

ARMY



SBR

SMALL BUSINESS INNOVATION RESEARCH



COMMERCIALIZATION Brochure



United States small businesses are the engine of innovation and economic stability and will undoubtedly be a major factor in our economic recovery. Each year small businesses account for approximately half of the United States Gross Domestic Product and are responsible for approximately three fourths of the new jobs created. Innovation is the primary tool that these small businesses use to be competitive against more established businesses and is the reason our economy is the envy of the world. The Small Business Innovation Research (SBIR) Program is the Nation's largest source of early-stage technology financing. Through programs such as SBIR we are ensuring that our small businesses have the opportunity to put ideas into practice and ultimately, into the hands of our Soldiers so they are prepared to meet future challenges.

This brochure focuses on the tremendous benefits the Army realizes through the SBIR Program. Through SBIR and other similar programs, we now know that the best ideas don't necessarily come from large corporations or even our government laboratories; most often innovative technologies are invented by creative individuals and small, entrepreneurial companies. The future readiness and effectiveness of our armed forces will be determined, in large measure, by our investment in cutting-edge technologies from U.S. small businesses.

On behalf of our brave men and women in uniform and the Army's leadership, I thank you for your unselfish contributions to our Soldiers, America's Army, and our Nation.

A handwritten signature in black ink that reads "Thomas H. Killion". The signature is fluid and cursive, with a long horizontal stroke at the end.

Thomas H. Killion
Deputy Assistant Secretary
(Research and Technology)

The SBIR and STTR Programs

Congress established the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs to provide small businesses and research institutions opportunities to participate in government-sponsored research and development (R&D).

The goals of the SBIR and STTR Programs are to:

1. Stimulate technological innovation.
2. Use small business to meet Federal R&D needs.
3. Foster and encourage participation by socially and economically disadvantaged small business concerns (SBCs), and by SBCs that are 51 percent owned and controlled by women, in technological innovation.
4. Increase private sector commercialization of innovations derived from Federal R&D, thereby increasing competition, productivity, and economic growth.

While STTR has the same objectives as SBIR regarding the involvement of small businesses in Federal R&D and the commercialization of their innovative technologies, the STTR Program requires participation by universities, federally funded research and development centers (FFRDCs), and other non-profit research institutions.

Both the SBIR and STTR Programs use a three-phase program structure, reflecting the high degree of technical risk involved in developing and commercializing cutting edge technologies.

- Phase I is a feasibility study that determines the scientific, technical, and commercial merit and feasibility of a selected concept. Phase I projects are competitively selected from proposals submitted against solicitation topics seeking specific solutions to stated government needs.

- Phase II represents a major R&D effort, culminating in a well-defined deliverable prototype (i.e., a technology, product, or service).
- In Phase III, the small business or research institute is expected to obtain funding from the private sector and/or non-SBIR/STTR government sources to develop the prototype into a viable product or service for sale in Government or private sector markets.



	SBIR	STTR
PHASE I	6 months \$70,000 maximum	6-12 months \$100,000 maximum
PHASE I Option	4-Month option (Government's discretion) \$50,000 maximum, to fund Interim Phase II efforts	No option
PHASE II	2 years \$730,000 maximum	2 years \$750,000 maximum
PHASE III	Unlimited time Non-SBIR funding	Unlimited time Non-STTR funding

For more information, visit our website: www.armysbir.army.mil

SBIR and STTR Eligibility Requirements

To qualify for the SBIR and STTR Program, a firm must meet the following criteria:

Organized for profit, with a place of business located in the United States, which operates primarily within the United States or which makes a significant contribution to the United States economy through payment of taxes or use of American products, materials or labor; in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the form is a joint venture, there can be no more than 49 percent participation by business entities in the joint venture; at least 51 percent owned and controlled by one or more individuals who are citizens of, or permanent resident aliens in, the United States, or it must be a for-profit business concern that is at least 51% owned and controlled by another for-profit business concern that is at least 51% owned and controlled by one or more individuals who are citizens of, or permanent resident aliens in, the United States -- (except in the case of a joint venture); and has, including its affiliates, not more than 500 employees.

The small business may subcontract a portion of its work, as long as the small business "prime" performs at least two-thirds of the Phase I work and half of the Phase II work. For the purposes of determining compliance, percent of work is usually measured by both direct and indirect costs; however, the actual method of measurement will be verified during contract negotiations.

The STTR Program is open to any team consisting of a small business (as defined previously) and a research institution. Central to the program is expansion of the public/private sector partnership to include the joint venture opportunities for small business and the nation's premier nonprofit research institutions. STTR's most important role is to foster the innovation necessary to meet the nation's scientific and technological challenges in the 21st century. The research institution may be any U.S.-based nonprofit research institution, federally funded research and development center (FFRDC), or university or college. The small business must perform at least 40% of the Phase I and Phase II work.

The research institution must perform at least 30% of the Phase I and Phase II work. Any part of the remaining 30% of the work may be subcontracted. For the SBIR Program Phase I and II efforts, the primary employment of the principal investigator must be with the small business firm at the time of the award and during the conduct of the proposed effort. Primary employment means that more than one-half of the principal investigator's time is spent with the small business. For the STTR Program Phase I and II efforts, the principal investigator may be primarily employed with either the small business or the research institution. In both programs, the Phase I and Phase II work must be performed in the United States, to include the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, the Trust Territory of the Pacific Islands, and the District of Columbia.



Chemical and Biological Defense (CBD) SBIR Program

The Chemical and Biological Defense (CBD) Program was established by the Department of Defense (DoD) to provide state-of-the-art defense capabilities to allow military forces of the United States to operate and successfully complete missions in chemical and biological warfare environments. This requires the availability of the most effective products to detect and protect to ensure sustained operations.

The overall objective of the CBD Small Business Innovation Research (SBIR) Program is to elicit innovative solutions from the small business community that address chemical and biological defense technology gaps confronting DoD and to include technologies that will also have high commercialization potential in the private sector.

The Joint Science and Technology Office for Chemical and Biological Defense (JSTO-CBD) provides the management for the Science and Technology component of the Chemical and Biological Defense Program. Technologies developed under the SBIR Program have the potential to transition to the Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD) if the appropriate level of technology maturity has been demonstrated. The JSTO-CBD Science & Technology programs and initiatives are improving defensive capabilities against Chemical and Biological Weapons.

SBIR topics are developed in each of the following program areas to address both chemical and biological threats.

- Detection and Identification — analytical techniques for both stand-off and point detection of chemical and biological agents; measurements conducted in air, water, soil and other complex matrices
- Modeling & Simulation — techniques to provide information associated with specific chemical and biological threat materials
- Protection — all areas of individual and collective protection
- Decontamination — processes and materials to be employed on facilities, equipment, and personnel
- Medical Technology — pre- & post-treatments to protect warfighters from exposure; therapeutics to mitigate the effects of chemical and biological threats; and diagnostics to detect and identify biological or chemical threats in warfighters



Phase III and Commercialization

A goal of the SBIR and STTR Programs is to increase private sector commercialization of innovations derived from Federal R&D, thereby increasing competition, productivity and economic growth. Phase III represents the successful culmination of an SBIR/STTR project. SBIR Phase III refers to work that derives from, extends, or logically concludes effort(s) performed under prior SBIR funding agreements, but is funded by sources other than the SBIR Program. Phase III work



is typically oriented towards commercialization of SBIR research or technology. While Phase II success is measured by whether the prototype product or service developed by the small business can meet an Army need, Phase III success can also be indicated by the small business marketing and selling the products or services outside of the SBIR and STTR Programs. Sales can include cash revenue from the Government or private sale of new products or non-R&D services embodying the specific technology and/or spin-off technology. Commercialization can also include additional investments in activities that further the development and/or commercialization of the specific technology.

The Army has instituted several programs to facilitate phase III: Commercialization Pilot Program (CPP); Fast Track; Phase II Enhancement; and Technical Assistance. The following pages discuss each of these programs in detail.



Commercialization Pilot Program

Fast Track

Phase II Enhancement

Technical Assistance

Commercialization Pilot Program (CPP)

The U.S. Army established the Commercialization Pilot Program (CPP) with the purpose of increasing SBIR technology transition and commercialization success. The Army selected MILCOM Venture Partners (MILCOM) to help manage the CPP. MILCOM assists the government with:

1. Identifying a focused set of ongoing SBIR Phase II participants for inclusion in the CPP.
2. Recommending the amount of additional funding to support the participants' commercialization plans developed under the CPP.

