Chemical and Biological Defense
CBIAC Information Analysis Center Newsletter
Spring 2004 Volume 5 Number 2
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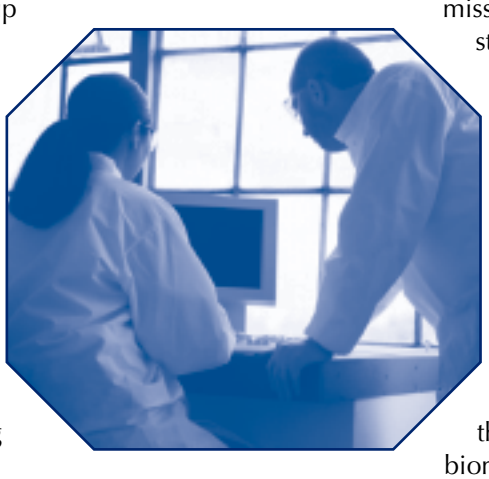
New Institute to Bring Benefits of Non-Medical Biotechnology Research to the Warfighter

Kevin P. O'Connell, Ph.D. and James J. Valdes, Ph.D.

The Army kicked off the new Institute for Collaborative Biotechnologies (ICB) in a ceremony held on February 5th, 2004 at the University of California, Santa Barbara (UCSB). The ICB, funded for five years, is a partnership that includes researchers at UCSB, the Massachusetts Institute of Technology (MIT), and the California Institute of Technology (Caltech). A number of industrial partners are also receiving and developing technologies transferred from the university laboratories.

The ICB effort complements the Army's overall effort to integrate biotechnology and its products into the Future Force. The U.S. Army Research Development and Engineering Command has established a Biotechnology Working Group whose charter is to look across all of the Army's Force Operational Capabilities and to see where biotechnology can provide superior solutions to mission requirements. The ICB is a critical element of this strategy. Structured as a University Affiliated Research Center, the ICB will focus on sensors and networks and will transition technology into the Army's technical base. Long-term, these innovative approaches will result in flexible, self-healing sensor networks for a myriad of battlefield applications, among other technologies.



Robert Campbell, the Army Research Office (ARO) program officer for the ICB grant, took inspiration from the fact that biology uses precise mechanisms to produce exquisitely structured materials, and that coordination of biological function at the molecular, cellular and systems level takes place by remarkably effective communication and information transfer. "The promise here is for providing unique enabling technology for more advanced integrated circuits for high-performance sensing, computing and information processing, and actuation than are used in existing manufacturing. This synthesis of high performance materials is accomplished with a precision of nanoscale-architectural control that exceeds the capability of current engineering, particularly in the designing and sculpting of materials in three-dimensions. Likewise, the integration of component function in biological systems is astonishing, so the lessons learned here are sure to have strong impact on engineered information processing systems integration as well." Campbell added, "The idea is to understand biological mechanisms and to harness them for design and fabrication of new materials, devices and systems performance to equip the Army of the 21st century. But the benefit to the United States is more than military."

Jim Chang, ARO director, expressed a similar opinion. According to Chang, the aim in setting up the ICB is to improve dramatically the effectiveness of the Army by creating a single conduit for developing, assessing and adapting new products and new biotechnologies in direct support of the Army's mission. Chang also pointed out that the ICB strongly leverages on the Army's behalf investments in biotechnology research by government research funding agencies such as the National Science Foundation and the National Institutes of Health.

The ICB is led by Daniel Morse, chair of the UCSB Biomolecular Science and Engineering Program and a professor of molecular genetics and biochemistry, who serves as director of the new institute. Morse is well-known for discoveries that helped inaugurate the emerging field of nano-biomolecular and biomimetic materials synthesis. A distinguishing feature of such synthesis is that it takes place at temperatures and pressures, and with molecular precursors, that are compatible with living organisms. In contrast, many present manufacturing processes entail extraordinary conditions of temperature or deleterious chemicals or a sterile environment. One of the model systems that exemplifies the approach is the synthesis of silicon microstructures by a marine sponge.

Silicon does not exist in nature in its free form, but is normally present in rocks as silica (i.e., sand in one form, glass in another). The rocks are melted and milled to extract the silicon that is then made into computer chips or incorporated into silicon-based polymers analogous to the more familiar carbon-based polymers. Morse and his colleagues have discovered that the fiberglass silica needles of a marine sponge are made by a protein they have dubbed silicatein, which both catalyzes

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U.S. Government agencies and private industry under contract to the U.S. Government can contact the CBIAC for information products and services. CBIAC services also extend to all state and local governments and the first responder community, to include local emergency planners, firefighters, medics and law enforcement personnel.

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The ***CBIAC Newsletter***, a quarterly publication of the CBIAC, is a public release, unlimited distribution forum for chemical and biological defense information. It is distributed in hardcopy format and posted in Portable Document Format (PDF) on the CBIAC Homepage.

The CBIAC welcomes unsolicited articles on topics that fall within its mission scope. All articles submitted for publication consideration must be cleared for public release prior to submission. The CBIAC reserves the right to reject or edit submissions. For each issue, articles must be received by the following dates: Winter (First Quarter) - November 1st; Spring (Second Quarter) - February 1st; Summer (Third Quarter) - May 1st; Fall (Fourth Quarter) - August 1st.

All paid advertisements and articles are subject to the review and approval of the CBIAC COTR prior to publication. The appearance of an advertisement or article in the *CBIAC Newsletter* does not constitute endorsement by the DoD or the CBIAC.

The CBIAC is located in building E3330, Room 150, Aberdeen Proving Ground-Edgewood Area, Maryland 21010. For further information or assistance, visit or contact the CBIAC.

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History Notes

Chemical & Biological Warfare Research & Development During The Civil War

By Jeffery K. Smart, Command Historian, U.S. Army RDE Command.

The Civil War proved to be a fertile time for research and development of experimental chemical and biological weapons and protective equipment. Many of these inventions and concepts proposed during the war were the forerunners of similar items used on a much larger scale during World War I, the first major war that included the use of chemical and biological weapons.

CHEMICAL WARFARE

Chemical Warfare Agents

Many of the key chemical warfare agents used during World War I were 18th and 19th century discoveries known to chemists prior to the Civil War. The following chemical warfare agents were discovered or synthesized prior to 1861:

- Chlorine (1774)[1]
- Hydrogen Cyanide (1782)[2]
- Cyanogen Chloride (1802)[3]
- Phosgene (1812)[4]
- Mustard Agent (1822)[5]
- Cacodyl (1837)[6]
- Chloropicrin (1848)[7]

Sulfur and Sulfuric Acid. In addition to the key World War I chemical warfare agents, sulfur, an ingredient of gunpowder, produced noxious fumes and was considered a potential chemical weapon. In 1861, the Confederacy had several hundred tons of sulfur stored in New Orleans for sugar refining. Charlotte, NC, had a factory that produced sulfuric acid for use to make nitric acid, which in turn was used to make mercury fulminate, used in percussion caps. In the North, there were sulfuric acid plants in operation in Pennsylvania, New Jersey, and Massachusetts that produced approximately 40,000 tons per year.[8]

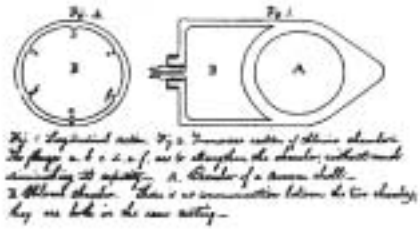
Chemical Warfare Proposals and Use

Although many of the chemical warfare agents were identified prior to the war, only a few of the chemicals were proposed for use on the battlefield during the war. These were generally the chemicals well known to industry and medicine.

