Suite for Trauma Casualties [Medical Surgical Shelter]	5,916,096*
6/26/2000	Method for Treating Antibiotic-resistant Infections	5,965,572
4/3/2001	Multivalent Dengue Virus Vaccine	6,638,514
4/16/2001	Transdermal Delivery System for Antigen [Transcutaneous Vaccine Delivery]	2 patents
3/4/2002	Taqman Internal Positive Control [PCR Reagents and Controls]	7,005,267
6/21/2002	Critical Care Platform for Litters [Platform for Medical Monitors]	6,493,890
9/20/2002	Topical Skin Protectants	5,607,979
5/22/2003	Antibodies against Type A Botulinum Neurotoxin	6,667,158
10/7/2003	Asporogenic <i>B. anthracis</i> Expression System	6,316,006 2 patents
11/13/2003	High Level Expression of Enterotoxigenic <i>Escherichia coli</i> (ETEC) Colonization Factors in DME Broth	10/798,956
12/1/2003	Method for the Production of Purified Invasin Protein and Use Thereof	09/830,025
5/28/2004	Automated Inhalation Toxicology Exposure	6,904,912*
6/2/2004	Commercial Development, Dengue Hybridomas	Term 14 years
6/15/2004	Battlefield Information System-Telemedicine (BMIST) additional execution dates: 8/5/2005, 9/19/2005, 5/22/2006	10/438,327
8/5/2004	Tendon Repair Clip	5,916,224

Military Infectious Diseases

Combat Casualty Care

Military Operational Medicine

Medical Chemical and Biological Defense

Advanced Technologies and IM/TT

Logistics and Facilities

Execution Date	Title of Patent [and/or licensed technology]	Patent Number
11/23/2004	Prolonged Storage of RBCs and Compositions	6,160,085 & 6,447,987
1/24/2005	Immobilized Enzymes Biosensors for Chemical Toxins. Detoxification with Sponges and Foams Plurality of Enzymes and Encapsulated Indicator. Preparation of Enzymatically Active Sponges and Foams for Detoxification of Hazardous Compounds	6,541,230, 6,406,876, 6,642,037
2/7/2005	Identification of Small Molecule Inhibitor of Anthrax Lethal Factor	60/533, 375
4/7/2005	Chimeric Filovirus Glycoproteins. MAR Virus-like Particles as a Vaccine for the Prevention of Lethal MAR Disease. Generation of Virus-like Particles and Demonstrations of the Lipid Raft as Sites of Filovirus Entry and Budding	10/289,839, 11/105,057, 10/066,506
6/14/2005	Automated Inhalation Toxicology Exposure System	6,904,912
9/26/2005	A Novel and Practical Serological Assay for the Clinical Diagnosis of Leishmania	7,008,774
11/29/2005	Compositions Having Neuroprotective and Analgesic Activity	6,046,200, 6,410, 537
12/13/2005	Personal Water and Additive Apparatus	10/875,020
1/8/2006	Method and System for Predicting Human Cognitive Performance	12 patents
2/2/2006	Multi-purpose, Self-erecting Structure Having Advanced Insect Protection and Storage Characteristics	6,672,323
2/27/2006	System and Method for Applying an Animal Access Door to an Inclined Surface	6,668,487
3/1/2006	Arthropod Repellant Pharmacophore Models, Compounds Identified as Fitting the Pharmacophore Models and Methods of Making and Using Thereof	10/701,566
7/5/2006	Leishmania Diagnostic Kit	No patent
7/28/2006	Small Molecule Inhibitors of Botulinum Neurotoxins	60/723,442
8/7/2006	Bacterial Superantigens	6,713, 284, 6,399,332
8/29/2006	Raman Spectral Biological Data	Non-patented

Execution Date	Title of Patent [and/or licensed technology]	Patent Number
9/6/2006	Antibodies against Type A Botulinum Neurotoxin	6,667,158
9/11/2006	Flavivirus Detection and Quantitation Assay	6,793,488
10/10/2006	Stabilized Lyophilized Blood Platelets	11/503,371
11/30/2006	Force Sensing Treadmill	6,878,100
12/31/2006	Antibodies against Type A Botulinum Neurotoxin	6,667,158
2/2/2007	Dengue Hybridomas	Not patented

¹List as of March 2, 2007.

Patents Issued to USAMRMC Laboratories²

The list that follows is a summary of the patents issued to USAMRMC laboratories. An asterisk (*) after the patent number indicates that the patent has expired.

Execution Date	Title of Patent	Patent Number
Armed Forces Research Institute of Medical Sciences		
3/21/2006	A Human Hepatocyte Line Derived from Normal Liver Tissue that Supports Malaria Parasite Development	7,015,036
Letterman Army Institute of Research		
7/24/1984	Surgical Retaining Device	4,461,284 *
9/25/1984	Preparation of Stroma-free, Non-heme Protein-free Hemoglobin	4,473,494 *
9/25/1984	Intramolecularly Crosslinked Hemoglobin	4,473,496 *
U.S. Army Aeromedical Research Laboratory		
7/31/1990	Ultra Ultrahigh Burning Rate Composite Modified Double-base Propellants Containing Porous Ammonium Perchlorate (Wallace Computer Services)	4,944,816 *
6/11/1991	Method of Ejecting an Interceptor Missile from Its Silo	5,022,306 *
12/28/2004	Low-backscatter Aperture Structure	6,834,971
2/1/2005	Lateral Visual Field Testing Device (LVFT)	6,849,050
2/24/2005	Low-backscatter Aperture	6,896,377
8/22/2006	Method for Recording Stimuli to Measure Speech Reception Thresholds	7,096,184
11/28/2006	Method for Measuring Speech Intelligibility Using the Modified Rhyme	7,143,031
12/12/2006	Method for Determining Speech Reception Threshold	7,149,684
TATRC: Telemedicine and Advanced Technology Research Center		
7/16/2002	Convertible Patient Isolation Pod (Telemedicine and Advanced Technology Research Center)	6,418,932
6/15/2004	Battlefield Information System-Telemedicine (BMIST)	10/438,327 & 10/991,258

Execution Date	Title of Patent	Patent Number
U.S. Army Biomedical Research and Development Laboratory		
6/12/1984	Portable Reclining Examination Chair	4,453,768*
12/6/1988	Collapsible Insect Trap	4,788,789*
7/17/1990	Semi-micro Manipulators	4,941,631*
10/2/1990	Atmospheric HCL Monitor	4,960,496*
6/29/1993	X-ray Cassette Holder and Positioning Device	5,224,148*
12/27/1994	Portable Surgical Table	5,375,276*
U.S. Army Center for Environmental Health Research		
5/9/2000	Apparatus and Method for Automated Biomonitoring of Water Quality	6,058,763
5/28/2002	An Apparatus and Method for Automated Biomonitoring of Water Quality	6,393,899
1/24/2006	Apparatus and Method for Portable Automated Biomonitoring of Water Quality	6,988,394
8/22/2006	Instant Fish Kit	7,094,417
U.S. Army Institute for Dental Research		
1/20/1987	Polyactic-polyglycolic Acid Co-polymer Combined with Decalcified Freeze-dried Bone for Use as a Bone Repair Material	4,637,931*
U.S. Army Institute of Surgical Research		
7/5/1983	Protective Gel Composition for Treating White Phosphorus Burn Wounds	4,391,799*
7/12/1983	Protective Gel Composition for Wounds	4,393,048*
4/6/1993	Anti-microbial Mafenide-Phosphanilate Compound, Pharmaceutical Compositions and Method of Use Thereof	5,200,402
11/7/2000	Self-piercing Pulse Oximeter A Assembly	6,144,867
3/20/2001	Medical Monitor Chassis	D439,388
6/5/2001	Biomedical Data Recorder Chassis	D443,062
6/26/2001	Disposable Pulse Oximeter Assembly and Protective Cover Therefor	6,253,098
7/3/2001	Pulse Oximeter Sensor Combined with a Combination Oropharyngeal Airway and Bite Block	6,256,524
7/17/2001	Method for Monitoring Arterial Oxygen Saturation	6,263,223

Execution Date	Title of Patent	Patent Number
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U.S. Army Institute of Surgical Research (cont.)