The objective of this effort is to increase Army SBIR technology transition and commercialization success, thereby accelerating the fielding of capabilities to Soldiers and to benefit the nation through stimulated technological innovation, improved manufacturing capability, and increased competition, productivity, and economic growth.

While technology transition to Army acquisition activities is the program's primary focus, the civilian marketplace and commercialization opportunities cannot be ignored. The Army can gain significant value through commercialized dual-use products.

The first critical step in the CPP participant identification process is to understand each active Phase II SBIR project's potential for rapid transition and commercialization. MILCOM conducts this activity through a series of progressive screening processes to ultimately identify and recommend a limited set of CPP participants. The initial data collection efforts involve an electronic commercialization assessment form that is delivered to active Phase II projects. At that time, additional details are also provided regarding timing, completion of the form, and program support contacts.

Twenty-five (25) Small Businesses participate in the CPP for each year. MILCOM provides these participants with guidance and assistance with commercialization and transition activities, including assistance with the production of a business plan, a transition plan and matching technologies with potential government and/or industry customers. Projects participating in the CPP must have the potential for rapid transitioning to Phase III and into the acquisition process and also be expected to meet high priority Army requirements. Additionally, each project must have the potential for commercial use in the private sector that offers a significant financial return.



Fast Track

Fast Track is a process for SBIR/STTR projects that attract outside investors who will match Phase II funding, in cash, contingent on the project's selection for phase II award. Projects that obtain such outside investments and thereby qualify for the Fast Track will (subject to qualifications described in the Solicitation):

- Receive interim funding of \$30,000 to \$50,000 between Phases I and II where applicable
- Be evaluated for Phase II award under a separate, expedited process; and
- Be selected for Phase II award provided they meet or exceed a threshold of "technically sufficient" and have substantially met their phase I technical goals.

Toward the end of a small company's Phase I SBIR/STTR project, the company and the investor submit a Fast Track application through the DoD Submission Website at www.dodsbir.net/submission. The application must be submitted within 150 days after the effective date of the SBIR/STTR Phase I contract, and the company must submit its Phase II proposal within 180 days after the effective date of its Phase I contract. The company is encouraged to discuss the application with its Phase I technical monitor; however, it need not wait for an invitation from the technical monitor to submit either a Fast Track application or a Fast Track Phase II proposal. The small business should contact its Phase I technical monitor for further instructions and guidance.

The Army will notify each Fast Track company, generally within 10 weeks after of the completion of Phase I, whether it has been selected for Phase II award. Once notified, the company and investor must certify, within 45 days, that the entire amount of the matching funds from the outside investor has been transferred to the company.



Phase II Enhancements

Phase II Enhancements provide SBIR funding to firms that require additional funding during their open Phase II contract. Instances where more funding may be required on a Phase II should initially be identified by the project's Contracting Officer's Representative (COR). The COR, in conjunction with the Technical Assistance Advocate (TAA) and the organization's SBIR Program Coordinator (PC) will compile the documentation needed for PM, SBIR to make a determination. Documentation should be forwarded to PM, Army SBIR no later than 6 months prior to the end of the Phase II period of performance. Businesses that graduate from the SBIR small business definition or are acquired by a larger business that would not qualify during their Phase II contract will not be considered for Phase II Enhancement funding. Generally SBIR Phase II Enhancement funding will not exceed \$500,000 per request and funding is subject to availability and a deliberate approval process. Small Businesses interested in Phase II Enhancements should contact their Contracting Officer Representative.

Phase II Enhancement documentation consists of the following:

1. A memorandum from the participating organization's Technical Director, PEO, or his/her designated representative to PM, Army SBIR providing a compelling reason for the additional funding.
2. A concise statement of work (SOW) for the additional effort to be executed with the SBIR Phase II Enhancement funds. The SOW should contain adequate detail to be included in any contract modification actions.
3. A detailed cost proposal for the Phase II Enhancement. Matching funds are not required, but if available, include amount and source in the cost estimate. Note that matching funds represent a commitment on the part of the transition partner and weigh favorably toward approval.
4. Resources provided for Phase II Enhancement will only be used for continuation of the Phase II effort. These funds are intended to support transition of the SBIR technology by means of enhancing capability, providing additional prototypes, addressing additional proof of concept, or similar areas of technology demonstration. They are not designed to supplement system development efforts, nor are they intended to provide capital equipment to develop a production capability of the SBIR technology.
5. Letters of interest or supporting documents should be provided from potential customers of the SBIR developed technology. Ideally, this would include a Technology Transition Agreement or a similar document that details how the SBIR technology will be used by the accepting organization.

SBIR Phase II Enhancement selection decisions will be made by the PM, Army SBIR as soon as possible after receipt of the SBIR Phase II Enhancement request. Once approved and money is distributed, all awards are subject to the successful completion of negotiations, and the availability of SBIR funding.



Technical Assistance

In accordance with the SBIR Reauthorization Act of 2000, Public Law 106-554, amendment of Section 9 of the Small Business Act (15 U.S.C 638), the Army provides technical assistance services to small businesses engaged in SBIR projects through a network of scientists and engineers engaged in a wide range of technologies. The objective of this effort is to reduce small business technical risk to facilitate the transition of SBIR developed technologies into the hands of our Soldiers.

Technical Assistance Advocates (TAAs) are located in six regions across the Army to provide technical assistance to small businesses who have Phase I and Phase II projects with the participating organizations within their regions.

Each TAA provides:

1. Advice to Phase I SBIR projects selected annually for the purpose of assisting in:
 - a. making better technical decisions concerning such projects;
 - b. solving technical problems which arise during the conduct of such projects;
 - c. minimizing technical risks associated with such projects; and
 - d. developing and commercializing new commercial products and processes resulting from such projects.
2. Advice to the Government regarding technology transition planning and development of technology integration roadmaps through participation in PEO requirements development, technology assessment, and technology transition planning and management activities, specifically to facilitate the provision of relevant and timely technical advice to supported small businesses regarding integration of SBIR derived technologies into DoD programs.
3. In coordination with the Government research manager, SBIR awardee, and any potential stakeholders, Phase III plans for Phase I projects selected for Phase II award. The Phase III plan must document the strategy, requirements, and resources to transition the SBIR project to Phase III and from research into an acquisition program, larger science & technology effort, or stand-alone product or service.



SUCCESS STORIES

Phase III represents the successful culmination of an SBIR project. While Phase II success is measured by whether the prototype product or service developed by the small business can meet an Army need, Phase III success is indicated by the small business marketing and selling the products or services outside of the SBIR Program with revenues from Government or private customers.

The following Success Stories represent the best in Phase III commercialization efforts by participating small businesses.



U.S. Army Edgewood Chemical Biological Center

Protein Manufacturing in Insect Expression (PMIE)

Chesapeake PERL (C-PERL)

Savage, MD.

www.C-perl.com

info@c-perl.com

Current methods for producing proteins typically utilize costly and time consuming bioreactors. The Army has multiple research programs that identify and develop recombinant proteins for broad-spectrum applications in nerve agent therapeutics, vaccines, material and personnel decontamination, toxin stimulants, and chemical and biological sensors. C-PERL and the Army's Edgewood Chemical Biological Center recognized these expanding requirements for a rapid, cost-effective means of producing hard-to-express recombinant proteins. C-PERL has developed an innovative technology to provide the requisite protein manufacturing capability and capacity to expedite the transition of basic research to the advanced development and acquisition of new products to support the Soldier.

C-PERL's patent protected Protein Manufacturing in Insect Expression (PMIE) system is completely integrated — from insect larvae production through large scale protein expression and purification — in state-of-the-art facilities. The PMIE system is based on well-established baculovirus expression technology and a patented system for automated oral inoculation. C-PERL's insect

protein expression technology provides the capability to produce conformational correct, complex proteins/enzymes that cannot be reliably produced by other systems without a need for subsequent complex treatment procedures.

The C-PERL PMIE system has proven to provide immediate benefits for Army research and development programs by reducing manufacturing time and cost of production and increasing the availability of hard-to-produce recombinant proteins to Army scientists and also the commercial market.