Poison Gas From Balloon. In 1861, Confederate Private Isham Walker wrote a letter to Lucius Walker, the Secretary of War, proposing that poison gas be used against Fort Pickens and the Federal ships guarding it near Pensacola, FL. To deliver the poison gas, Walker proposed using a gas balloon. His plan was not accepted.[9]

Chlorine Shell. On April 5, 1862, the same day the Union Army began siege operations against the extensive Confederate fortifications at Yorktown, VA, John W. Doughty, a New York City schoolteacher, wrote to Secretary of War Edwin M. Stanton suggesting that 10-inch artillery shells filled with liquid chlorine gas be used against the Confederates. He envisioned:

> *If the shell should explode over the heads of the enemy, the gas would, by its great specific gravity, rapidly fall to the ground: the men could not dodge it, and their first intimation of its presence would be by its inhalation, which would most effectually disqualify every man for service that was within the circle of its influence; rendering the disarming and capturing of them as certain as though both their legs were broken.*



Doughty's Chlorine Shell (National Archives)

He also pointed out that chlorine shells would be particularly effective against ironclads and steam rams, creating an atmosphere that would make the "inmates to be more anxious about their own safety than about the destruction of their enemy." The lack of persistency of chlorine was also a benefit:

> *It may be asked if the gas which drove the enemy from his guns, would not prevent the attacking party who used the gas, from taking possession of the abandoned position. I answer it would not: for, this shell does not like the Chinese stink-pots, deposit a material emitting a deleterious gas lighter than the atmosphere, but suddenly projects into the air, a free gas much heavier than the atmosphere, which does its work as it descends to the earth, where it is soon absorbed.*

The proposed shell had two compartments: one filled with two or three quarts of chlorine and the other with explosives. This principle of gas compressed in a chemical chamber released by the action of a bursting charge became the standard for chemical weapons of the Twentieth Century. He enclosed a drawing of the proposed shell in his letter.

The moral question of using chemical weapons was also addressed in his letter since he thought the shells would save the lives of the attackers and defenders. He concluded:

> *As to the moral question involved in its introduction, I have, after watching the progress of events during the last eight months with reference to it, arrived at the somewhat paradoxical conclusion, that its introduction would very much lessen the sanguinary character of the battlefield, and at the same time render conflicts more decisive in their results.*

Continued pg. 11

Contract Awards • *by Mary Frances Tracy*

Synthesis and In Vitro Analysis of Promising Antivirals for Hantaviruses
Southern Research Institute
Birmingham, AL
$3,987,925 December 22, 2003
By U.S. Army Medical Research Acquisition Activity, Frederick, MD

Develop Proprietary Molecules that Activate the Immune System
Corxia Corp.
Seattle, WA
$11,600,000 January 5, 2004
By National Institute of Allergy and Infectious Diseases, Bethesda, MD

Food and Waterborne Diseases Integrated Research Network, Clinical Research Unit
University of Maryland
Baltimore, MD
$7,327,580 February 17, 2004
By Department of Health and Human Services, National Institutes of Health, National Institutes of Allergy and Infectious Diseases, Bethesda, MD

Two Prototype Electrochemical Detector Systems
CombiMatrix Corp.
Mukilteo, WA
$3,245,000 (Increment as part of a $5,880,588 contract)
March 5, 2004
By U.S. Army Robert Morris Acquisition Center, Aberdeen Proving Ground, MD

Technical Support for a Prospective Cohort Study: Health Effects of Microbial Pathogens in Recreational Waters
WESTAT, Inc.
Rockville, MD
$15,114,074 March 9, 2004
By RTP Procurement Operations Division, Research Triangle Park, NC

Transform Research Programs to Exploit Emerging Scientific Opportunities to be More Responsive to DoD Needs
Rice University
Houston, TX
Drexel University; Philadelphia, PA
University of California at Berkeley; Berkeley, CA
$2,800,000 in fiscal 2004 (Up to $14.7 million over five years) March 09, 2004
By United States Department of Defense

Environmental Anthrax Decontamination
NanoBio Corp.
Ann Arbor, MI
$70,000 March 12, 2004
By U.S. Environmental Protection Agency, Washington, DC

Triangulation Identification Genetic Evaluation of Risks (TIGER) Biosensor System
Ibis Therapeutics
Carlsbad, CA
$19,500,000 March 12, 2004
By Defense Advanced Research Projects Agency, Arlington, VA

Handheld CB Aptamer Based MEMES Fluorescence Point Detection
Omnisite Biodiagnostics, Inc.
Austin, TX
$735,267 April 1, 2004
By Department of the Navy, Office of Naval Research, Arlington, VA

High Throughput Sample Preparation for Detection of Bio-Agents in Water
Palo Alto Research Center, Inc.
Palo Alto, CA
$94,656 April 1, 2004
By Robert Morris Acquisition Center, Research Triangle Park, NC

Anti-terrorism Force Protection Measures at Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility
Alan Shintani, Inc.
Honolulu, Hawaii
$6,457,000 April 7, 2004
By U.S. Naval Facilities Engineering Command, Pacific Division, Pearl Harbor, HI

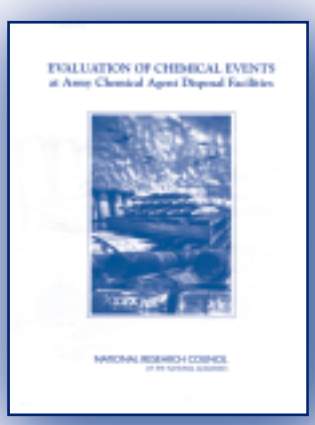
Technical and Scientific Support and Applied Research Effort in Support of the Human Effectiveness Directorate and Biosciences and Protection Division of the Air Force Research Laboratory, Wright-Patterson Air Force Base, OH
Veridian Engineering
Buffalo, NY
$26,800,000 (indefinite delivery/indefinite quantity)
April 8, 2004
By U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base, OH

Design, Construction and Installation of the Guardian Installation Protection Program Lead Systems Integrator
Science Applications International Corp.
San Diego, CA
$26,426,000 April 28, 2004
By U.S. Army Space and missile Defense Command, Huntsville, AL

New CBIAC Information Resources • *By Richard M. Gilman*

Books

Committee on Evaluation of Chemical Events at Army Chemical Agent Disposal Facilities, National Research Council. **Evaluation of Chemical Events at Army Chemical Agent Disposal Facilities.** Washington, DC: National Academy Press, 2002.