7/24/2001	Nasopharyngeal Airway with Reflectance Pulse Oximeter Sensor	6,266,547
10/22/2002	Pacifier Pulse Oximeter Sensor	6,470,200
12/17/2002	Critical Care Platform for Litters	6,493,890
2/4/2003	Method and Apparatus for Power Doppler Ultrasound Image Analysis	6,514,208
3/18/2003	Catheter Securing Device and Bite Block	6,533,761
5/20/2003	Syringe Holder Attachment for Medication	6,565,054
8/26/2003	Orthogonal Arterial Catheter	6,610,045
2/24/2004	Wound Dressing System	6,695,824
3/23/2004	Device for Upper Extremity Elevation	6,708,935
6/29/2004	Securing Device for an Endotracheal Tube	6,755,191
1/18/2005	Critical Care Platform for Litters	6,842,922
5/10/2005	Combination Mouth Guard, Bite Block, Endotracheal Tube Securing Device	6,890,322
5/10/2005	Improvement of Fibrin Bandage Performance	6,891,077
1/3/2006	Orthogonal Arterial Catheter	6,981,969
12/12/2006	Needle with Fiberoptic Capability	7,149,562

U.S. Army Medical Research and Materiel Command

11/17/1987	Dermal Substance Collection Device	4,706,676*
4/11/1989	Dermal Substance Collection Method	4,819,645*
10/2/1990	Dermal Substance Collection Device	4,960,467*
12/30/2003	Neurocognitive Assessment Apparatus and Method	6,669,481

U.S. Army Medical Materiel Agency

7/16/2002	Convertible Patient Isolation Pod	6,418,932
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U.S. Army Medical Research Institute of Chemical Defense

6/25/2002	Active Topical Skin Protectants Using Combinations of Reactive Nanoparticles and Polyoxometalates on Metal Salts	6,410,603
6/25/2002	Active Topical Skin Protectants Containing OPAA Enzymes and Clecs	6,410,604
7/2/2002	Active Topical Skin Protectants Containing Polyoxometalates and/or Coinage Metal Complexes	6,414,039

Execution Date	Title of Patent	Patent Number
U.S. Army Medical Research Institute of Chemical Defense (cont.)		
7/9/2002	Active Topical Skin Protectants Using Hybrid Organic Polysilsesquioxane Materials	6,417,236
7/16/2002	Active Topical Skin Protectants Using Polyoxometalates	6,420,434
8/20/2002	Active Topical Skin Protectants Using Polymer-coated Metal Alloys	6,437,005
10/29/2002	Active Topical Skin Protectants	6,472,437
10/29/2002	Active Topical Skin Protectants Containing S-330	6,472,438
4/29/2003	Free-floating Cryostat Sections for Use in Light and Electronic Microscopy	6,555,334
10/28/2003	Method for Self-detection of Pupillary Response	6,637,885
3/22/2005	Automated Method of Identifying and Archiving Nucleic Acid Sequences	6,871,147
U.S. Army Research Institute of Environmental Medicine		
4/27/1993	Doppler Radar/Ultrasonic Hybrid Height Sensing System	5,206,652*
5/16/1995	Pneumatic Winch	5,415,379*
11/4/1997	Vigilance Monitor System	5,682,882
4/14/1998	Antisense Oligonucleotides Specific for the Muscarinic Type 2 Acetylcholine Receptor mRNA	5,739,119*
8/15/2000	Apparatus and Method for Measuring the Relative Velocity and True Distance between Two Objects	6,104,671
12/3/2002	Apparatus for Lifting or Pulling a Load	6,488,267
12/30/2003	Temperature-required Cell Perfusion	6,670,170
4/12/2005	Force-sensing Treadmill	6,878,100
U.S. Army Medical Research Institute of Infectious Diseases		
7/30/1985	Antitrypanosomal Activity Coordination Compounds	4,532,122*
2/9/1993	cDNA Clone Coding for Venezuelan Equine Encephalitis Virus and Attenuating Mutations Thereof	5,185,440
3/29/1994	Nucleotide Sequences Encoding the Expression of a Hantaan Virus Nucleocapsid Protein and G1 and G2 Glycoproteins	5,298,423

Execution Date	Title of Patent	Patent Number
U.S. Army Medical Research Institute of Infectious Diseases (cont.)		
6/14/1994	Small Animal Restraint Device	5,320,069*
9/26/1995	Vaccine against Ricin Toxin	5,453,271
4/9/1996	Attenuating Mutations in Venezuelan Equine Encephalitis Virus	5,505,947
3/25/1997	Hantavirus Vaccine	5,614,193
5/6/1997	Monoclonal Antibody against Ricin A Chain	5,626,844*
7/1/1997	Method of Inducing an Immune Response with a Live Venezuelan Equine Encephalitis Virus Expressing a Heterologous Immunogen	5,643,576
8/11/1998	Alphavirus RNA Replicon Systems	5,792,462
9/15/1998	Protective Monoclonal Antibody against Botulinum Neurotoxin Serotype F	5,807,741*
12/28/1999	Method for Purifying Cholera Toxin	6,008,329
4/2/2000	Flow-through Cell Culture Chamber	6,046,806
3/13/2001	Genetic Induction of Antiviral Immune Response and Genetic Vaccine for Filovirus	6,200,959
7/10/2001	DNA Vaccines against Tick-borne Flaviviruses	6,258,788
7/17/2001	Overcoming Interference in Alphavirus-immune Individuals	6,261,567
7/17/2001	Live, Attenuated Virus Vaccines for Western Equine Encephalitis Virus, Eastern Equine Encephalitis Virus, and Venezuelan Equine Encephalitis Virus IE and IIIA Variants	6,261,570
9/11/2001	Protective Peptides of Neurotoxin of <i>C. botulinum</i>	6,287,566
10/2/2001	Live, Attenuated Venezuelan Equine Encephalitis Vaccine	6,296,854
11/13/2001	A Sporogenic <i>B. anthracis</i> Expression System	6,316,006
5/14/2002	Method of Making a Vaccine for Anthrax	6,387,665
6/4/2002	Bacterial Superantigen Vaccines	6,399,332
6/18/2002	Dip-stick Assay for C-reactive Protein	6,406,862
9/17/2002	Prophylactic and Therapeutic Monoclonal Antibodies	6,451,309
12/17/2002	Botulinum Neurotoxin Vaccine	6,495,143
2/11/2003	Marburg Virus Vaccines	6,517,842
2/18/2003	Alphavirus RNA Replicon Systems	6,521,235

Execution Date	Title of Patent	Patent Number
U.S. Army Medical Research Institute of Infectious Diseases (cont.)		
3/11/2003	Alphavirus RNA Replicon Systems	6,531,135
4/1/2003	Alphavirus RNA Replicon Systems	6,541,010
5/13/2003	DNA Vaccines against Poxviruses	6,562,376
9/16/2003	Prophylactic and Therapeutic Monoclonal Antibodies	6,620,412
10/7/2003	Monoclonal Antibodies to Ebola Glycoprotein	6,630,144
10/14/2003	Vaccine against Staphylococcus Intoxication	6,632,640
12/23/2003	Antibodies against Type A Botulinum Neurotoxin	6,667,158
3/22/2005	Ricin Vaccine and Methods of Making and Using Thereof	6,869,787
4/5/2005	Prophylactic and Therapeutic Effects of Monoclonal Antibodies to the Glycoprotein of Ebola Virus	6,875,433
6/14/2005	Automated Aerosol Exposure System	6,904,912
7/19/2005	Product and Method for Nucleic Acids Purification	6,919,200
1/10/2006	Protective Efficacy of Ebola Virion Proteins Expressed from VEE Virus Replicons	6,984,504
2/28/2006	Taqman Internal Positive Control	7,005,267
4/25/2006	Substrates for High-throughput Assays of Clostridial Neurotoxin Proteolytic Activities	7,034,107
5/2/2006	Development of a Nontoxic, Recombinant Vaccine against Botulinum Neurotoxin Serotype F	7,037,060
5/23/2006	Monoclonal Antibody of Type A Botulinum Neurotoxin	7,049,085
5/30/2006	Taqman RT-PCT Internal Positive Control	7,052,848
7/25/2006	Development of a Nontoxic, Recombinant Vaccine against Botulinum Neurotoxin Type F	7,081,529
8/1/2006	Artemisinins with Improved Stability and Bioavailability for Therapeutic Drug Development and Application	7,084,132
8/8/2006	A Genetically Attenuated Staphylococcal Enterotoxin B Vaccine	7,087,235
8/15/2006	Marburg Virus Vaccine	7,090,852
1/2/2007	Substrates for High-throughput Assays of Clostridial Neurotoxin Proteolytic Activities	7,157,553