Phase III Impact

C-PERL was selected for the U.S. Army Commercialization Pilot Program and received an additional \$600K in SBIR funding. As a result of this work, C-PERL was awarded a multi-year contract that will total more than \$1M from the Defense Threat Reduction Agency to further support its Bioscavenger protein development effort. C-PERL was also provided \$692K in additional SBIR extended support funding for production and commercialization of a protein for the U.S. Military HIV Research Program, a multi-dimensional research project headed by the Walter Reed Army Institute of Research.

Chesapeake  PERL



U.S. Army Aviation & Missile Research, Development & Engineering Center

Dynamic Data-Driven Prognostics and Condition Monitoring

Qualtech Systems Inc.

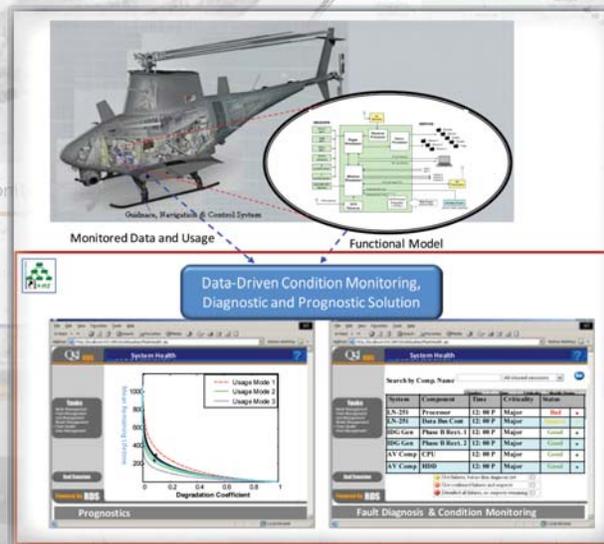
Wethersfield, CT
 www.teamqsi.com
 info@teamqsi.com

Increased reliability, availability, safety, and cost efficiency requirements for Army platforms have highlighted a demand for a reliable condition monitoring and prognostic solution for onboard electronic systems. Qualtech Systems Inc. (QSI), in collaboration with University of Maryland's Center for Advanced Life Cycle Engineering, developed a data-driven condition monitoring, diagnostic and prognostic solution applicable to onboard electronic systems of airborne platforms. The approach comprises advanced signal processing, feature extraction, fault detection and isolation, and forecasting algorithms. By using monitored data and functional structure of a system, the technology can detect and identify parametric faults, trace back to their sources, and forecast the performance level and remaining lifetime for the overall system as well as for the degraded components. A major advantage of the solution lies in its capability to "learn" the degradation dynamics of a target system with minimal human intervention, thereby facilitating minimal effort customization and wide range of applicability across platforms.

Since electronic systems are rapidly proliferating in all advanced engineering applications, this technology will be useful for both military and commercial users. Industrial sectors that employ costly high-tech equipment and automobile manufacturing can both use the solution for real-time health assessment and to anticipate equipment performance degradation and possible outage. Performance assessment and condition forecasting of medical equipment (e.g., CT Scan, ECG, EEG, etc.) is another potential application of this prognostic solution.

Phase III Impacts

QSI has experience in building advanced health management solutions for Pratt & Whitney engines, Sikorsky helicopters, and the Boeing AH-64D Apache helicopter. Under a collaborative effort with BAE Systems, QSI technology is being incorporated into the Army's Joint Light Tactical Vehicles for onboard real-time fault isolation and troubleshooting. QSI is also working closely with Northrop Grumman Corporation's Aerospace Systems in order to incorporate their technology for the RQ-8 "Fire Scout" UAV program.





U.S. Army Medical Research and Materiel Command

ResQvent™ - Traumatic Brain Injury Treatment

Advanced Circulatory Systems, Inc. (ACSI)

Roseville, MN

www.advancedcirculatory.com

fhunter@advancedcirculatory.com

With assistance from the SBIR Program, Advanced Circulatory Systems, Inc. (ACSI) is developing a product called the ResQvent™. The ResQvent is an electronic, portable, reusable device that delivers ACSI's novel Intrathoracic Pressure Regulation (IPR) therapy and positive pressure ventilation. Non-invasive IPR therapy creates a vacuum inside the chest cavity that doubles blood flow to the brain and heart. This increased circulation increases blood pressure and lowers intracranial pressure in patients with elevated intracranial pressures (e.g., head trauma), in patients in shock from blood loss or sepsis, and in patients in cardiac arrest.

IPR therapy extends the "golden hour" of survival for traumatic brain injury (TBI) and severe hypotension victims in hostile or difficult to access locations. TBI and severe hypotension have high morbidity/mortality

rates when medical care is not immediately available, ResQvent extends the window for Soldiers or injured civilians to receive medical attention. The ResQvent and its underlying IPR technology are vital to the Department of Defense because it allows for non-invasive, non-surgical treatment for TBI and hemorrhagic shock patients at the point of injury and provides continued resuscitative care throughout the entire evacuation process. The ResQvent also has an integrated positive pressure ventilator and vacuum source used to control the vacuum in the chest. The device is small, lightweight, battery-powered, and portable for military use in the theater of operations and in other emergency settings.

Phase III Impacts

ACSI has already commercialized two other products that deliver IPR therapy, the ResQPOD® and ResQGARD®, with sales to the military totaling over \$1.2M to date. The ResQPOD received an American Heart Association Class IIa recommendation — higher than any drug used in the treatment of adult patients in cardiac arrest. ACSI's impedance threshold device technology was inducted into the Space Foundation Hall of Fame in 2008. ACSI was recently selected to receive \$600K from the U.S. Army SBIR Commercialization Pilot Program to complete development of the ResQvent and begin field integration.



ADVANCED CIRCULATORY SYSTEMS, INC.



U.S. Army Research Laboratory

SENTRI™ - Personnel Detection and Warning System

Safety Dynamics

Tucson, AZ

www.safetydynamics.net

info@safetydynamics.net

The Army has the need for smart sensors that can increase situational awareness and improve the rate of time-sensitive targeting of incoming threats and threat identification. Safety Dynamics developed a hardware platform and localization system that uses multiple algorithms, including an Army-funded, biologically-based neural network to “recognize” the sound of gunshot from multiple calibers in noisy environments.

Sensor Enabled Neural Threat Recognition and Identification (SENTRI) does not require line-of-sight to the shooter, does not miss discharges from subsonic small-arms fire, and eliminates false positives generated by other pulsatile sounds like vehicle backfires and fireworks. Further, the system performs recognition functions in less than one second, alerts the user, and sends camera control commands to a connected Pan, Tilt, Zoom video camera — transferring it to the origin of the shot for instant threat identification. SENTRI™ has benefits for both the military and commercial sector. Soldiers equipped with this technology

will receive an early warning signal as well as information on the general direction of threats, whether they are from enemy personnel, explosives, or sniper fire. Commercially, in every occasion where dogs are used for search and rescue or where video monitoring is not allowed (e.g., public restrooms, changing rooms), the use of SENTRI™ can change the appeal of these facilities for would-be terrorists and criminals. The Los Angeles Sheriff’s Department added SENTRI™ to its Advanced Surveillance and Detection Program to detect crimes as they happen and collect video evidence for use in legal proceedings and also to meet Homeland Security surveillance needs.



Phase III Impacts

To date, Safety Dynamics has received \$4M in private investments for its SENTRI™ technology.



Safety Dynamics



U.S. Army Engineer Research and Development Center

SensorBone™ - Secure Wireless Backbone for Surveillance

Argon ST

San Diego, CA

www.argonst.com

sensorbone@argonst.com

Persistent Intelligence, Surveillance, and Reconnaissance (ISR) is a key requirement for commanders. This requires significantly improved data and information flow from remote and denied areas over a period of time without the need for frequent servicing or power supply replenishment. Commercially, there is also a growing need to effectively manage and monitor vast amounts of land and surrounding environments with minimal dependence on local infrastructure. Argon ST's SensorBone™ was developed to directly respond to these requirements.

SensorBone™ is a self-organizing, energy-efficient, scalable, rapidly deployable, and secure wireless backbone system that enables real-time environment and event monitoring with thousands of heterogeneous sensors deployed over a large remote area. SensorBone™ is the first system of its kind to meet challenging requirements that have often been seen as conflicting: long-range communication, low energy, fast detection relay, ease of deployment and management, and low cost. SensorBone™ drastically improves the effectiveness and capabilities of persistent ground

ISR operations with low-cost unattended sensors in hostile and environmentally challenging areas, a critical need for both future asymmetric warfare and wide-area land management with environmental monitoring. SensorBone™ allows critical sensor data to be relayed to monitoring centers in near real time without requiring human input. As a result, rapid response to situations observed from accurate and up-to-date data can be performed without putting Soldiers in harm's way. SensorBone™ is an ideal solution for extended sensor network operations in remote and hostile environments such as the battlefield, military training ranges, and national/state parks, and also for border security and high-risk infrastructure protection.