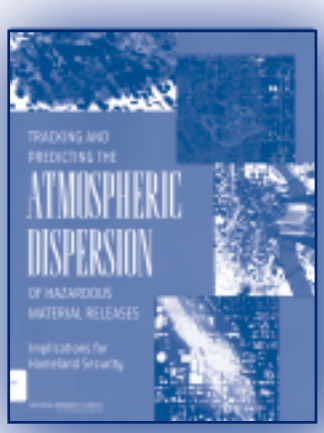
Since 1990 the Army's Program Manager for Chemical Demilitarization has been engaged in the destruction of America's chemical weapons stockpile. To date, about a quarter of that stockpile has been successfully destroyed. However, there have been a number of chemical incidents resulting in leaks into the atmosphere surrounding the demil facilities or higher levels of chemical agents or there constituents within the demilitarization plants themselves.

These events raised concerns among public officials and citizens about the safety of the demilitarization processes. As a result, the National Research Council was tasked to review and assess both technological and management aspects of the chemical agent demilitarization process. This report is a statement of their findings.

CB-190165 • ISBN 0-309-08629-9
National Academy Press • Box 285
2101 Constitution Ave., N.W. • Washington, DC 20055
Phone: 1-800-624-6242 or 202-334-3313
http://www.nap.edu

Committee on the Atmospheric Dispersion of Hazardous Material Releases Board on Atmospheric Sciences and Climate. National Research Council. **Tracking and Predicting the Atmospheric Dispersion of Hazardous Material Releases: Implications for Homeland Security.** Washington, DC: National Academy Press, 2003.

"There is a growing concern that future terrorist activities may involve the release of chemical or biological weapons or the detonation of 'dirty bombs' that release radioactive material. Atmospheric observations and models can be used to track a hazardous release and to forecast how a plume of hazardous material may spread. Emergency responders can use this information to identify affected locations and make life-saving decisions about evacuating or sheltering endangered populations. The BASC (Board on Atmospheric Sciences and Climate) members agreed that there was a great need to critically examine the observational and modeling tools used for tracking the atmospheric dispersion of chemical, biological, or nuclear (C/B/N) agents and to assess the value of dispersion forecasts for providing useful information to emergency responders and the general public." (*Preface*)



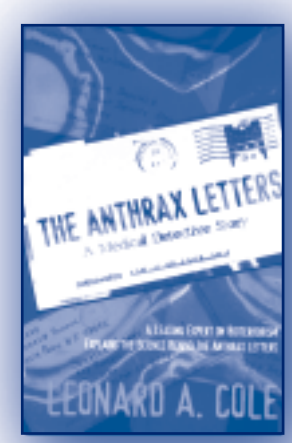
Includes nine appendices dealing with such topics as "Overview of Atmospheric Transport and Modeling," "Meteorological Observing Systems for Tracking and Modeling C/B/N Plumes," and "Scientific and Technical Information Needs of Emergency First Responders."

Full text can be reviewed online at the website of the National Academy Press reading room located at http://www.nap.edu.

CB-191260 • ISBN 0-309-08926-3
National Academy Press • Box 285
2101 Constitution Ave., N.W. • Washington, DC 20055
Phone: 1-800-624-6242 or 202-334-3313
http://www.nap.edu

Cole, Leonard A. **The Anthrax Letters: A Medical Detective Story.** Washington, DC: National Academies Press, 2003.

This book chronicles the anthrax attacks of October 2001 from the perspectives of the doctors and scientists who investigated the incidents, the victims and their families and the public health officials who formulated the policies and took the actions needed to deal with the crisis.



Includes a bibliography and an index.

Full text can be reviewed online at the website of the National Academy Press reading room located at http://www.nap.edu.

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2101 Constitution Ave., N.W. •
Washington, DC 20055
Phone: 1-800-624-6242 or 202-334-3313
http://www.nap.edu

Documents

Tim LaTourrette et al. **Protecting Emergency Responders. Vol. 2. Community Views of Safety and Health Risks and Personal Protection Needs**. Santa Monica, CA: Rand Corporation, 2003.
http://www.rand.org/publications/MR/MR1646/MR1646.pref.pdf

Continued pg. 9

Calendar of Events

If you would like to have a Chemical and/or Biological Defense or Homeland Security course or event posted on the CBIAC Calendar of Events, submit the pertinent information via email to **cbiac@battelle.org**. *Due to space limitations, the CBIAC will accept submissions on a first-come, first-served basis and reserves the right to reject submissions. For a more extensive list of events, visit our website at* **http://www.cbiac.apgea.army.mil/**.

July 11-15, 2004
Health Physics Society 49th Annual Meeting
Washington, DC
http://hps.org/newsandevents/meetings/meeting2.html

July 12-15, 2004
Partnering with Industry: Innovative Technologies in Homeland Security 2004 Conference & Exhibition
San Diego, CA
http://www.dhstech.com/

July 19, 2004
Federal Channels Seminar: Selling and Marketing to the Federal Government
McLean, VA
http://www.fbcinc.com/federalchannels/

July 19-20, 2004
Emergency Preparedness for Facilities
Arlington, VA
http://www.homelanddefensejournal.com/conf_emerg_prep.htm

July 19-21, 2004
Course: Combating Terrorism: The Organizational Response
MIT
Cambridge, MA
http://professional.mit.edu/ApplicationFiles/web/WebFrame.cfm?web_id=164

July 19-23, 2004
Medical Effects of Ionizing Radiation (MEIR) Field Course
Kirkland Air Force Base, NM
http://www.afrri.usuhs.mil/www/outreach/meir/meirschd.htm

July 23-27, 2004
ASM Conference on Cell-Cell Communication in Bacteria
Banff, Alberta, Canada
http://www.asm.org/meetings/index.asp?bid=22678

July 25-27, 2004
The 2004 Homeland Security Solutions Summit – Practical Solutions to Compelling Security Challenges
Research Triangle Park, NC
http://www.ozonelink.com/summit04.asp

July 26-30, 2004
Florida Environmental Health Association / Joint Annual Education Meeting & Trade Show
Orlando, FL
www.feha.org

July 28-29, 2004
READY! The Emergency Preparedness and Response Conference & Exposition
Washington, DC
http://www.readyusainfo.com

August 3-6, 2004
SMART Tech Trends: Global Gateway for Science & Technology
Pittsburgh, PA
http://www.techtrends.org

August 6-12, 2004
7th Annual Force Health Protection Conference: Supporting Military Transformation
Albuquerque, NM
http://chppm-www.apgea.army.mil/fhp/

August 16-19, 2004
9th Annual Joint Services Environmental Management Conference Sustaining the Force: Optimizing Readiness through the Prevention of Pollution
San Antonio, TX
http://www.jsemconference.com

August 18-19, 2004
Research, Technologies and Applications in BioDefense
Washington, DC
http://www.healthtech.com/2004/btr/index.asp

September 8-10, 2004
Enviro-Pro TECOMEX 2004
Mexico City, Mexico
www.ejkrause.com/enviropro

September 11-14, 2004
NEMA 2004 Annual Conference
New York City, NY
http://www.nemaweb.org/?526

September 12-17, 2004
COURSE: Medical Management of Chemical and Biological Casualties (MCBC)
USAMRICD, APG, MD and
USAMRIID, Ft. Detrick, MD
ccc@apg.amedd.army.mil
http://ccc.apgea.army.mil/courses/in_house/brochureMCBC.htm