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Walter Reed Army Institute of Research		
11/4/1969	Two-dimensional Structure Encoding Typewriter	3,476,311 *
7/27/1971	2-(Phenylalkylamino) Ethanethio-Sulfuric Acids as Antiradiation Agents	3,595,899*
8/3/1971	Method of Synthesizing Selenoureas from Thioureas	3,597,444 *
8/17/1971	Alpha-Dilower Alkyl Amino-2,6,-DI-[p-Chlorophenyl]-4-Pyridine Methanols and Derivatives Thereof	3,600,396 *
12/21/1971	Alpha-Adrenergic Blocking Agents	3,629,410 *
1/18/1972	Meningococcal Polysaccharide Vaccines	3,636,192 *
4/11/1972	Synthesis of N-substituted 2-Amino-Ethanethio-Sulfuric Acids	3,655,715 *
10/2/1973	2,6-Bis-Trifluoromethyl-Phenyl-4-Pyridinecarboxylic Acid and Derivatives Thereof	3,763,148 *
10/9/1973	4-Pyridylcarbinolamine Anti-malarials	3,764,604 *
5/27/1975	2-Aryl-6-Trifluoromethyl-4-Pyridyl-Carbinolamines Antimalarials	3,886,167 *
2/24/1976	2-Substituted Phenyl-6-Trifluoromethyl-4-Pyridyl-Carbinolamines	3,940,404 *
4/27/1976	2-Aryl-6-Trifluoromethyl-4-Pyridyl-Carbinolamines Antimalarials	3,953,463 *
6/8/1976	Comparator Circuit for Automatic Analysis Apparatus	3,961,898 *
1/16/1979	Microwave Time Delay Spectroscopic Methods and Apparatus for Remote Interrogation of Biological Threats	4,135,131 *
4/3/1979	Thermometric Transducer Device	4,148,005 *
7/24/1979	Ridged Waveguide Antenna Submerged in Dielectric Liquid	4,162,500 *
1/29/1980	Liposome Carriers in Chemotherapy of Leishmaniasis	4,186,183 *
8/28/1990	Unsymmetrical Organic Disulfide Compounds Useful as Antiradiation Agents	4,952,338
2/5/1980	Use of Phosphonium Salts in Treatment of African Trypanosomiasis	4,187,300 *
6/24/1980	Anti-leishmanial Lepidine Derivatives	4,209,519 *

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Walter Reed Army Institute of Research (cont.)		
12/16/1980	An Electromagnetic Method for the Noninvasive Analysis of Cell Membrane Physiological and Pharmacology	4,240,027*
1/20/1981	Calibration Method for Lumped Capacitance Measurement of Complex Permittivity at HV, VHF, and UHF Frequencies	4,246,534*
1/27/1981	Method and Apparatus for Physiologic Facsimile Imaging of Biologic Targets Based on Complex Permittivity Measurements Using Remote Microwave	4,246,534*
5/15/1981	Narcotic Antagonists in the Therapy of Shock	4,267,182*
6/2/1981	Method and Apparatus for Physiologic Facsimile Imaging of Biologic Targets Based on Using Remote Microwave Interrogation	4,271,389*
8/4/1981	Topical Prophylaxis against Schistosomiasis	4,282,253*
8/25/1981	Method for Producing a Vaccine against Bacterial Infections Caused by <i>Pseudomonas aeruginosa</i>	4,285,936*
11/10/1981	Auto-optical Centering Device for Photometers	4,299,493*
11/24/1981	Liposome Carriers in Leishmaniasis Chemotherapy with 8-Aminoquinoline Derivatives	4,302,459*
3/2/1982	2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones	4,317,776*
8/31/1982	Floating Device for Density Gradient Fractionation	4,346,608*
8/30/1983	Method of Treating Gonorrhea Infections with 2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones	4,401,670*
11/15/1983	Silver Metachlorodine in Treatment of Infections	4,415,565*
11/22/1983	Treatment of Malaria with Liposomes Containing 8-Aminoquinoline Derivatives and Glycoconjugates	4,416,872*
1/17/1984	Thyrotropin-releasing Hormone in Therapy of Shock as a Central Nervous System Stimulant	4,426,378*
2/17/1984	4-Methyl-5 (Unsubstituted and Substituted Phenoxy)-6-Methoxy-8-[Aminoalkylamino] Quinolines	4,431,807*
2/28/1984	Narcotic Antagonists in the Therapy of Shock	4,434,168*

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Walter Reed Army Institute of Research (cont.)		
4/3/1984	2-Acetyl Quinoline Thiosemicarbazones Useful in Treatment of Gonorrhoea, Malaria, or Bacterial Infections	4,440,771 *
4/17/1984	Neisseria Gonorrhoea Vaccine	4,443,431 *
5/8/1984	Sampling Device	4,447,395*
5/8/1984	Method for Treating Bacterial Infections with 2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones	4,447,427*
6/12/1984	Scleral Depressor	4,453,546*
12/11/1984	Topographic Marking Device	4,488,043*
1/15/1985	Medical 2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones and Preparation Thereof	4,493,930*
11/19/1985	5-(Straight chain 3-12 Carbon Alkoxy)-8-Quinolines and Their Use for Treatment of Malaria	4,554,279*
4/8/1986	Suture Needle Holder	4,580,567*
5/27/1986	Sensitive Radioimmunoassay Using Antibody to L-Hyoscyamine	4,591,573*
6/24/1986	2-Acetylpyridine Thiosemicarbazones as Antiviral Agents	4,596,798*
10/14/1986	4-Methyl-5 (Unsubstituted and Substituted) Phenoxy-2,6-Dimethoxy-8-(Aminoalkylamino) Quinolines (Tafenoquine)	4,617,394
12/20/1986	Oral Vaccine for Immunization against Enteric Disease	4,632,830
4/14/1987	Transition of Metal Complexes of the Selenium Analogs of 2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones Useful for Treating Malarial Infections and Leukemia	4,657,903*
4/21/1987	Anti-leishmanial Lepidine Derivatives	4,659,708*
4/21/1987	Topical Prophylaxis against Schistosomal Infections	4,659,738*
5/12/1987	2-Acetyl- and 2-Propionylpyridine Selenosemicarbazones	4,665,173*
10/14/1987	Hybridoma Cell Lines and Monoclonal Antibodies to <i>Clostridium difficile</i> Toxins A & B	5,071, 759*
11/17/1987	Process for the Preparation of Detoxified Polysaccharide-Outer Membrane Protein Complexes, and Their Use as Antibacterial Vaccines	4,707,543*