Phase III Impacts

The Office of Naval Research and a DoD agency awarded Argon ST \$2.1M in supplemental research and development contracts over the last three years to adapt SensorBone™ core technologies for unattended ground ISR and tagging, tracking, and locating applications. In addition, SensorBone™ received \$480K from the U.S. Army's Commercialization Pilot Program. Argon ST is currently engaged with DoD to develop a transition plan to enable SensorBone™ nodes to be deployed as early as FY2011.





U.S. Army Research Laboratory

PCoMP™ - Nanocomposite Thermal Spray Powder

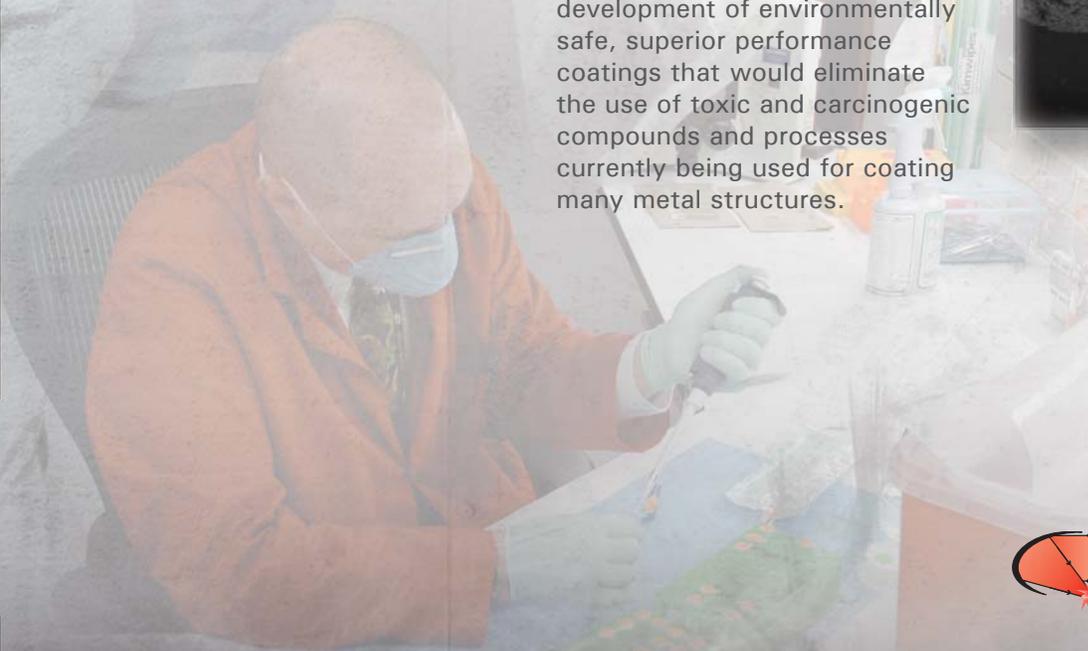
MesoCoat Inc.
Euclid, OH
www.mesocoat.com
ajsherman@mesocoat.com

The annual cost of corrosion to the U.S. economy is estimated at \$270 billion — \$40 billion of which is attributed to the Department of Defense (DoD). To address this issue, MesoCoat Inc. has developed PComP™, an easily grindable thermal spray coating composition to replace tungsten carbide cobalt and hard chrome plating in high-wear equipment rebuilding applications. PComP™ nanocomposite thermal spray powders offer an unparalleled combination of toughness and hardness whose characteristics are a result of a unique, patented coating microstructure that combines high hardness zones of a ductile metal in an optimum geometry.

Coating solutions provided by MesoCoat's technology would directly reduce the cost of corrosion. MesoCoat's PComP™ technology can enhance wear and corrosion resistance, along with reducing spallation in a variety of applications including aircraft materials, landing gears, rail guns, bearings, military vehicles, and ship structures. The nanocomposite materials will replace chrome plating for repairing F-22, F-15, F-16, and F-35 aircraft since DoD has banned use of chrome plating and no acceptable substitute exists for joint fighters. Funds from a DoD program to develop thermal barrier and chrome replacement coatings have assisted MesoCoat with the development of environmentally safe, superior performance coatings that would eliminate the use of toxic and carcinogenic compounds and processes currently being used for coating many metal structures.

Phase III Impacts

MesoCoat closed a \$1.4M seed investment round in December 2009 that includes milestone-based options for an additional \$18.8M. Equity and seed investments, federal grants and contracts, and ongoing investment from various industry leading value chain partners, have helped MesoCoat grow in size.





U.S. Army Research Laboratory



Low-cost and Power, Portable Drug Lab Detection System

Seacoast Science

Carlsbad, CA

www.seacoastscience.com

info@seacoastscience.com

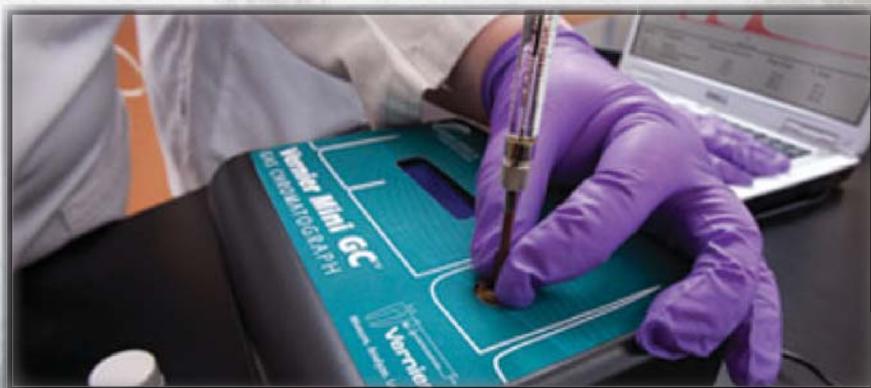
The U.S. military is looking for newly developed sensor technology to assist in reducing the supply of illicit drugs. Early identification of the location of a suspected drug lab is a critical first step in control. Today no technology is readily available to detect and document the illegal production and trafficking of drugs.

Seacoast Science is using its advanced chemical sensing technology to develop a micro-electromechanical systems-based, low-cost, low-power, portable drug lab detection system for field use. Under Phase I SBIR funding, this system was originally intended to be used to detect the common drugs and Volatile Organic Compounds (VOCs) that are used in makeshift labs to manufacture illicit drugs, such as meth and cocaine. This

system has since been expanded to be a dual use device that can also be used to protect law enforcement from exposure to toxic chemicals when entering suspected drug labs. Seacoast continued this work in a Phase II SBIR effort to develop detectors for use in the War-on-Drugs in Central and South America. Seacoast Science expanded the scope of this project to develop a high-tech precursor detection system that can be used by local, state, and federal agencies as well as private companies. The SeaPORT Miniature Gas Chromatograph system includes chemical separation by gas chromatography (GC) to aid in correctly identifying detected toxic chemicals and can become a critical tool in protecting the health and safety of first responders and innocent people that live, work, and play near clandestine drug laboratories.

Phase III Impacts

Seacoast Science received \$1.8M from the U.S. Army Research Office to further develop its technology, including spinoff products and applications. Additionally, Seacoast Science's SeaPORT Mini GC was named as one of CONNECT's Most Innovative New Products for 2007.



SEACOAST SCIENCE, INC
A CHEMICAL SENSOR COMPANY



U.S. Army Medical Research and Materiel Command

Compartment Syndrome Training Simulator

Touch of Life Technologies

Aurora, CO
www.ToLTech.net
info@toltech.net

Compartment syndrome is the compression of nerves and blood vessels that leads to muscle and nerve damage and problems with blood flow, and can result in loss of limb and even life; recognizing and treating this syndrome is made more difficult due to the nature of trauma. To address this critical need, Touch of Life Technologies (ToLTech) produced a highly adaptable virtual environment for training, diagnosis, and treatment of compartment syndrome. Detailed anatomic models were developed from the Visible Human Dataset created at the University of Colorado. Morphology, pathology, and posture of the models can be altered to produce endless variety. Haptic feedback, collocated with 3-D stereo graphics, gives the sensation of interacting with the resulting virtual patients. The hardware to collocate the haptic sensation with the graphic representation (patent pending to ToLTech) produces the highest fidelity computer-generated stereo graphics known.