September 14-15, 2004
Maritime Security Expo 2004
New York City, NY
www.maritimesecurityexpo.com

October 13-15, 2004
Worldwide Chemical Conference and Exhibition XXI
Fort Leonard Wood, MO
http://www.ndia.org/Template.cfm?Section=5300&Template=/ContentManagement/ContentDisplay.cfm&ContentID=3534

In the News • *By Mary Frances Tracy*

DoD Announces WMD-CST Fielding Plan

NEWS RELEASE from the United States Department of Defense March 9, 2004

"The Department of Defense notified Congress today the fielding plan for 12 additional Weapons of Mass Destruction-Civil Support Teams (WMD-CSTs). Congress directed the establishment of 23 additional teams in the National Defense Authorization Act for FY03 and funded the establishment of the first 12 in the Defense Appropriations Act for FY04. Currently, there are 32 certified teams."
http://www.defenselink.mil/releases/2004/nr20040309-0445.html

Oregon National Guard Unit to get Special Terrorist Training

The Associated Press March 10, 2004

"An Oregon National Guard unit is going to get special training and equipment to respond to terrorist threats involving weapons of mass destruction…the unit will give Oregon its own experts on weapons that use chemical, biological or radioactive materials."
http://www.katu.com/news/story.asp?ID=65269

Maryland to get Federal Anti-Terror Support Team

Homeland Security Group March 15, 2004

"As part of a federal initiative to help local authorities respond to acts of terrorism, Maryland is one of 12 states to receive a 22-member Weapons of Mass Destruction-Civil Support Team funded by the U.S. Department of Defense…
The team will include full-time Army and Air National Guard members trained to respond to a nuclear, chemical or biological attack. The team will fall under command of the governor and will be equipped with protective and communications equipment and a mobile lab.
The unit will help police, fire, and medical personnel determine the nature of an attack and provide medical and technical advice."
http://www.mipt.org/pdf/hsr124.pdf

HHS Moves to Acquire New Anthrax Vaccine for Stockpile

Department of Health and Human Services Press Office
March 12, 2004

"The Department of Health and Human Services has requested proposals from industry for the development, testing and manufacture of a new anthrax vaccine."
http://www.hhs.gov/news/press/2004pres/20040312b.html

NIOSH Certifies First Air-Purifying Respirators for Protection Against CBRN Exposures

NIOSH Update March 16, 2004

"The National Institute for Occupational Safety and Health (NIOSH) issued the first two certifications under its program for testing and certifying for air-purifying respirators intended to protect emergency responders from chemical, biological, radiological, and nuclear (CBRN) exposures…
NIOSH issued the certifications to the MSA Millenium APR, manufactured by Mine Safety Appliances Co. (MSA), Pittsburgh, Pa., and the 3M FR-M40, manufactured by 3M Corp., Maplewood, Minn."
http://www.cdc.gov/niosh/updates/upd-03-16-04.html

Army Plague Vaccine Looks Promising

Global Security Newswire March 25, 2004

"A plague vaccine developed by the U.S. Army was shown to be effective in a new experiment attempting to incorporate "real world" conditions…
The new vaccine was invented at the U.S. Army Medical Research Institute of Infectious Diseases at Fort Detrick, Md., and proved 100-percent effective in the Rocky Mountain study, according to the National Institutes of Health."
http://www.nti.org/d%5Fnewswire/issues/2004/3/25/1a7c1cb2%2D73c5%2D4087%2Da1fa%2D515c03bbd002.html

New Solution Monitors Chemical, Toxic Threats

Brad Grimes
Washington Technology March 30, 2004

"NetBotz Inc. of Austin, Texas, has created an IP-based security solution that integrates with sensors from Sunnyvale, Calif.-based RAE Systems Inc. to detect life threatening gases, chemicals and radiation.
The platform can provide homeland security officials and first responders with instant warnings about atmospheric threats, including dangerous air quality levels, chemical weapons and toxic agents…"
http://www.wtonline.com/news/1_1/daily_news/23120-1.html

Department of Homeland Security Awards Billions in Grants to State and Local Governments

Department of Homeland Security Press Release
March 30, 2004

"In the coming weeks, the Department of Homeland Security will award $2.2 billion from the State Homeland Security Grant Program and $725 million from the Urban Area Security Initiative to state and local governments to help first responders across the nation better protect their communities. These funds are part of over $8 billion the Department has allocated or awarded since March 1, 2003 to help our nation's first responders and state and local governments to prevent, respond and recover from potential acts of terrorism and other potential disasters."
http://www.dhs.gov/dhspublic/interapp/press_release/press_release_0380.xml

NORTHCOM Unit Recognized for Homeland Security Efforts

Anthony J. Falvo
American Forces Press Service April 1, 2004

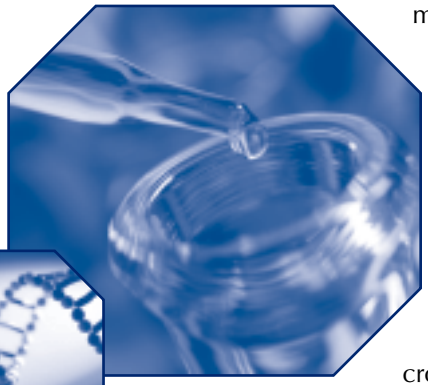
"For its accomplishments and contributions to Operation Noble Eagle and the overall security of the United States, Standing Joint Force Headquarters-Homeland Security, a component command of U.S. Northern Command, received the Joint Meritorious Unit Award and the Global War on Terrorism Medal in a March 26 ceremony…"
http://www.defenselink.mil/news/Apr2004/n04012004_2004040112.html

Continued pg. 10

"New Institute" *cont.*

the formation of microscopic silica structures, and acts as a template for growth. The remarkable feature of silicatein, they have found, is that it can also be used to make non-biological semiconducting and photovoltaic materials. Their work demonstrates that biomolecular recognition and enzymatic catalysis, evolved over ages for the world of carbon-based materials, can be harnessed and used productively with inorganic materials. One of ICB's missions is to take advantage of alternative pathways for synthesis that have been honed by millennia of selection.

Researchers at the MIT arm of the ICB are headed by Angela Belcher, associate professor of Materials Science and Engineering and Biological Engineering. Belcher is known for nano-biotechnology research that began with a path-breaking experiment that engineered the binding of a biological material--peptides (short chains of amino acids)--to inorganic semi-conducting materials. This strategy for "bottom-up" fabrication, atom by atom in imitation of nature, contrasts with the current "top-down" practice via subtraction from a bulk material to make a chip. The bottom-up approach enables the assembly of particles into an electronic structure, which can consist of layers of different semi-conducting materials or different phases of the same material or some combination of both.



David Tirrell, professor and chair of the Chemistry and Chemical Engineering Division, leads the effort at Caltech. Tirrell has gained wide recognition for a series of experiments showing that the molecular recognition of the cell's protein synthesis machinery can be tricked to overlook subtle modifications introduced in the laboratory. The techniques have enabled his research group to engineer proteins with new structures and functions. The resultant semi-synthetic proteins and their newly incorporated atoms provide new functionality including controlled mechanical properties and enhanced thermal and chemical stability.