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Walter Reed Army Institute of Research (cont.)		
12/15/1987	Azabicycloalkane Phenyl Substituted Alkane Carboxylates, Their Preparation and Use as Anticholinergic Agents	4,713,391 *
1/5/1988	Adjustable Mold for Fabricating Bone Replacements	4,717,115 *
4/19/1988	2-Acetyl- and 2-Propionylpyridine Thiosemicarbazones	4,739,069 *
10/11/1988	2-Acetylpyridine Thiosemicarbazone Compositions as Antiviral Agents	4,777,166 *
12/13/1988	Novel Antimalarial Dihydroartemisinin Derivatives	4,791,135 *
12/27/1988	Excito-Repellency Test System	4,794,549 *
2/28/1989	Method for Producing Protection in an Animal against Cyanide Poisoning Using 8-Aminoquinolines	4,808,598 *
9/5/1989	Method for Detecting Phosphatidylinositol through Binding to Concanavalin A	4,863,874 *
11/28/1989	Unsymmetrical Organic Disulfide Compounds Useful as Antiradiation Agents	4,883,890 *
12/5/1989	Monoclonal Antibodies to Cholesterol and Methods	4,885,256 *
1/30/1990	Antimalarial Compositions and Methods	4,897,403 *
3/6/1990	Antigenic Determinants Recognized by Antidotes Obtained Using a Pathogenic Agent or Derivative Thereof That Presents a Restricted Set of Antigens	4,906,564 *
3/20/1990	Transdermal Vapor Collection Method and Apparatus	4,909,256 *
7/24/1990	Unsymmetrical Organic Disulfide Compounds as Useful as Antiradiation Agents	4,943,657 *
7/31/1990	Oversize Laser Mailer and Return Envelope and Method	4,944,449 *
11/27/1990	Carbaphens: Aprophen Analogs That Are Binary Antidotes for Organophosphate Poisoning	4,973,734 *
12/18/1990	Organic Disulfide Compound Useful as Antiradiation Agents	4,978,782 *
2/12/1991	Simple Conversion of Artemisinic Acid into Artemisinin	4,992,561 *

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Walter Reed Army Institute of Research (cont.)		
3/12/1991	Phospholipid Compositions and Their Effective Use as Anti-tumor Agents	4,999,344*
3/19/1991	Device and Method for Providing Doses of a Liquid Material over Time to a Gut-associated Lymphoid Tissue or a Test Animal	5,000,732*
4/30/1991	Unique Bone Regeneration Tricalcium Phosphate	5,011,495*
6/25/1991	Carbaphens: Apropen Analogs That Are Binary Antidotes for Organophosphate Poisoning	5,026,897*
8/6/1991	Recombinant DNA Molecules for Producing Terminal Transferase-like Polypeptides	5,037,756
8/19/1991	Polypeptides Selectively Reactive with Antibodies against Human Immunodeficiency Virus and Vaccines Comprising the Polypeptides	6,248,574*
10/8/1991	Nucleic Acid Probe and Method for the Rapid Detection of Typhoid Fever Bacteria	5,055,394*
12/10/1991	Mouse Hybridoma Cell Lines Producing Antibodies Specific for <i>Clostridium difficile</i> Toxins	5,071,759*
12/24/1991	Insect Containing Test Apparatus	5,074,247*
12/31/1991	Photo Processing Work Station	5,077,570*
5/12/1992	Potential of Immunotoxin Action by Brefeldin A	5,112,607*
5/12/1992	Novel Antimalarial Dihydroartemisinin Derivatives	4,791,135*
6/6/1992	Surgical Clamp	3,667,471*
7/14/1992	Bis-Methylene Ether Pyridinium Compounds	5,130,438*
1/28/1992	Method for Producing a Vaccine against Bacterial Infections caused by <i>P. aeruginosa</i>	4,285,936*
4/6/1993	Anti-microbial Mafenide-Phosphanilate Compound, Pharmaceutical Compositions and Method of Use Therefor	5,200,320*
4/13/1993	Method for Treating Leishmaniasis (NIH rights)	5,202,320*
4/20/1993	Compounds Exhibiting Antiparasitic Activity and a Method for Their Use	5,204,352*
4/27/1993	Method for the Treatment of Malaria	5,206,236*
7/20/1993	Encapsulated Plant-derived Phosphatidylinositol Compositions for the Prevention of Mitogenically Induced Cell Proliferation	5,229,376*
8/24/1993	Hydrolytic Stabilizer for Unstable Organic Ions	5,238,927*

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Walter Reed Army Institute of Research (cont.)		
9/7/1993	Computer-driven Amino Acid Indexer for Peptide Synthesis	5,243,540*
11/2/1993	Synthesis and Use of Novel [-]-3-Substituted-N-Alkylmorphinans as Anticonvulsants and/or Antiischemic Agents	5,258,386*
1/25/1994	Heterocyclic and Aromatic Thiosemicarbazones Useful in the Treatment of Filariasis	5,281,597*
3/1/1994	Alkaloids of <i>Picralima nitida</i> Used for Treatment of Protozoal Diseases	5,290,553*
7/19/1994	1-Phenylalkancarboxylic Acid Derivatives as Anticonvulsant and Neuroprotective Agents	5,331,010*
9/27/1994	Absorbable Tissue Adhesives	5,350,798
3/21/1995	Method of Lysing Thrombi	5,399,158
5/16/1995	High Efficiency Balanced Oscillating Shuttle Pump	5,415,532
5/23/1995	Vaccines against Diseases Caused by Enteropathogenic Organisms Using Antigens Encapsulated within Biodegradable-Biocompatible Microspheres	5,417,986
9/20/1995	Nucleotide Sequences Encoding the Expression of Hantaan Virus Nucleocapsid Protein and the G1 & G2 Glycoproteins	5,298,423*
11/28/1995	Microsphere Drug Application Device	5,470,311
12/19/1995	Test for Quantitative Thrombin Time	5,476,771
3/29/1996	Process for Making Liposome Preparation	6,007,838*
12/14/1996	4-Methyl-5 (Unsubstituted and Substituted) Phenoxy-2,6-Dimethoxy-8-(Aminoalkylamino) Quinolines Sitamiquine	4,431,807*
5/6/1997	Transportable Life Support System	5,626,151
5/20/1997	Use of Sialidase Inhibitors in the Prevention and Treatment of Infectious and Inflammatory States	5,631,283*
6/20/1997	Improved Liposome Formulations	5,820,880*
8/26/1997	Drug Releasing Surgical Implant or Dressing Material	5,660,854
9/8/1997	Immunological Compositions	6,110,492*
12/2/1997	Microparticles of Maximal Uptake Capacity by Both M Cells and Non-M Cells	5,693,343

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Walter Reed Army Institute of Research (cont.)		
12/9/1997	Compositions for Use to Deactivate Organophates	5,695,750*
12/15/1997	Transdermal Delivery System for Antigen	5,910,306*
12/16/1997	Method for Production of Antigens under Control of Temperature-regulated Promotors in Enteric Bacteria	5,698,416
1/16/1998	Extraction Process for Producing PLGA Microspheres	5,705,197*
1/27/1998	Method of Treating Malaria with Desbutylhalofantane	5,711,966
2/10/1998	Solid Fat Nanoemulsions as Vaccine Delivery Vehicles	5,716,637
3/10/1998	Immuno-potentiating Systems for Preparations of Immunogenic Materials	5,726,292
4/7/1998	Infectious Japanese Encephalitis Virus cDNA Clones That Produce Highly Attenuated Recombinant Japanese Encephalitis Virus and Vaccines Thereof	5,736,148*
6/9/1998	Vaccines against Intracellular Pathogens Using Antigens Encapsulated within Biodegradable Biocompatible Microspheres	5,762,965
10/13/1998	Liposomal Formulation	5,820,880*
10/20/1998	Shigella Vector for Delivering DNA to a Mammalian Cell	5,824,538
6/8/1999	Transdermal Delivery System for Antigen	5,910,306
6/22/1999	Method of Raising Antibodies against <i>E. coli</i> of the Family CS4-CFA/I	5,914,114
6/29/1999	Advanced Surgical Suite for Trauma Casualties	5,916,096
6/29/1999	Peptide-containing Liposomes, Immunogenic Liposomes, and Methods of Preparation and Use	5,916,588
7/6/1999	Fiber Optic Periodontal Endoscope	5,919,129
8/17/1999	Mutants of <i>Brucella melitensis</i>	5,939,075
9/28/1999	Simple PCR Technique for Detecting and Differentiating Bacterial Pathogens	5,958,686
10/12/1999	Methods for Treating Antibiotic-resistant Infections	5,965,572*
10/26/1999	Drug Releasing Implant or Dressing Material	5,972,366*