The resulting virtual environment can be used to present training experiences for most medical specialties. Fasciotomy, regional anesthesia, joint injections, and ophthalmic skills (including stitching) are among the initial applications. All applications contain a mentor and training program that utilizes sophisticated and objective measures to guide, score, and critique the trainees as they work toward proficiency. While the platform common to each of these applications is slated for release in the spring of 2010, ToLTech has already sold multiple units for use in training muscle injections for treatment of cervical dystonia.

Phase III Impacts

Touch of Life Technologies has received \$170K in sales of the Compartment Syndrome Simulator to the Department of Defense and Primes; \$211K in sales to the private sector; and \$250K in investments from the private sector. Additionally, as part of the Phase II effort, a DVD that demonstrates fasciotomies was created in partnership with the American Academy of Orthopedic Surgeons. The DVD is available for distribution to the Army, DoD, and our allies worldwide.



TOUCH OF LIFE



TECHNOLOGIES



U.S. Army Space and Missile Defense Command

Miniature Explosive Pulsed Power for Munitions

Loki, Inc.

Rolla, MO

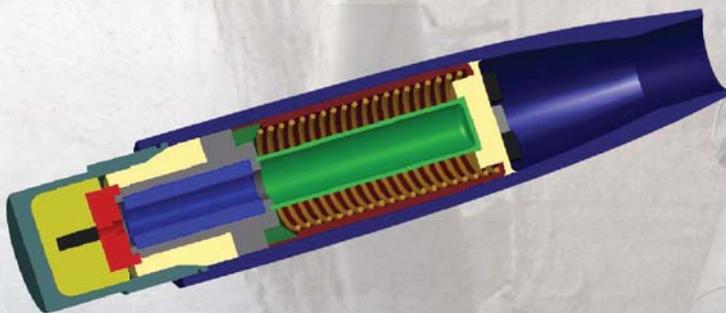
www.lokiconsult.com

The radius of damage and the destructive power of conventional munitions are limited to that of the blast and fragmentation. A directed energy component, such as high power microwaves or ultra wideband signals, can attack sensitive electronics and has longer lethal ranges than blast waves and fragments. Therefore, there is a need to extend the lethal range of munitions, increase the scope of the target set, and enhance destruction capability. Loki, Inc. created a new type of miniature, autonomous, explosive-driven, high power source that provides multiple pulses. Each system is a complete unit that includes all components necessary for operation: a miniature explosive-driven primary power source (the ferroelectric generator or

FEG), an ultra-miniature power-conditioning system, and a deployable antenna. The overall diameter of the system is 40mm or less, because they are used to increase the lethal range, target set, and destructive capability of small caliber munitions. FEGs developed under this effort could be applicable to multiple military and commercial applications requiring pulsed power, including water purification units, nondestructive testing systems (x-ray and neutron generators), magnetic resonant imaging systems, lightning simulators, and oil and mineral exploration. Miniature microwave sources developed under this effort could be used as burst communication devices in remote sites, for telemetry, and as the microwave source in active sensor systems.

Phase III Impacts

Loki Inc. has received \$100K in sales of explosive-driven generators to the University of Alabama-Huntsville, Teledyne-Solutions, the U.S. Army Aviation and Missile Research, Development Center (AMRDEC, the Naval Research Laboratory (NRL), and the Naval Air Systems Command (NAVAIR). The U.S. Army Space and Missile Defense Command, AMRDEC, NRL, the Missile Defense Agency, and NAVAIR are currently investigating the use of these generators for a variety of applications, to include pulsed-power and high-powered microwave production. Additionally, technology transfer to a prime defense contractor is currently underway.





U.S. Army Research Laboratory

Wireless Asset Tracking System

Innovative Wireless Technologies, Inc. (IWT)

Forest, VA

www.iwtwireless.com

sales@iwtwireless.com

Soldiers have a critical need for situational awareness and real time communications. Current systems have limitations due to a reliance on fixed infrastructure equipment that slows deployment, reduces visibility, and limits reachback communications outside the proximity of the fixed reader equipment. The task of manually tracking contents, location, equipment, and materials in containers can be an enormous and highly complex job. Maintaining situational awareness in indoor and urban environments is difficult because buildings, walls, and other obstacles obstruct Radio Frequency (RF) propagation. Under a Phase II SBIR contract, IWT addressed this capability gap and developed a rugged, multi-band transceiver and successfully demonstrated its geo-location capabilities.

IWT developed a cost and power efficient asset tracking system based on a wireless ad hoc mesh network with geolocation capability that provides real time communications and situational awareness without the need for infrastructure equipment. The system consists of a low cost, small size multi-band radio platform that can be expanded for broader applications to include Blue Force Tracking, communication-on-the-move, sensor networks, and smart grid systems. It also includes a localized mesh network consisting of both one-way and two-way tags that provide a tiered, economical, and scalable architecture based on cost and power consumption. The local network utilizes RF waveforms that are optimized for harsh RF conditions, which includes high path loss and severe multi-path concerns. It also incorporates embedded Global Positioning Systems that establish an anchor point for the absolute position of network tags.

Phase III Impacts

To date, IWT has received \$594K in combined Phase II Plus funding from the Telemedicine and Advanced Technology Center and the Army Research Laboratory and a \$700K U.S. Army Commercialization Pilot Program contract to develop a field-testable prototype asset tracking system.



Innovative Wireless Technologies



U.S. Army Research Laboratory

Whole-Hand Multispectral Biometric System

Lumidigm, Inc.

Albuquerque, NM

www.lumidigm.com

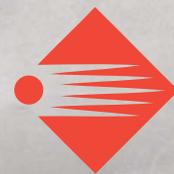
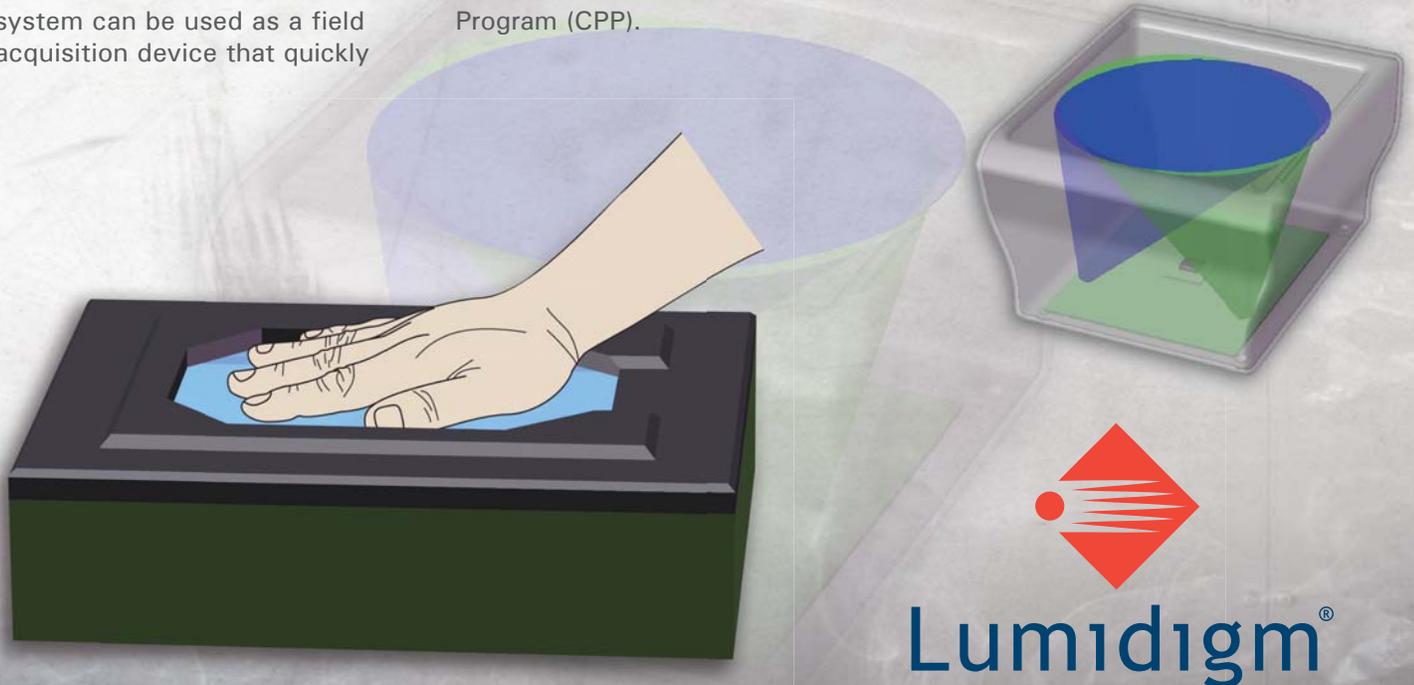
Rob.Rowe@Lumidigm.com