The research plan for the Institute for Collaborative Biotechnologies will be organized around three emphases. The first, "Sensors, Electronics and Information Processing", is led by professor Guillermo Bazan of UCSB. Bazan's work will focus on the development of sensors using biological molecules and paradigms for sensing with unprecedented sensitivity, accuracy, and speed and the translation of information from sensors into electronic information for real-time sensing and response capabilities.

Prof. Morse of UCSB leads work on the second major emphasis, "Biotechnological and Biologically Inspired Routes to Electronic, Optical and Magnetic Materials". The work will examine the use of biological mechanisms and biomolecular mechanisms to control nanofabrication of new materials for electronic, optical, and optoelectronic activity, including new approaches to the generation of electrical energy and portable sources of energy such as would be carried for defense applications.

The third research emphasis, "Biotechnological and Biologically Inspired New Routes to Information Processing", led by UCSB professors David Awschalom and Evelyn Hu, considers the use of biological models of molecular signaling and recognition and integration of information at scales ranging from molecules to ecosystems. Awschalom heads the UCSB Center for Spintronics and Quantum Computing. Hu is UCSB's science director for the California NanoSystems Institute (CNSI), whose state-of the-art research facilities, nearing the construction phase, will greatly enhance the ability of ICB researchers at UCSB to advance their cross-disciplinary research agendas.

Significant industrial partners include Applied Biosystems, the world's primary supplier of high performance DNA analysis instruments, and Genencor International, the world's largest producer of recombinant proteins and an industry leader in fermentation science. IBM, a leader in bioinformatics and biological data analysis, is also a significant player. The for-profit industrial partners have the opportunity and the incentive to translate to the civilian marketplace the fruits of the research findings. "A thriving U.S. economy is essential to the country's defense as is a well-equipped Army," said Campbell.

For further information, email Kevin O'Connell at kevin.oconnell1@us.army.mil.

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U.S. Army Edgewood Chemical Biological Center
News Release No. 04-02 24 March 2004

Army Scientific Advisor Dr. James Valdes Wins Presidential Rank Award

Aberdeen Proving Ground, Md. - Dr. James J. Valdes, the U.S. Army's scientific advisor for biotechnology, received a Presidential Rank award for 2003 at a ceremony in the Pentagon on March 12, 2004. With his receipt of this award, Dr. Valdes joins an exclusive group of career government personnel honored by this recognition of exceptional professional accomplishment.

Dr. Valdes is located at the U.S. Army Edgewood Chemical Biological Center at the Edgewood Area of Aberdeen Proving Ground, Md. Throughout his career, Dr. Valdes has made original and creative scientific contributions in biotechnology and neurochemistry that have resulted in significant impacts within these fields. As the author of more than 100 scientific articles, Dr. Valdes has received international recognition in scientific journals and at prestigious symposia. He is a sought-after speaker and consultant for the private sector. Dr. Valdes' leadership in defining strategic direction for Army scientific initiatives and building the Army's biotechnology infrastructure and staff has had a major impact on biodefense research at ECBC and throughout the Joint Services. His work is particularly focused in the area of detecting biological threat agents and identification of their long-term effects.

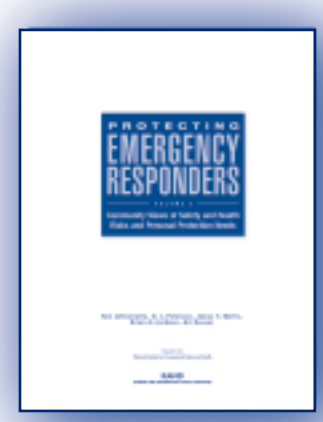
The Acting Secretary of the Army Les Brownlee and the Vice Chief of Staff Gen. George Casey presented the award, which was signed by President George W. Bush. Award winners are chosen through a rigorous selection process that includes nomination by their agency heads, evaluation by boards of private citizens, and approval by the president. The evaluation criteria focus on leadership and results.

According to the Office of Personnel Management, a small group of high-performing senior career employees are recognized each year with the Presidential Rank Award for exceptional long-term accomplishments. Winners of this prestigious award are strong leaders, professionals, and scientists who achieve results and consistently demonstrate strength, integrity, industry, and commitment to excellence in public service. This year marked the first time Scientific Professionals, including Senior Technical personnel such as Dr. Valdes, were eligible for the Presidential Rank award, which was previously only given to members of the Senior Executive Service.

ECBC is the Army's principal research and development center for non-medical chemical and biological defense technology, engineering and services. ECBC has achieved major technological advances for national defense, civilian needs and industrial competitiveness, with a long and distinguished history of providing the Armed Forces with quality systems and outstanding customer service. ECBC is located at the Edgewood Area of Aberdeen Proving Ground, Md. For more information about the Edgewood Chemical Biological Center, please visit our Web site at <http://www.ecbc.army.mil> or call (410) 436-3610.

New CBIAC Info. Resources *cont.*

"Firefighters, law-enforcement officers, and emergency medical personnel play a critical role in protecting people and property in the event of fires, natural disasters, medical emergencies, and actions by terrorists and other criminals. This report presents an overview of occupational hazards and personal protection needs as viewed by emergency responders in the United States.



The primary goal of this report is to help define technology needs and research priorities for personal protection for emergency responders." (*Preface*)

Includes numerous tables and two appendices.

CB-187087• Rand Corporation
1700 Main Street • P.O. Box 2138
Santa Monica, CA 90407
Phone: (310) 451-7002
http://www.rand.org

U.S. Coast Guard. **Hazardous Materials Response Special Teams Capabilities and Contact Handbook**. Washington, DC: United States Coast Guard, 2004.
http://www.uscg.mil/hq/g-%20%20m/HAZMAT%20Response%20Special%20Teams%20Handbook.pdf

"This Handbook is intended to be used as a reference job aid for United States Coast Guard (USCG) Federal On Scene Coordinators (FOSCs) and other Federal, State and local responders and planners. It is designed to provide quick access to the capabilities of various special teams specifically related to oil, hazardous material, and Weapons of Mass Destruction (WMD) response. It is not a policy document, but rather an informational guide for response and planning personnel. The handbook is laid out to allow responders to quickly glance at each response component or category of technical expertise and ascertain which corresponding teams have the capability and resources to execute the response action(s). For planning purposes, additional narrative information is also provided to further describe the level of each team's capability in performing the necessary functions of response." (*Preface*)

CB-171924 • United States Coast Guard
2100 Second Street, SW • Washington, DC 20593

In the News *cont.*

Department of Homeland Security Selects Contractors for New Biological Detection Systems

Department of Homeland Security Press Release
April 1, 2004
"The U.S. Department of Homeland Security's Science and Technology Directorate today announced that more than a dozen teams… have been selected for contract negotiations with the Homeland Security Advanced Research Projects Agency (HSARPA). These contractors will be expected to conduct research and development leading to next generation biological detection sensors and systems."
http://www.dhs.gov/dhspublic/display?content=3415