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Walter Reed Army Institute of Research (cont.)		
11/9/1999	Adjuvant for Transcutaneous Immunization	5,980,898
11/16/1999	Lethal Mosquito Breeding Container	5,983,557
11/16/1999	Oral or Intranasal Vaccine Using Hydrophobic Complexes Having Proteosomes and Lipopolysaccharides	5,985,285
12/28/1999	Process for Making Liposome Preparations	6,007,838*
4/2/2000	Compositions Having Neuroprotective and Analgesic Activity	6,046,200
4/19/2000	Advanced Surgical Suite for Trauma Casualties	5,916,096*
5/23/2000	Use of Antibodies to Sialidase as Anti-infectious Agents and Anti-inflammatory Agents	6,066,323
6/13/2000	Recombinant Dengue Virus DNA Fragment	6,074,865
6/26/2000	Method for Treating Antibiotic-resistant Infections	5,965,572*
7/18/2000	Method for Production of Plasmodium Causing Relapsing Malaria	6,090,614
7/25/2000	Vaccine for Induction of Immunity to Malaria	6,093,406
8/29/2000	Method of Measuring Tumor Suppressor Gene p53	6,110,671
9/12/2000	Recombinant Vaccine Made in <i>E. coli</i> against Dengue Virus	6,117,640
9/26/2000	Protein Biomarker for Mustard Chemical Injury	6,124,108
11/21/2000	Prolonged Storage of Red Blood Cells	6,150,085
12/12/2000	Treatment or Prophylaxis of Retinal Pathology and Spinal Cord Injury	6,159,958
2/13/2001	Lethal Mosquito Breeding Container	6,185,861
2/20/2001	Method and Kit for Detection of Dengue Virus	6,190,859
4/10/2001	Diagnostic Methods for Cyclospora	6,214,548*
4/17/2001	Sustained-release Non-steroidal, Anti-inflammatory and Lidocaine PLGA Microspheres	6,217,911
6/5/2001	System and Method for Predicting Human Cognitive Performance Using Data from an Actigraph	6,241,686
6/12/2001	Invaplex from Gram Negative Bacteria, Method of Purification, and Methods of Use	6,245,892

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Walter Reed Army Institute of Research (cont.)		
6/19/2001	Polypeptides Selectively Reactive with Antibodies against Human Immunodeficiency Virus and Vaccines Comprising the Polypeptides	6,248,574*
7/3/2001	Inactivated Dengue Virus Vaccine	6,254,872
7/31/2001	Substituted Aromatic Compounds for Treatment of Antibiotic-resistant Infections	6,268,383
8/14/2001	Methods for Treating Antibiotic-resistant Infections	6,274,598
8/21/2001	Use of Purified Invaplex from Gram Negative Bacteria as a Vaccine	6,277,379
9/4/2001	Antileishmanial Composition for Topical Application	6,284,739
9/4/2001	Indolo[2,1,B] Quinazole-6,12-Dione Antimalarial Compounds and Methods of Treating Malaria Therewith	6,284,772
10/30/2001	An Attenuated Japanese Encephalitis Virus Adapted to Vero Cells and a Japanese Encephalitis Vaccine	6,350,650
10/30/2001	Therapeutic Treatment and Prevention of Infections with Materials Encapsulated within a Biodegradable-Biocompatible Polymeric Matrix	6,309,669
10/30/2001	Sequestrin of <i>Plasmodium falciparum</i>	6,310,046
11/13/2001	Method of Diagnosing of Exposure to Toxic Agents by Measuring Distinct Pattern in the Levels of Expression of Specific Genes	6,316,197
1/15/2002	Method and Compositions for Treating and Preventing Retinal Damage	6,339,102
3/5/2002	Icon for a Portion of a Display Screen	D454,140
5/21/2002	Lethal Mosquito Breeding Container	6,389,740
6/11/2002	Antifungal and Antiparasitic Compounds	6,403,576
6/18/2002	Immobilized Enzymes Biosensors for Chemical Toxins	6,406,876
6/25/2002	Antimicrobial-mediated Bacterial DNA Delivery	6,410,012
6/25/2002	Chemotherapeutic Treatment of Bacterial Infections with an Antibiotic Encapsulated within a Biodegradable Polymeric Matrix	6,410,056
6/25/2002	Compositions Having Neuroprotective and Analgesic Activity	6,410,537

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Walter Reed Army Institute of Research (cont.)		
7/16/2002	Method for Predicting Human Cognitive Performance	6,419,629
8/13/2002	Treatment of and/or Prophylaxis against Brain and Spinal Cord Injury	6,432,434
8/13/2002	Compositions Having Anti-leishmanial Activity	6,433,023
9/10/2002	Sustained Release Hydrophobic Bioactive Polylactic and Glycolic Acid Microspheres	6,447,796
9/10/2002	Prolonged Storage of Red Blood Cells	6,447,987
9/21/2002	Flavivirus Detection and Quantification Assay	60/453,956*
9/24/2002	Icon for a Portion of a Display Screen	D463,445
9/24/2002	Icon for a Portion of a Display Screen	D463,446
9/30/2002	Live Vaccine against Brucellosis	6,444,445
10/22/2002	Method of Treating, Preventing, or Inhibiting Central Nervous System Injuries and Diseases	6,469,049
1/28/2003	Attenuated Dengue-2 Virus Vaccine	6,511,667
2/4/2003	Recombinant Vaccine against Dengue Virus	6,514,501
3/4/2003	System and Method for Predicting Human Cognitive Performance Using Data from an Actigraph	6,527,715
3/4/2003	Attenuated Dengue-3 Virus Vaccine	6,528,065
3/4/2003	Sustained Release Non-steroidal, Anti-inflammatory, and Lidocaine pGA Microspheres	6,528,097
3/11/2003	Method and System for Predicting Human Cognitive Performance	6,530,884
3/11/2003	Indolo[2,1-B] Quinazole-6, 12-Dione Antimalarial Compounds and Methods of Treating Malaria Therewith	6,531,487
3/25/2003	Attenuated Dengue-4 Virus Vaccine	6,537,557
4/1/2003	Differentially Acting OP Detoxifying Sponges	6,541,230
4/22/2003	Method and System for Predicting Human Cognitive Performance	6,553,252
5/6/2003	Vaccine against Gram-negative Bacteria	6,558,677
6/3/2003	Previns as Specific Inhibitors and Therapeutic Agents for Botulinum Toxin B and Tetanus Neurotoxins	6,573,244
9/2/2003	Adaptation of Virus to Vertebrate Cells	6,613,556

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Walter Reed Army Institute of Research (cont.)		
9/30/2003	Digital Radiographic Sensor View Capture	6,628,751
10/28/2003	Multivalent Dengue Virus Vaccine	6,638,514
11/4/2003	Sequestrin of <i>Plasmodium falciparum</i>	6,641,815
11/4/2003	Preparation of Enzymatically Active Sponges or Foams for Detoxification of Hazardous Compounds	6,642,037
11/25/2003	Chemical Information Systems	6,654,736
12/16/2003	Antivesicant Compounds and Methods of Making and Using Thereof	6,664,280
1/6/2004	Multipurpose Self-erecting Structure Having Advanced Insect Protection and Storage Characteristics	6,672,323
3/16/2004	Reversed Amidines and Methods of Using for Treating, Preventing, or Inhibiting Leishmaniasis	6,706,754
3/30/2004	Buforin I as a Specific Inhibitor and Therapeutic Agent for Botulinum Toxin B and Tetanus Neurotoxins	6,713,444
5/25/2004	Method for Predicting Human Cognitive Performance	6,740,032
6/1/2004	Method and System for Predicting Human Cognitive Performance Using an Actigraph	6,743,167
6/8/2004	Assay for Detecting, Measuring, and Monitoring the Activities and Concentrations of Proteins and Methods of Use Thereof	6,746,850
6/22/2004	Protein Biomarker for Mustard Chemical Injury	6,735,155
6/29/2004	Use of Lipoyxygenase Inhibitors and PPAR Ligands as Anticancer Therapeutic and Intervention Agents	6,756,399
8/22/2004	High-level Expression of ETEC Colonization Factors in DME Broth	6,793,488
9/28/2004	Use of Penetration Enhancers and Barrier Disruption Agents to Enhance the Transcutaneous Immune Response	6,797,276
10/5/2004	Chemosensitizing Agents against Chloroquine-resistant <i>P. falciparum</i> and Methods of Making Use Thereof	6,800,618
10/13/2004	Mass Spectrometry of Colonization Factors	6,797,485