Lumidigm has developed a biometric system for fast and reliable image capture of the hand. During a single, rapid placement of the subject's hand on the sensor, the system collects all of the biometric details available from the palmar surface of the hand, including fingerprints and coarse and fine features of the palm — even details from those portions of the hand that are not in direct contact with the sensor. The system also acquires usable data when the skin is dry or dirty, or the environment is extremely wet or cold, ensuring that the system is reliable in field operations and other adverse conditions. The system can be used as a field acquisition device that quickly

and reliably collects biometric features that can be compared to existing databases and can also be used to provide biometric identification at entry points and other critical locations. The system was designed to be a stationary desktop unit, but based on user feedback, the greatest utility to the Army at this time would be to repackage the system as a smaller, easily transported unit that can be set up in the field to acquire biometric data from the fingers (both 4-slap and rolled), and the writer's palm. Using its proven multispectral imaging technology, Lumidigm is working to that end under the Commercialization Pilot Program (CPP).

Phase III Impacts

Lumidigm has received a \$1.7M Army contract in partnership with Stanley, Inc.; developed an infrared whole-hand system for a government customer; is a recipient of a 2006 Tibbetts award for the successful commercialization of its first-generation multispectral imaging fingerprint sensor developed under a Phase II Air Force SBIR; has 15 related US patents granted; has raised over \$20M in private funding to date; and has secured CPP funding for a single sensor that will quickly acquire all available biometric information from a hand.



Lumidigm®



U.S. Army Medical Research and Materiel Command

Smallpox Biodefense Therapy

BioFactura, Inc.

Rockville, MD
www.biofactura.com
info@biofactura.com

The U.S. government has identified smallpox as one of the highest priority biological threats. Although a World Health Organization global campaign eradicated naturally occurring smallpox by the late 1970's, there remains concern that clandestine stores of smallpox virus could be used as a biological weapon. Historically, smallpox killed 30% of those infected, and the hemorrhagic and flat (confluent) forms of smallpox were nearly 100% lethal. Presently, there is no effective treatment for smallpox. BioFactura is developing a drug composed of human-like versions of anti-pox antibodies that were originally discovered at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) and the National

Institutes of Health (NIH). These antibodies have been shown to protect and treat animals exposed to lethal doses of pox viruses. The objective of this program is to provide a medical countermeasure for a smallpox biological attack and, in parallel, develop a medical treatment for adverse reactions to the smallpox vaccine. BioFactura anticipates that a combination of these antibodies will provide superior performance over the legacy human blood-derived treatment for adverse smallpox vaccination events. Under its Army SBIR contract, BioFactura is developing and integrating novel biopharmaceutical discovery, development, and manufacturing technologies to rapidly accelerate this and other critical products to market.

Phase III Impacts

BioFactura has been awarded over \$3 million in DoD funding including an Army SBIR Phase II Enhancement, and Congressional Special Project awards to develop and advance the technology towards the key milestone of an Investigational New Drug (IND) application with the Food and Drug Administration (FDA). A successful IND will allow the company to initiate the human clinical trials required for drug approval and sales. BioFactura's Smallpox Biodefense Therapeutic will be procured through the Joint Program Executive Office-Chemical Biological Defense (JPEO-CBD) to meet a critical DoD requirement and medical need of the warfighter. Additionally, the drug may be procured for civilian biodefense by the Biomedical Advanced Research and Development Authority (BARDA). Furthermore, the discovery and manufacturing platforms developed by BioFactura have broad applications in commercial biopharmaceutical markets.





U.S. Army Research Laboratory



AMBIS™ - Multimodal Biometric Identification System

Ultra-Scan Corporation

Amherst, NY

www.ultra-scan.com

info@ultra-scan.com

As the need for rapid and positive identification of individuals increases, there is an inevitable global rise in biometric identification systems. Requirements for these systems are driven from such applications as commercial fraud reduction in financial systems and patient identification within a healthcare setting, and from military applications such as securing our nation's borders against terrorism. While more and more commercial and government organizations are implementing biometrics for personal identity management and security applications, both near and long-term operational success has been hampered due to fundamental limitations in accuracy that are unique to each currently employed biometric technology (fingerprint, facial recognition, iris recognition, etc.). As a result of this technology performance gap, the industry has responded by capturing multiple biometric measurements such as fingerprint, facial, and iris biometric samples to achieve the desired system accuracy. This approach, while promising, has lacked the robust scientific analysis needed to unequivocally answer key fundamental questions.

The solution developed by Ultra-Scan Corporation, AMBIS or Automatic Multimodal Biometric Identification System, is a mathematically optimum solution that operates with any number of different biometric modalities, supports multiple vendor technologies for a given modality, and integrates seamlessly without the need for modification of existing algorithms. This technology will enable the virtual integration of global multimodal databases and permit simultaneous, seamless searching. The processing power of agencies such as the U.S. Department of Defense, Federal Bureau of Investigation, and Department of Homeland Security as well as the UK Home Office will be significantly enhanced as these agencies now have the technology to integrate the strengths of their independent identification technologies to provide unparalleled system performance.

Phase III Impacts

Ultra-Scan has received \$1M in Army research funding, over \$6M in federal and private sector sales, and has one U.S. patent.



ARMY STTR

The Small Business Technology Transfer Program



U.S. Army Tank Automotive Research, Development and Engineering Center

3-D Army Fleet Durability Prediction

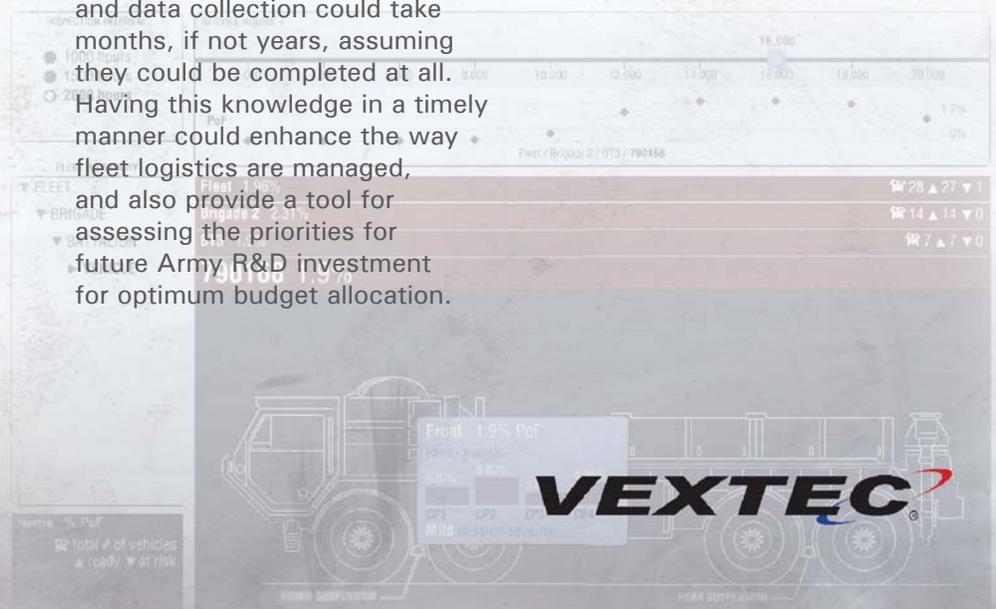
VEXTEC Corporation
Brentwood, Tennessee
www.vextec.com
info@vextec.com

Until now, Army vehicle component durability forecasting has been limited to oversimplification of the true manufactured material responses to stress. For instance, when predicting durability for an Army fleet of thousands of units, no two vehicles are operated in exactly the same way or under the same conditions. Many Army vehicles being operated today in extreme environmental conditions in Iraq and Afghanistan were originally designed and tested for operations in Western Europe. These two very different operational environments impose extremes in mission severity, operating conditions, and maintenance requirements, and ultimately, create extreme durability variations in the Army's fleet.