Device to Provide Advanced Biological Diagnostic Capability to Warfighter

JO2 Jessica Benigni
USJFCOM Public Affairs April 5, 2004
"…The Epidemic Outbreak Surveillance (EOS) system, a proposed advanced concept technology demonstration (ACTD) sponsored and supported by the USJFCOM Command Surgeon and in partnership with the U.S. Air Force Surgeon General, detects viruses days earlier than conventional methods."
http://www.jfcom.mil/newslink/storyarchive/2004/pa040504.htm

NATO Opens Chemical Weapons Training in Czech Republic

Global Security Newswire April 6, 2004
"NATO yesterday opened a chemical weapons training center in the Czech Republic…
The center, based in the city of Vyskov, is NATO's only chemical weapons training site and will develop regulations for NATO chemical warfare troops...While the center is not set to receive NATO accreditation until next year, it has already begun to train 400 foreign specialists…"
http://www.nti.org/d%5Fnewswire/issues/2004/4/6/352bd5d9%2D670f%2D4b93%2Db9dc%2D07ec6fc4dcd0.html

Santorum, Specter, & CDC Announce Public Health Improvement Pilot Program Based in Lehigh Valley

Amy Hybels
Press Release of Senator Santorum April 6, 2004
" Bethlehem, PA - Senator Rick Santorum, Chairman of the Senate Republican Conference, Senator Arlen Specter, Chairman of the Labor, Health and Human Services, and Labor Appropriations Subcommittee, and officials from the Centers for Disease Control announced today the creation of a public health improvement pilot program entitled 'Health and Security for the 21st Century Project.' This program, focused on improving response and mitigation of bioterrorism and related chemical, radiological, and nuclear incidents, will serve as a template with the potential of being replicated nationally."
http://santorum.senate.gov/pressreleases/record.cfm?id=220186

Smiths Detection Announces First Mail Screening System to Detect Anthrax and Ricin Simultaneously

Smith's Detection Press Release April 7, 2004
"Smiths Detection, the world's leading provider of X-ray and trace detection equipment, announces a unique mail screening system for letters and packages that can detect biological and toxin agents. The Bio-Seeq Mail Sentry, launched recently to screen mail for anthrax, has been improved to become the first-ever mail screening system that can simultaneously detect hazardous agents such as Anthrax, Ricin, Tularemia and Plague."
http://63.89.158.169/News/item.asp?NewsItem=74

DoD Ready to Assist in Event of Homeland Attack

Gerry J. Gilmore
American Forces Press Service April 12, 2004
"The Defense Department stands ready to assist authorities at the federal, state and local levels in the event of another terrorist attack on the homeland…
In the event of a chemical, biological, nuclear or radiological attack on the United States, [Peter F.] Verga said, the Joint Task Force Civil Support in Norfolk, Va.; the Joint Task Force Consequence Management East at Fort Gillem, Ga.; or the Joint Task Force Consequences Management West at Fort Sam Houston, Texas—all under U.S. Northern Command—'would be available to provide command and control of forces in support of civil authorities.'"
http://www.defenselink.mil/news/Apr2004/n04122004_200404126.html

Vol. 1 No. 2 of the Chem-Bio Defense Online Magazine is Now Available!

The Joint Program Executive Office for Chemical and Biological Defense (JPEOCBD) **Chem-Bio Defense Magazine** is a free acquisition news and information resource distributed throughout Chemical and Biological Defense community. Available in both electronic and hardcopy format, it can be viewed on the JPEO-CBD website at http://www.jpeocbd.osd.mil/. To subscribe, visit http://www.jpeocbd.osd.mil/jpeocbd_subscribe.htm.

"Chem & Bio Warfare" *cont.*

This plan was apparently never acted on, as it was probably presented to Brigadier General James W. Ripley, Chief of Ordnance, who was described by one author as being "congenitally immune to new ideas."[10]

Chloroform as a Knockout Gas. In April 1862, shortly after the engagement between the U.S.S. Monitor and the C.S.S. Virginia at Hampton Roads, VA, ended in a draw, Union Commodore L. M. Goldsborough, commanding naval forces at Hampton Roads, sent the following letter to Assistant Secretary of the Navy Gustavus V. Fox:

The present program for the Merrimac is to take the Monitor at all hazards, for which she is provided with numerous grapnels and steel wedges, the latter to choke the tower [turret] and prevent its revolving; go to Yorktown, thence to Washington City, and finally to New York. Chloroform is to be used in abundance by the Merrimac to produce insensibility on board the Monitor. I was under the impression that chemicals were rather scarce among them.

The Turret of the U.S.S. Monitor
(US Army Military History Institute)

This plan was never carried out and its own crew destroyed the Virginia later in the year.[11]

Chloroform Spray Fire Engine. A similar idea by Joseph Lott from Hartford, Connecticut in 1862 was to load fire engines with chloroform and spray it on enemy troops behind their earthworks defending Yorktown and Corinth. This idea was also not acted upon.[12]

Hydrochloric/Sulfuric Acid Cloud. With trench warfare and stalemate facing the opposing sides at Petersburg, VA, in June 1864, Forrest Shepherd of New Haven, CT, a professor of agricultural chemistry at Western Reserve University, wrote to President Abraham Lincoln proposing that the Army use a mist of hydrochloric acid against the Confederates. He envisioned:

that by mingling strong sulfuric acid with strong hydrochloric, or muriatic acid on a broad surface like a shovel or shallow pan, a dense white cloud is at once formed, and being slightly heavier than the atmosphere, rests upon the ground and is high enough to conceal the operator behind it. This may easily be continued by additional sprinkling of the two acids and a light breeze will waft it onward.

The effect on the enemy was:

When the cloud strikes a man it sets him to coughing, sneezing, etc., but does not kill him, while it would effectually prevent him from firing a gun, or if he should fire, to aim at his object. It has occurred to me that Gen. [Ambrose E.] Burnside, with his colored troops might, on a dark night, with a gentle breeze favorable, surprise and capture the strongholds of Petersburg, or Fort Darling, perhaps without loss or shedding of blood.

Although the heat generated from the mixing of hydrochloric acid and sulfuric acid would vaporize some of the hydrochloric acid, the volume required to create a potent cloud that would drift intact across to the Confederate lines would require large amounts of both acids. Perhaps for this reason, Shepherd's letter was apparently filed away and quickly forgotten.[13]

A Pump Fire Engine (Library of Congress)

Cacodyl Glass Grenade. In January 1864, Captain E. C. Boynton proposed a "Kacodyl" glass grenade that combined an incendiary with a toxic gas. He envisioned this grenade for use against ships:

When a mixture of acetate of potash and arsenious acid is distilled at a low red heat, a disagreeable odor, and actively poisonous, results, called Alkarsine... If this liquid be exposed to the air, it oxidizes, ignites, and throws off deadly fumes of arsenious acid.

When Alkarsine is distilled with strong chlorohydric acid, and the product digested in a vessel containing zinc, water, and carbonic acid, a heavy oily liquid insoluble in water is produced, which takes fire the instant it is brought in contact with the air. If this substance, termed Kacodyl... was confined in glass globes or bottles, and dropped in the deck of a vessel, or thrust below, all the horrors of combustion and deadly arsenical inhalations would be realized, beside which the terrors of the Greek fire would be contemptible.