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Walter Reed Army Institute of Research (cont.)		
10/12/2004	Oral or Intranasal Vaccines Using Hydrophobic Complexes Having Proteosomes and Lipopolysaccharides	6,803,042
11/9/2004	Pharmaceutical Composition Containing pGlu-Glu-Pro-NH ₂ and Method for Treating Diseases and Injuries to the Brain, Spinal Cord, and Retina Using Same	6,815,425
11/17/2004	Immunologically Active Peptides Capable of Inducing Immunization against Malaria and Intact Genes Encoding Therefore and Method of Excising and Cloning Same	4,693,994*
11/30/2004	Compositions for Treatment of Hemorrhaging with Activated Factor VIIA in Combination with Fibrinogen and Methods of Using Same	6,825,323
11/30/2004	Trifluoromethylepinephrine Compounds and Methods of Making and Using Thereof	6,825,382
1/18/2004	Therapeutic Treatment and Prevention of Infections with Bioactive Materials Encapsulated within a Biodegradable-Biocompatible Polymeric Matrix	6,844,010
2/1/2005	System and Method for Detecting Visual Alertness	6,849,050
2/15/2005	Isolation and Purification of <i>P. falciparum</i> Merozoite Protein-142 Vaccine	6,855,322
2/15/2005	Sustained Release Hydrophobic Bioactive PLGA Microspheres	6,855,331
9/24/2002	Attenuated Dengue-4 Virus Vaccine	6,537,557
2/15/2005	Development of <i>E. coli</i> Expressed Recombinant MSP142 as a Vaccine for Malaria	6,855,322
2/15/2005	Taxol Microencapsulation into Poly-lactic and Glycolic Acid and Copolymer: Biodegradable Drug	6,855,331
3/22/2005	Prevention and/or Treatment of Human Enterotoxigenic <i>Escherichia coli</i> Infections with Bovine Erythrocytic Fractions	6,869,602
3/29/2005	Conjugate Vaccine against Gram-negative Bacterial Infections	6,872,398
5/31/2005	Induction and Detection of Antibodies to Squalene	6,900,025
6/14/2005	Steroidal Mixed Tetraoxanes as Antimalarial Drugs	6,906,098

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Walter Reed Army Institute of Research (cont.)		
9/6/2005	Model for Testing Immunogenicity of Peptides	6,939,546
10/4/2005	Artemisinins with Improved Stability and Bioavailability for Therapeutic Drug Development and Application	6,951,846
9/6/2005	Drug Releasing Surgical Implant or Dressing Material	5,972,366*
3/7/2006	A Novel and Practical Serological Assay for the Clinical Diagnosis of Leishmaniasis	7,008,774
3/7/2006	Digital Radiography Sensor, Occlusal Positioning Device	7,010,089
9/28/2006	Vaccine against Gram-negative Bacterial Infections	7,018,636
4/11/2006	Vaccine against Gram-negative Bacterial Infections	7,025,963
4/25/2006	Novel Burst-free Sustained Release Poly (lactide/glycolide) Microspheres	7,033,608
4/28/2006	Process for Purification of Recombinant <i>Plasmodium falciparum</i> AMA-1 from <i>E. coli</i>	7,029,685
5/2/2006	Transdermal Immunization with Cholera Toxin	7,037,499
5/16/2006	Bacterial Delivery System	7,045,336
6/13/2006	Process for Purification of Recombinant <i>Plasmodium falciparum</i> AMA-1 from <i>E. coli</i>	7,060,276
5/16/2006	Cross-reaction and Cross-protection of CS4-CFA/1 Family of Enterotoxigenic <i>E. coli</i> (ETEC) Fimbriae	7,094,883
9/5/2006	Synthesis and Prophylactic Antimalarial Activities of Biguanide Derivatives	7,101,902
9/26/2006	Oral or Intranasal Vaccines Using Hydrophobic Complexes Having Proteosomes and Lipopolysaccharides	7,112,332
10/10/2006	A Method for Obtaining CS6 Proteins from Recombinant Bacteria	7,118,758
12/19/2006	Process for Expression and Purification of <i>Plasmodium vivax</i> MSP1-P42 Expressed in <i>Escherichia coli</i>	7,150,875

*List as of March 2, 2007.

In addition to the technology development activities of the U.S. Army Medical Research and Materiel Command (USAMRMC) laboratories and the U.S. Army Medical Materiel Development Activity, USAMRMC has a medical procurement-oriented component—the U.S. Army Medical Materiel Agency (USAMMA). In many cases, USAMMA helps commercial vendors design and produce medical equipment items that meet military needs. Procurement of new technology has two main purposes—the modernization (upgrades) and augmentation (new capabilities) of equipment sets. The following list highlights recent commercial technology procurement actions.¹ Accelerated procurements to support Operation Iraqi Freedom demonstrated the Command's responsiveness to operational requirements.

Product Category	Product Description
Blood and Fluid Warming System	The blood and fluid warming system is portable and battery operated. The system can be attached close to the patient, below the current fluid pump. A portable pump that goes with the warmer is also available. The warmer can be purchased separately.
Blood Collection Device	A blood collection device supports the collection and preparation of single-donor blood products to include platelets, red blood cells, and plasma.
Dental Equipment	A portable dental ultrasonic scaler is used for periodontal debridement. The system automatically drives the insert at its natural harmonic frequency, the point of maximum tip stroke; automatically adjusts system power to maintain tip stroke compensating for clinical load and conditions; allows for “cruise control” with finer control of power to deliver perfectly tuned performance every time; and delivers consistent tip stroke while enabling quick insert changes to maximize instrument adaptability. The scaler will be used in conjunction with the Dental Electric Field Treatment and Operating System III for preventive dental services supporting divisional units and in Combat Support Hospitals.

Product Category	Product Description
Gas Analyzer	A handheld gas analyzer accepts unique testing chips to detect the presence of various gases and vapors. The analyzer takes as little as 20 seconds to report results. Up to 50 measurements can be stored in the handheld unit. The Army system comes with the handheld unit, remote analyzer, a hardened case, and 13 testing chips: 1 for testing and 12 different gases.
Gas Detector	A photo-ionization detector with standard gas detectors detects the lower explosive limit, oxygen, carbon monoxide, and sulfur dioxide. All of this is in a single compact monitor with a sampling pump. The unit can be used as a personal monitor, a handheld sniffer, or as a continuous operation area monitor.
Heat Stress Monitor	A portable heat stress monitor incorporating wet-bulb globe temperature (WBGT)-sensing technology calculates and displays a WBGT index value based on ambient air temperature, humidity, air flow, and radiant heat. The monitor also automatically determines the stay times or work-rest regimen for the environment. The Army configuration comes with the standard accessories and one sensor bar assembly with a 2" globe style sensor.
Ophthalmology Surgical Instrument	An ophthalmology surgical instrument is used by a trained ophthalmologist to repair injuries or correct disease of the anterior eye. The technology transforms traditional ultrasound into digitally modulated phaco energy in microbursts and cooling microrests. This allows for less energy to be directed into the eye while continuing to maintain cutting efficiency. Turbulence and chatter are dramatically reduced, thus decreasing the repulsion of nuclear fragments and requiring less time and energy to engage fragments. Additionally, micro-processor sensors digitally monitor anterior chamber conditions, ensuring chamber stability and significantly reducing postocclusion surges.
Portable Sterilizer	Portable sterilizers will be used to equip the forward surgical team with a small and light steam sterilizer. This product is in dental sets.
Tissue Processor	The Automatic Lab tissue processor is a multifunctional, microwave-accelerated tissue processor with rapid operation that will allow laboratories to process tissue "on demand," dramatically reducing specimen turnaround time.