VEXTEC's Virtual Twin simulator addresses this issue by creating a 3-D digital recreation of microstructural grain arrangements for every single critical component in a manufactured fleet. Therefore, when a commander moves a 100,000 unit fleet from the forests and highways of Europe to the deserts of Iraq or the mountains of Afghanistan, the Virtual Twin simulator can be exercised to evaluate the physics change impacting the 100 million grains that make up each unit for all 100,000 units in the fleet. VEXTEC can complete this analysis within a few hours of computational processing, whereas current methods of analysis based on physical testing and data collection could take months, if not years, assuming they could be completed at all. Having this knowledge in a timely manner could enhance the way fleet logistics are managed, and also provide a tool for assessing the priorities for future Army R&D investment for optimum budget allocation.

Phase III Impacts

VEXTEC was awarded \$500K in U.S. Army Commercial Pilot Program funding to demonstrate a proof of concept VLM simulator for the Army Tactical Truck program. Sales to the private sector are over \$620K.





U.S. Army Engineer Research and Development Center

Waterborne Pathogen Detection

Sporian Microsystems, Inc.
Lafayette, CO
www.sporian.com
info@sporian.com

There is a need for remote, near-real time detection and location in austere environments of waterborne biological pathogens in potential drinking water sources. Since surface water is the primary water source for our deployed Soldiers, there is a critical requirement to determine the extent of potability, especially in undeveloped countries, and to provide continuous monitoring of water quality.

To address this need, Sporian Microsystems, Inc. designed and built a small portable biosensor device that is transportable to field locations to monitor streams and effluents for the detection of biological pathogens. This detection system will function remotely and can be integrated with wireless communications and global positioning to provide timely, critical information.

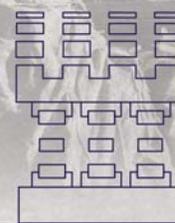
Sporian's technology consists of a patented optical biosensor that is sensitive, selective, and can operate for long periods on very little power. It can be easily tailored in the field to detect a variety of pathogens by replacing swappable modular cartridges. The sensor is connected to a buoy with wireless networking capability, tamper detection

sensors, and additional sensor scalability. Buoys communicate wirelessly with rugged gateways that aggregate data and provide a first tier of data analysis. This facilitates rapid detection and notification of natural or human tainting of the water supply. Sporian's system will provide our Soldiers with significantly increased ability to monitor the quality of in-theater water supplies.

The US Army Research, Development and Engineering Command (RDECOM) and the US Army Tank Automotive Research, Development and Engineering Center (TARDEC) have also shown an interest in the system and have been involved in field testing. Sporian has received interest in its technology from companies in both the water quality and health care industries. Sporian has been awarded two patents for its sensing architecture.

Phase III Impacts

To date, Sporian has received \$123K in Phase III funding awarded by the US Army Engineer Research and Development Center (ERDC), and anticipates another \$305K in the second quarter of 2010. Sporian is integrating its system with commercial off the shelf (COTS) water sensors from other vendors, adding global positioning system (GPS) capabilities, integrating photovoltaic energy harvesting, providing additional tools to permit ERDC systems to query Sporian's database, and performing field testing.



**SPORIAN
MICROSYSTEMS, INC**





U.S. Army Research Laboratory

Anti-microbial Impregnated Textiles

Luna Innovations, Inc.

Blacksburg, VA

www.lunainnovations.com

solutions@lunainnovations.com

Currently, biological agents and disease pathogens pose a serious threat to homeland security, first responders, the domestic food supply, and our deployed Soldiers. Luna Innovations is developing self-decontaminating textiles that quickly render the biological agents harmless upon contact with the material. This is achieved by permanently attaching biocides to the textile surface, producing a long-lasting protective garment — even after repeated laundering.

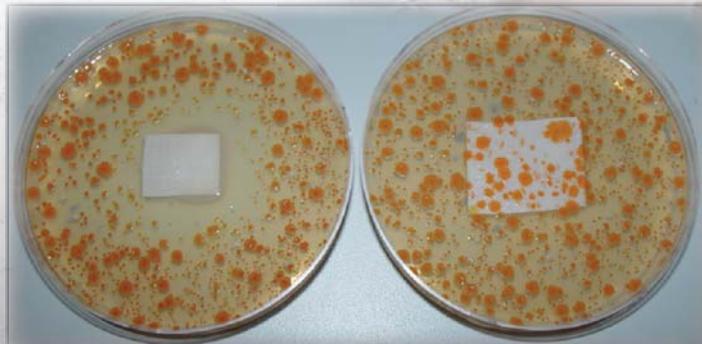
In addition to the self-decontaminating textile application, this technology has evolved into a renewable, self-cleaning coating program for decontamination of biological agents on vehicles and equipment. Current decontamination processes for biological agents are complex, cumbersome, and costly. Technology developed by Luna replaces this process by employing a multi-functional coating formulation with the ability to continuously decontaminate the surface exposed to biological agents. The self-decontaminating coatings have been shown to efficiently neutralize biological pathogens at the surface achieving near quantitative killing of vegetative bacteria

and a 99.99+% reduction against Anthrax-type spores. The multi-functional formulation consists of the biocide and nutrient/germinant that can be incorporated directly into a Chemical Agent Resistant Coating resin. This resin is active against vegetative cells and spores, which simplifies the decontamination process for vehicles and equipments.

The potential benefits of this coating technology to military and civilian institutions are tremendous based on its ability to greatly reduce the threat of biological agents and minimize transmission of harmful pathogens from contaminated surfaces. The primary commercial markets for this technology are the food and health care industries for protection and passive hazard mitigation of biological agents and disease pathogens for food safety and hospital hygiene.

Phase III Impacts

Luna Innovations has received \$3.4M from various Department of Defense programs to advance biocidal surface technology. The technology developed by Luna in the textile program is being adapted to self-decontaminating surface coatings for vehicles and equipment. The market for military vehicle and equipment biocidal coatings is estimated at \$165M to \$210M per year.



ACHIEVEMENT AWARDS

The Army conducts an annual awards program to recognize Phase II efforts which exemplify the SBIR goal of bringing innovative technologies and products to the marketplace. All Army SBIR Phase II Small Businesses whose project concludes in a given fiscal year are eligible to compete for an Achievement Award. Winners are selected based on the following four criteria: originality and innovation of research; relevance of the research to the Army mission; immediate commercialization potential of the research, reflecting the primary goal of bringing technology and products to the marketplace; and overall quality performance of the project.

Each year, the Army selects the most exceptional Phase II projects and presents awards at a formal awards ceremony, held at a suitably prestigious location in the Washington, DC area. A senior Army Science and Technology official presents the awards to the SBIR companies as well as to their sponsoring Army organization's Technical Director, SBIR Coordinator, and contract Technical Monitor.

The Achievement Awards Program is competitive. This year, 471 projects were eligible to compete of which 37 nominations were forwarded to the Selection Committee. Eleven projects were selected that represent the best in small business research and development.

The following stories reflect the successes of the 2010 Army SBIR Achievement Awardees.





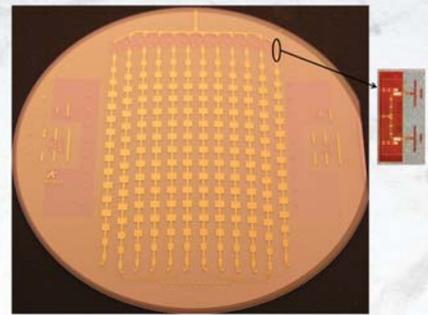
U.S. Army Research Laboratory

Wafer Based Phased Array Antenna for Communications on the Move

Agile RF, Inc.
Santa Barbara, CA
www.agilerf.com

The Army currently utilizes phased array antennas for radar and communications, but use is severely constrained due to high cost. Historically, over half of the cost of the antenna has been in the price of the phase shifter. Agile RF, Inc. developed a line of low-cost voltage-controlled analog phase shifters from 1 to 40 GHz. Cost savings on the antenna are further increased by producing a monolithic antenna complete with the

distribution network, phase shifters, and antenna radiating elements on a single substrate. The entire radiating antenna and subsequent phase shifting elements are printed on the wafer. The process utilizes industry-standard semiconductor manufacturing techniques and alleviates the typical manufacturing difficulties experienced when assembling high-frequency components, resulting in reduced assembly time and dramatically



increased yield. This reduced overall cost will enable the military and commercial wireless industry to more broadly utilize phased array antennas for high-frequency radar and communications. This in turn will enable the connection of ground vehicles to satellite links and link direct broadcast satellite (Direct TV) and internet into automobiles, enabling high data rate communications on the move.