There is no evidence that such grenades were ever tested against a wooden ship, although as early as 1862, there was at least one anonymous report in Scientific American that stated: "Several incendiary and asphyxiating shells have been invented for the purpose of scattering liquid fire and noxious fumes around the space where they explode."[14]

Suffocating Smoke Cartridge. Following the tunneling incident that led to the Union debacle at the Crater during the Petersburg siege, Confederate troops prepared a combustible cartridge to produce a suffocating smoke as a countermeasure to prevent another surprise tunneling operation. Under the direction of Colonel William W. Blackford, an engineer officer, the Confederates dug tunnels of their own extending out in front of several of their key positions. In these tunnels, the soldiers dug holes four inches in diameter extending out approximately 10-15 feet toward Union lines and placed sentinels to watch the holes. Colonel Blackford provided the instructions for these sentinels:

Continued pg. 12

"Chem & Bio Warfare" cont.

In case the enemy struck one of these holes, the guards on duty were provided with cartridges of combustibles, the smoke from which would suffocate a man. These they were to run into the holes and fire by a fuse, closing their end of the hole tightly, and then, summoning the guard, they were to dig into and take possession of the opposing mine as rapidly as possible, giving another dose of suffocating smoke from time to time to keep the enemy out of his workings until they could dig into them.

William W. Blackford (Armed Forces Chemical Journal)

Unfortunately, the composition of the combustible was unknown. One historian guessed that it might have been similar to gunpowder but containing a much higher proportion of sulfur. This would create a sulfur dioxide cloud when burned. Another guess was that the material was similar to the mixture used in stink balls. This was a mixture of sulfur, rosin, pitch, asafetida, raspings from horses' hoofs, and other materials designed to produced a nauseating smoke. The actual use of these cartridges was not reported, but were known to have at least been deployed to the front lines.[15]

Stink Shell. In 1864, Brigadier General William N. Pendleton, Lee's Chief of Artillery, considered the "Chinese stink-balls" as a potential chemical weapon to break the siege of Petersburg. He wrote Lieutenant Colonel Briscoe G. Baldwin, Lee's Chief of Ordnance:

I saw noticed in a recent paper a stink-shell, and it seems to me such missiles might be made useful to some extent at least. . . The question is whether the explosion can be combined with suffocating effect of certain offensive gases, or whether apart from explosion such gases may not be emitted from a continuously burning composition as to render the vicinity of each falling shell intolerable. It seems at least worth a trial.

The response back from Ordnance Department was: "Stink-balls, none on hand; don't keep them; will make if ordered." Apparently, they were never ordered.[16]

The Petersburg Trenches (Library of Congress)

BIOLOGICAL WARFARE

Biological Warfare Agents

The human race has been attacked by diseases from the earliest of times. Biological warfare, however, differed from the random introduction of diseases by being human initiated, deliberate, and directed at a specific target. Several of the key biological warfare agents identified as weapons during the 20th century were identified or at least described prior to the Civil War:

- Anthrax (5000 BC)[17]
- Smallpox (1122 BC)[19]
- Yellow Fever (1600's)[21]
- Plague (1320 BC)[18]
- Typhus (430 BC)[20]

During the Civil War, there were several reported attempts to use biological warfare by the Confederates against Union forces and civilian populations.

Yellow Fever Infected Bodies and Contaminated Clothing. In 1862, R. R. Barrow, a Southern planter, proposed taking bodies infected with Yellow Fever and contaminated clothing to Union held New Orleans in an attempt to spread the disease. Of course, the plan would have failed due to the post war discovery that mosquitoes rather than clothing and material transmitted yellow fever. There was no indication that the Barrow's proposal was ever carried out.

Smallpox Contaminated Clothing. Dr. Luke Blackburn of Kentucky, a Southern sympathizer, apparently plotted to infect clothing with the smallpox virus and then sell them to Union troops during 1863. Reference to this incident appeared in a 1893 book concerning the youngest U.S. officer in the war:

Subsequently, when young [Charles W.] Randall was a Lieutenant in the Seventeenth Vermont, his health became permanently impaired by smallpox, which it was believed he took from infected clothing, having purchased in Washington some undergarments at a store which afterward came under suspicion as a place of consignment under the infection scheme suggested by Dr. Blackburn of Kentucky. But, whatever the origin, the disease destroyed his blood, and shortly after the war he died of quick consumption.[23]

Dr. Luke Blackburn (Kentucky State Archives)

This plan was similar to the attempt to infect Indians with smallpox during colonial wars.

Yellow Fever Infected Clothing. In 1864, Dr. Blackburn, while in St. Georges, Bermuda, also attempted to cause a yellow fever epidemic in the North by shipping infected clothing there. When his plot was discovered, he left Bermuda and took refuge in Canada.[24]

Continued pg. 13

"Chem & Bio Warfare" *cont.*

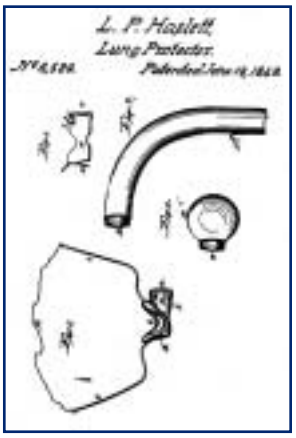
Dead Animals and Poisons in Drinking Water. There were several reported incidents of Confederate forces contaminating wells and ponds with either poisons or the carcasses of dead animals. Major General William T. Sherman reported that the Confederates retreating from Vicksburg drove animals into the ponds and then shot them. The U.S. Army apparently considered this form of warfare as barbarous and uncivilized. War Department General Orders No. 100, dated April 24, 1863, stated: "The use of poison in any manner, be it to poison wells, or food, or arms, is wholly excluded from modern warfare."[25]

CHEMICAL/BIOLOGICAL WARFARE DEFENSIVE TECHNOLOGY

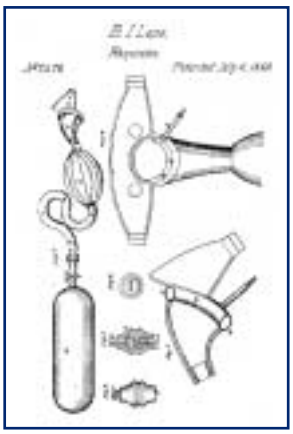
With the growing use of toxic chemicals in industry, the need for protection of firemen in toxic smokes, and the war proposals for using chemical weapons, it was not surprising that the development of protective equipment against toxic chemicals occurred simultaneously with the proposals to use chemical weapons.

Protective Masks

Haslett Mask. One of the earliest known patents for a protective mask in the United States was Lewis P. Haslett's in 1847. Haslett was from Louisville, KY, and improved on his first patent for an Inhaler or Lung-Protector in 1849. This patent stated: "I... have invented a new and useful Machine for Protecting the Lungs Against the Inhalation of Injurious Substances..." This early protective device covered the nostrils and used water moistened woolen fabric as a filtering material. It also had an exhaling valve to prevent carbon dioxide poisoning. For "more volatile substances, such as gas, smoke, etc.," the device used a hose that moved the intake valve near to the floor.[26]



Lane Mask. Benjamin I. Lane of Cambridge, MA, patented his Respiring Apparatus, also called "Lane's Pneumatic Life-Preserver," in 1850. His patent stated that the apparatus allowed the breathing of pure air from an air chamber "...thereby enabling a person to enter buildings and vessels filled with smoke or impure air and into sewers, mines, wells, and other places filled with noxious gases or impure air..." The nosepiece was made of vulcanized rubber with a head strap and goggles and was attached to the brass copper air chamber or tank by a vulcanized rubber tube. A vulcanized rubber bag between the tank and the facepiece held enough of the pressurized air for four or five breaths. Then the user exhaled through his mouth, which was unprotected, which automatically triggered the refilling of the bag from the tank.