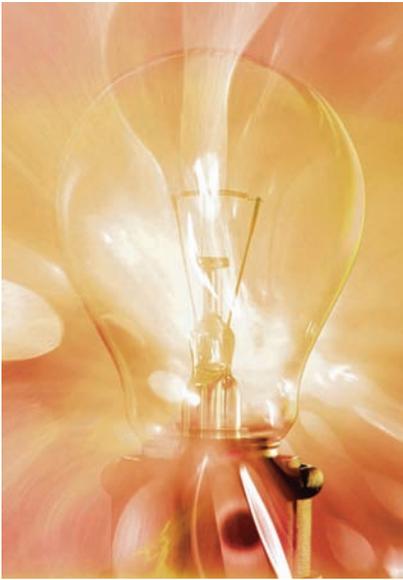
¹ Operational fielding data are as of March 2007.



Appendix C

**Small Business Innovation Research
Phase II Projects**





The Small Business Innovation Research (SBIR) program is a congressionally mandated program that was established in 1982 to increase the participation of small businesses in federal research and development (R&D). The goal of the dual-use SBIR program is to tap into the innovativeness and creativity of the small business community to help meet government R&D objectives. At the same time, these small companies develop technologies, products, and services that they can then commercialize through sales in the private sector or back to the government.

Successful SBIR projects move through three phases:

- ◆ Proposals are submitted against a set of topic requirements written by Army scientists and technologists and are published in an annual solicitation. Phase I is the entry point where a company proves the feasibility of its concept in 6 months for up to \$70,000. An option for up to \$50,000 is available to fund interim Phase I–Phase II activities if the project is selected to receive a Phase II award. Approximately 1 in 10 Phase I concepts is selected for award.
- ◆ Phase II is a substantial R&D effort, up to \$730,000 over 2 years, and is intended to result in a dual-use technology, product, or service. Approximately 50 percent of invited Phase II proposals are selected for award.
- ◆ Phase III, the commercialization phase, is the goal of every SBIR effort. In Phase III, the successful company markets its dual-use product or service to the government, the private sector, or both. No SBIR funding is provided in Phase III.

Current SBIR Phase II projects and their objectives are as follows.

A05-130 TITLE: Development of Pre- and Post-Exposure Neural Protectants against Organophosphorus (OP) Compounds Based on Novel and Specific Biochemical Markers of OP Exposure
OBJECTIVE: Develop pre- and post-exposure neural protectants against OP compounds based on novel and specific biochemical markers of OP exposure.

A05-131 TITLE: Chemical Casualty Care: Wound Dressings Designed to Speed Wound Closure following Debridement of Cutaneous Vesicant Injuries
OBJECTIVE: Design and manufacture a wound dressing that can be placed over vesicant burns that have been debrided of damaged tissue to greatly enhance the rate of wound closure.

A05-161 TITLE: Development of Advanced Military Prosthetic Shoulder System
OBJECTIVE: Design and build a prosthetic shoulder system that can be deployed in military environments, which can function easily through multiple planes of motion under loaded conditions, using a lightweight material design with customized body fitting to support consistent control of the system.

A05-162 TITLE: Field Deployable Electroencephalogram (EEG) for Assessing Nonconvulsive Seizures
OBJECTIVE: Design and build, or acquire, an inexpensive portable detector suitable for far-forward use by combat medics and Navy corpsmen, which noninvasively and reliably tells an operator whether or not a patient is experiencing electrical seizure activity.

A05-163 TITLE: Digital Wound Detection System
OBJECTIVE: Develop a warfighter-wearable, low-power detection system that can process the signals associated with a wounding event and report the location and severity of the resultant trauma.

A05-166 TITLE: Development of a High-throughput Molecular Differentiation Device
OBJECTIVE: Adapt state-of-the-art technology to develop a diagnostic system capable of simultaneously detecting and identifying up to 100 militarily relevant pathogens or targets from human blood or serum samples.

A05-167 TITLE: Rapid, Lightweight, and Compact Heat Sterilization of Medical and Dental Instruments in Forward and Theater Medical and Dental Units

OBJECTIVE: Develop a lightweight and compact portable sterilization system that uses steam to rapidly sterilize medical and dental instruments without a requirement for external water or power sources. The device will sterilize medical, dental, or optionally other biocontaminated articles within flexible (bags) or rigid enclosures.

A05-168 TITLE: Robotic Bioagent Detector for Combat Casualty Care and Force Protection

OBJECTIVE: Design a prototype robotic field bioagent detection and identification system capable of autonomous or teleoperation; integrate the system with and implement it on the emerging family of Joint Architecture for Unmanned Systems-compliant unmanned ground vehicles intended for medical force health protection and combat casualty care missions.

A05-170 TITLE: Enhanced Detection, Containment, and Treatment of *Acinetobacter baumannii* Infections

OBJECTIVE: To design and implement an intervention model for reducing morbidity and mortality due to *Acinetobacter baumannii* infections in medical treatment facilities, including U.S. military treatment facilities.

A05-171 TITLE: Enhanced DNA Vaccine Delivery to Protect against Biothreat Agents

OBJECTIVE: Develop a nonviral DNA delivery system to convey vaccine candidate(s) that target biothreat agents or their toxic products. To vaccinate with DNA-encoding bacterial (vegetative cell or spore) or viral proteins or toxic antigens to target different pathogens as well as different stages during infection with one pathogen.

A05-172 TITLE: Compartment Syndrome Simulator

OBJECTIVE: Develop proof-of-concept and design, build, and demonstrate a personal computer-based simulation training system replicating compartment syndrome of the lower extremity to assist in training military and civilian health care professionals in establishing timely diagnosis and performance of complete, anatomically appropriate compartment releases.

A05-175 TITLE: Chloroplast Genetic Engineering to Produce Diagnostic Antigens and Vaccines

OBJECTIVE: Develop a strategy and methods for the rapid production of antigens in transgenic plant chloroplasts for use in diagnostic assays or vaccines.

A05-176 TITLE: Field-expedient Combat Load Assessment Device

OBJECTIVE: Develop a state-of-the-art scale that deployed light infantry units can use at the platoon level to quantify the loads warfighters carry into the field for either training or combat missions.

A05-177 TITLE: Targeted Therapy for Neoplastic Diseases

OBJECTIVE: Develop a nanoencapsulated transposon for the targeted treatment of disease.

A05-179 TITLE: Generation of Stable Eukaryotic Cell Lines Expressing High Yields of Therapeutic Human Antibodies against Biowarfare Viral Threat Agents

OBJECTIVE: Engineer an expression system for the generation of stable eukaryotic cell lines that express high levels of therapeutic human antibodies against biowarfare viral threat agents using a process that is both rapid and cost-effective compared to existing methods, permits rapid optimization of large-scale fermentation processes to achieve maximum antibody production yields, and generates clinical-grade, quality material using Good Laboratory Practice manufacturing standards.

A05-180 TITLE: Pre-hospital Trauma Data Collection and Mining

OBJECTIVE: Collect continuous pre-hospital physiologic data of civilian trauma casualties and analyze the data to determine key predictive and diagnostic features for forecasting militarily relevant clinical outcomes.

A05-181 TITLE: Development of a Serum-based Biomarker for the Detection of Prostate Cancer

OBJECTIVE: Develop, design, evaluate, and validate innovative screening assays for early detection and monitoring of prostate cancer in blood or serum samples.



Appendix D

List of Acronyms



A

AAS	Advanced Anticonvulsant System
ACCLS	Automated Critical Care Life Support
ACHD	Active Component Hospital Decrement
AFRIMS	Armed Forces Research Institute of Medical Sciences
AGULVE	Aerosol Generator, Ultra-Low Volume, Electric
AHLTA	Armed Forces Health Longitudinal Technology Application
AMEDD	Army Medical Department
AMTT	Advanced Medic Training Technologies
APPMO	Army PACS Program Management Office
ARD	Acute Respiratory Disease
ARFORGEN	Army Force Generation
ASER	AMEDD Suicide Event Report
AST	Advanced Surgical Technologies
ATNAA	Antidote Treatment Nerve Agent Autoinjector
ATR	Active Thermal Resuscitation

B

BAA	Broad Agency Announcement
BMIST	Battlefield Medical Information System-Tactical
BMIST-J	Battlefield Medical Information System Tactical-Joint
BW	Biological Warfare

C

CANA	Convulsant Antidote for Nerve Agent
CASEVAC	Casualty Evacuation
CASIT	Center for Advanced Surgical and Interventional Technology
CAT	Combat Application Tourniquet
CaTS	Clinical and Technical Support
CBRNE	Chemical, Biological, Radiological/Nuclear, and Explosive
CBT	Computer-based Training
CCFP	Combined Camouflage Face Paint
CDE	Common Development Environment
CDM	Clinical Data Mart

CDMP	Comprehensive Diabetes Management Project
CDMRP	Congressionally Directed Medical Research Programs
CeMBR	Center for Military Biomaterials Research
CEP	Communications Earplug
CIMERC	National Bioterrorism Civilian Medical Response Center
CIMIT	Center for Integration of Medicine and Innovative Technology
CMGEE	Credant Mobile Guardian Enterprise Edition
COG	Ceramic Oxygen Generator
CRADA	Cooperative Research and Development Agreement
CSEA	Combat Support Equipment Assessment
CT	Computed Tomography
CW	Chemical Warfare

D

DEFTOS	Dental Field Treatment and Operating System
DIN-PACS	Digital Imaging Network-Picture Archiving and Communications System
DoD	U.S. Department of Defense
DTRA	Defense Threat Reduction Agency
DTV	Dengue Tetraivalent Vaccine

E

EEE	Eastern Equine Encephalitis
EIC	Electronic Information Carrier
EMS	Emergency Medical Services
EPA	U.S. Environmental Protection Agency
ESB	Environmental Sentinel Biomonitor
ESD	Enterprise Service Desk
ESSENCE	Electronic Surveillance System for the Early Notification of Community-based Epidemics
ETEC	Enterotoxigenic <i>Escherichia coli</i>
EUL	Enhanced Use Lease
EWA	Enterprise Web AMEDD E-Forms System Support

F

FCBC	Field Management of Chemical and Biological Casualties
FDA	U.S. Food and Drug Administration
FFW	Future Force Warrior
FIBWA	Field Identification of Biological Warfare Agents
FIRM	Fatigue Intervention and Recovery Model
FMOGDS	Field Medical Oxygen-Generating and Distribution System
FMSS	Future Medical Shelter System

G

GEIS	Global Emerging Infections System
GMP	Good Manufacturing Practice
GSK	GlaxoSmithKline

H

HBOC	Hemoglobin-Based Oxygen Carrier
HEV	Hepatitis E Virus
HFRS	Hemorrhagic Fever with Renal Syndrome
HIFU	High Intensity Focused Ultrasound
HIV	Human Immunodeficiency Virus
HSD	Hypertonic Saline Dextran
HSDs	Head-Supported Devices

I

I&Ws	Indications and Warnings
iABS	intelligent Aquatic Biomonitoring System
IAVA	Information Assurance Vulnerability Alert
IAVM	Information Assurance Vulnerability Management
IM	Information Management
IT	Information Technology
ITD	Impedance Threshold Device

J

JBAIDS	Joint Biological Agent Identification and Diagnostic System
JPMO	Joint Product Management Office
JVAP	Joint Vaccine Acquisition Program

L

LSTAT	Life Support for Trauma and Transport
-------	---------------------------------------

M

MANAA	Medical Aerosolized Nerve Agent Antidote
MCBC	Management of Chemical and Biological Casualties
MCC	Microclimate Cooling
MC4	Medical Communications for Combat Casualty Care
MEDCOM	U.S. Army Medical Command
MEDNOSC	Medical Network Operations and Security Center
MEM	MEDCOM Enterprise Management
MHS	Military Health System
MIDRP	Military Infectious Diseases Research Program
MITS	Medical Identification and Treatment Systems
MMRP	Medical Materiel Readiness Program
MM&S	Medical Modeling and Simulation
MOMRP	Military Operational Medicine Research Program
MOPP	Mission-Oriented Protective Posture
MRAP	Mine Resistant Ambush Protected
MRDD	Malaria Rapid Diagnostic Device
MSTI	Medical Simulation Training Initiative
MTFs	Military Treatment Facilities
MTTS-A	Medium Troop Transport System-Ambulance
MUSTPAC	Medical Ultrasound, Three-Dimensional, Portable with Advanced Communications
MV-E	Medical Vehicle–Evacuation
MV-T	Medical Vehicle–Treatment

N

NAAK	Nerve Agent Antidote Kit
NIAID	National Institute of Allergy and Infectious Diseases
NMRC	Naval Medical Research Center
NOS/EM	Network Operating System/Electronic Messaging

P

PACS	Picture Archive and Communications Systems
PC	Personal Computer
PCA	Patient-Controlled Analgesia
PDA	Personal Digital Assistant
PFB	Pseudofolliculitis Barbae
PIC	Personal Information Carrier
PM	Program Manager
P/PDHA	Pre/Post-Deployment Health Assessment
PPE	Personal Protective Equipment
PUMA	Programmable Universal Manipulation Arm
PVT	Psychomotor Vigilance Task

R

RBCXL	Red Blood Cells, Extended Life
RSDL	Reactive Skin Decontamination Lotion
RVPSOG	Rotary Valve Pressure Swing Oxygen Generator

S

S3	Surgery Scheduling System
SAPS	Stand Alone Patient Simulator
SBIR	Small Business Innovation Research
SDC	Sample Data Collection
SEA	Staphylococcal Enterotoxin A
SEB	Staphylococcal Enterotoxin B
SERPACWA	Skin Exposure Reduction Paste against Chemical Warfare Agents

SMART-HS	Special Medical Augmentation and Response Teams – Health Systems
SMEED	Special Medical Emergency Evacuation Device
SNAPP	Soman Nerve Agent Pretreatment Pyridostigmine
SOFMH	Special Operations Forces Medical Handbook
STATCare	Simulation Technologies for Advanced Trauma Care
STDs	Sexually Transmitted Diseases
STS	Severe Trauma Simulation

T

TAIHOD	Total Army Injury Health and Occupational Database
TARA	Technology Assessment and Requirements Analysis
TATRC	Telemedicine and Advanced Technology Research Center
TC3	Tactical Combat Casualty Care
TEWLS	Theater Enterprise-Wide Logistics System
TGAS	Toxic Gas Assessment Software
TMIP	Theater Medical Information Program
TOP	Training, Overuse Injury, and Performance
TURP	Transurethral Resection of the Prostate

U

UAV	Unmanned Aerial Vehicle
URL	USAMMA Revolution in Logistics
USAARL	U.S. Army Aeromedical Research Laboratory
USACEHR	U.S. Army Center for Environmental Health Research
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAHFPA	U.S. Army Health Facility Planning Agency
USAISR	U.S. Army Institute of Surgical Research
USAMITC	U.S. Army Medical Information Technology Center
USAMMA	U.S. Army Medical Materiel Agency
USAMMCE	U.S. Army Medical Materiel Center–Europe
USAMMDA	U.S. Army Medical Materiel Development Activity

USAMRICD	U.S. Army Medical Research Institute of Chemical Defense
USAMRIID	U.S. Army Medical Research Institute of Infectious Diseases
USAMRMC	U.S. Army Medical Research and Materiel Command
USAMRU-E	U.S. Army Medical Research Unit-Europe
USARIEM	U.S. Army Research Institute of Environmental Medicine

V

VA	U.S. Department of Veterans Affairs
VEE	Venezuelan Equine Encephalitis
VIG	Vaccinia Immune Globulin
VNC	Video Network Center
VR-Demo	Virtual Reality Demo

W

WebRSIS	Web-Enabled Refractive Surgery Information System
WEE	Western Equine Encephalitis
WPSM	Warfighter Physiological Status Monitor
WRAIR	Walter Reed Army Institute of Research
WRESP	Warfighter Refractive Eye Surgery Program



Appendix E

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