The tank was worn on the users back and was pressurized to five or seven atmospheres by an air pump or bellows.[27]

Stenhouse Mask. British inventors also designed protective masks. In 1854, John Stenhouse, a prominent Scottish chemist, aware of the dangers of toxic chemicals, designed a protective mask using a charcoal filter that protected against chlorine, hydrogen sulfide, ammonia and other gases. The mask consisted of powdered wood charcoal held in place between two layers of wire gauze. The charcoal was replaceable through a small door in gauze. The frame of the mask was copper, with soft lead edges lined with velvet to fit the face. The upper support strap was elastic, while the lower strap tied behind the head. He declined to patent the mask and instead made the design available to the general public. Apparently a number of his masks were produced and used by several large chemical manufacturers in London.

Stenhouse Mask (Armed Forces Chemical Journal)

George Wilson, a professor of technology at the University of Edinburgh, envisioned a military use for Stenhouse's mask. He wrote in 1854, during the Crimean War when there were several proposals to use chemical weapons, that:

> *The longing for a short and decisive war has led to the invention of a suffocating bombshell; which on bursting, spreads far and wide an irrespirable or poisonous vapor; one of the liquids proposed for this shell is the strongest ammonia, and against this it is believed that the charcoal respirator may defend our soldiers. As likely to serve this end, it is at present before the Board of Ordnance.*[28]

Since the proposed chemical shells were rejected, the need for a protective mask was also apparently rejected.

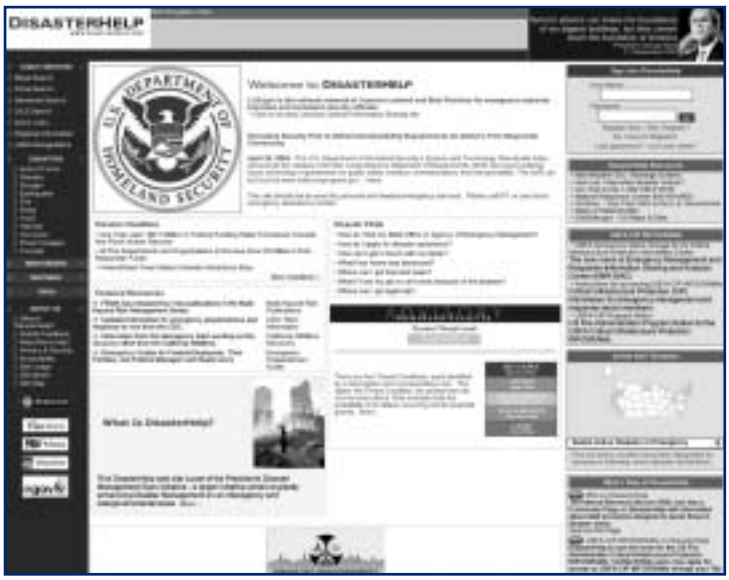
Hoffmann Mask. Theodore A. Hoffmann patented an "Improvement in Respirators" in 1866 that consisted of an apparatus worn on the nose and mouth to protect against "malarious and contagious elements" in the atmosphere. The mask was made of two layers of cotton or other textile fabric, shaped to fit the mouth and

Continued pg. 15

Disaster Management is one of the 24 initiatives chosen in support of the President's management agenda to make government more focused on the citizen and results through expanding E-Government. It is a cross-agency initiative designed to meet the nation's need for a unified point of access to disaster- related information and to improve preparation, mitigation, response, and recovery for all hazards by creating the ability to seamlessly and securely share incident information across the nation's emergency management community.

Led by the Emergency Preparedness and Response (EP&R) directorate within the Department of Homeland Security (DHS), this program currently consists of two interrelated components – Disaster Management Interoperability Services (DMIS) and the DisasterHelp.gov online portal.

DMIS provides interoperability services and a basic set of digital tools to over 600 responder organizations to enable the sharing of incident information. As this number continues to grow, DMIS has already been used to support actual incidents and numerous exercises. DMIS allows the collaborating emergency management organizations to create a common operating picture as viewed on a shared map, and provides a number of functions including alerts, on-scene weather, instant messaging, and a time-stamped journal DMIS is currently available at no cost to authorized organizations throughout the nation. (www.dmi-services.org).



DisasterHelp.gov represents a unified point of access to disaster-related information and services for citizens and emergency organizations. This web portal provides quick access to disaster mitigation, preparedness, response, and recovery information from across the participating federal, state, local, and non-government organizations. The information is available to the public, and the site allows registered users to personalize the interface. DisasterHelp.gov also offers a "Collaboration Center" to verified members of the emergency management community, which enables the sharing of best practices through communities of interest, and the secure exchange of documents via a secure online knowledge center that the user sets up and controls.

The Disaster Management E-Gov initiative demonstrates the power of information sharing.

"Chem & Bio Warfare" *cont.*

nose. The edges of the mask were bound with an elastic border to prevent leakage.[29]

Collective Protection Systems

Stenhouse Collective Protection System. Stenhouse also worked on an early version of collective protection for a room. He designed a filter similar to his mask filter that purified air entering rooms. It was successfully tested on several government buildings and absorbed obnoxious smells from the city streets.[30]

Although the proposals and attempts at chemical and biological warfare during the Civil War were mostly unsuccessful, the concepts were not forgotten. Fifty years later, some were used with deadly results during World War I.

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26 U.S. Patent No. 6,529, June 12, 1849.
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Description: This CD-ROM contains the complete proceedings of the Chemical and Biological Medical Treatment Symposium – III held in Spiez, Switzerland on May 7-12, 2000. It presents the work of over 100 experts in medicine, science, and related disciplines from the government, academic and industrial sectors of the 32 participating countries. Topics addressed include OP treatment, convulsions, cholinesterase measurement, mustard treatment, riot control agents, decontamination, bioscavengers, bioterrorism, biological agent treatment and detection, threats, and emergency response issues.

BACWORTH Encyclopedia Version 6.2a

(Replaces HB-03-02)
Distribution Limitation: U.S. Federal Government Agencies Only; Export Controlled; For Official Use Only
CBIAC Product Number: HB-04-03 ***Price:*** $175.00
Publication Date: January 2004 ***Product Category:*** Handbook
Media: CD-ROM
Description: The Biological and Chemical Warfare Online Repository and Technical Holdings (BACWORTH) Encyclopedia Version 6.2a contains detailed data on 86 CB agents, toxins, and riot control agents. Entries include both at-a-glance summaries and detailed description levels. There are also 16 overview functional chapters addressing critical CB defense topics in a non-agent specific format. The Encyclopedia cites more than 1,500 references. Each Agent entry covers 13 key topics.

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