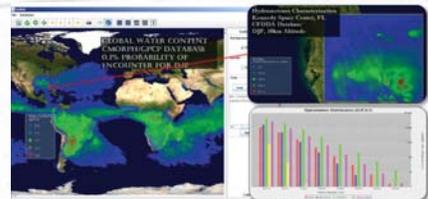
U.S. Army Aviation & Missile Research, Development & Engineering Center

Missile Design Weather Toolkit

CFD Research Corporation
Huntsville, AL
www.cfdr.com

Integration of weather information in the missile design process is critical in supporting reliability, survivability, and weight reduction while maintaining robustness, threat range, design, and development cost. CFD Research Corporation implemented a new methodology in weather specification: characterizing weather in specific deployment regions and classifying weather severity as a function of season, environment, missile geometry, and flight parameters. The ultimate goal is to give missile test engineers

the tools to more accurately and efficiently design and optimize missile survivability in realistic weather environments. CFD Research Corporation developed the Missile-Weather Toolkit for the exploration, extraction, and analysis of regional weather data with respect to missile specific flight parameters to describe missile survivability in weather environments. This Phase II prototype is based on methodologies developed for the Kinetic Energy Interceptor program and was used



by the U.S. Army Aviation and Missile Research Development and Engineering Center to support a Navy validation study for the Electromagnetic Rail Gun program in June 2009. The current capability utilizes satellite weather data and military-approved standards to support existing military programs. The software is built on a modular framework that allows for future research and development of weather specification using higher resolution weather information.



U.S. Army Simulation & Training Technology Center



Multiple Amputation Trauma Trainer™ (MATT™)

KGS (formerly dNovus RDI)

Fairfax, VA 22031

www.kforcegov.com

The Multiple Amputation Trauma Trainer™ (MATT™) is a medical training manikin that delivers high-fidelity simulations of lower body blast injuries commonly caused by IEDs and other sources. Now in production, MATT™ was jointly developed by dNovus RDI (now KGS) and the U.S. Army Simulation and Training Technology Center. It employs state-of-the-art special effects materials and technologies to deliver incredibly realistic visual and haptic stimuli with lifelike response

to treatment. Tourniquets must be applied with realistic force to control hemorrhaging; responders can use field techniques such as hand, knee, and elbow pressure on arterial pressure points to occlude bleeding. MATT's unparalleled ruggedness allows it to be carried and dragged through inhospitable field training environments without damage, making it ideally suited for use in Combat Lifesaver training courses. MATT™ is the first anthropomorphic trauma simulator to implement

animatronic movement of injured limbs, significantly increasing the realism and appropriate difficulty of treatment. Extraordinary visual and haptic realism provides desensitization to traumatic amputation injuries, allowing Medics, Corpsmen, Soldiers, and other first responders to perform life saving tasks more efficiently and effectively in the field, which leads to significant improvement in the treatment of blast injuries.



U.S. Army Research Laboratory

Go-to-War (GTW™) Simulator

Knowledge Based Systems, Inc.

College Station, TX

www.kbsi.com

Knowledge Based Systems' Go-to-War (GTW™) simulator is a unified modeling, simulation, and experimentation framework to assess the impacts of current and future force employment, maintenance doctrine, and resourcing strategies on dynamic warfighter "Go-to-War" capability.

One notable application of GTW™ is as a decision aid to forecast weapon system spare parts requirements, operational status, and capability in terms of missions planned versus those that can be successfully

executed. Accurately forecasting spare parts demands and the resulting dynamics of warfighting asset availability is made possible by accounting for interactions among the key factors that drive demand (e.g., maintenance doctrine, operational use policy and plans, operating environment). Already proven in real-world applications, the GTW™ simulator has significant payoff potential measured in terms of increased operational availability, a smaller logistics footprint, and considerable parts acquisition cost savings.



This highly versatile technology can be used in various analysis and decision-making applications, including spare parts demand forecasting, deployment planning, sustained surge operation feasibility analysis, force structure needs determination, tradeoff analysis, and various "what-if" analyses (e.g., budget impact analysis).



U.S. Army Natick Soldier Research, Development & Engineering Center

Durable, High Performance Personal Armor Plates

M Cubed Technologies, Inc.
Trumbull, CT
www.mmmmt.com

The Army's need for rapid deployment capabilities and the increasing loads on the Infantry Soldier combine to create a demand for lightweight armor systems. The current ballistic protection offered against small arms rounds is based on ceramic tiles with fiber-reinforced composite backing. To enhance current body armor systems, the Army requires decreased weight; increased durability and multi-

hit performance; reduced cost; and the capability to defeat more aggressive threats. To meet these requirements, M Cubed, with Simula (now BAE Systems) and Rutgers University, developed a durable, ceramic composite with low cost, low weight, and high performance. This novel composite has been successfully commercialized as a ballistic protective insert for small arms protection. To date, over



250,000 tiles, with a sales value of over \$55 million, have been sold. A key innovation was the use of a multi-constituent material to inhibit crack propagation. Moreover, by the proper choice of constituents in the ceramic composite, raw material cost was reduced.



U.S. Army Communications-Electronics Research, Development & Engineering Center

Hostile Fire Detection System (HFDS)

Oceanit Labs
Honolulu, HI
www.oceanit.com

One of the most critical challenges facing the Army is to detect enemy fire quickly and accurately for force protection. Existing acoustic systems protect against gunshots only and are relatively slow; optical systems are large and expensive, suffer from a high false alarm rate, and do not provide 360 degree coverage. To address these issues, the Army needed an enhanced Hostile Fire Detection System (HFDS) that can operate from ground or airborne platforms and detect multiple types of weapons.

Oceanit's HFDS provides the world's fastest hostile fire detection system. Using a novel sensor chip that operates at 10,000+ frames per second, this next-generation optical system can be deployed on multiple platforms. HFDS provides full 360 degree battlespace coverage from a single sensor with great accuracy. This ultra high-speed sensing enables improved detection, reduces false alarms, and provides the ability to identify friend/foe weapon types. With a reaction time of one-tenth of a second, the system provides a warning before a shot is heard. Its fast reaction time supports automated countermeasures.

The HFDS camera can be controlled from any Pentium computer; signal processing and control software runs on Linux or Windows O/S, and provides a simple Internet Protocol interface for netcentric operation. These features allow HFDS to be deployed on a variety of missions.

HFDS will greatly enhance intelligence on the battlefield and provide the real-time information essential to support deployed Soldiers.





U.S. Army Communications-Electronics Research, Development & Engineering Center

One-Cycle Controlled Power Electronics Controls & Conditioning (OCC-PECC)

One-Cycle Control, Inc.
Irvine, CA
www.onecyclecontrol.com

Generators run at peak efficiency in a narrow power range; when the required power goes up or down, a generator will become less efficient and burn more fuel than necessary. Additionally, different voltages and frequencies are required for different loads. OCC-PECC is a modular power electronics building block that includes a supercapacitor Energy Storage Module (ESM) to enable variable-speed load-following hybrid-power gensets. OCC-PECC commands generator speed in response to load changes while converting the resulting variable-

voltage variable-frequency ("Wild") three-phase power to deliver switch-selectable output voltage (120Vac single-phase, 120/240Vac split-phase, and 120/208Vac three-phase) and switch-selectable output frequency (50/60/400Hz) high-quality power. The 10kW OCC-PECC is based on a modular structure that is scalable to serve lower and higher power levels and can be retrofitted to existing generator sets or integrated with future systems to deliver improved fuel efficiency, power density, and power quality. The generator sets using OCC-PECC



weigh less, use less fuel, and cover a wider range of power, thus reducing the amount of fuel needing to be supplied to the Soldier in the field; and commonality of parts means less inventory needs to be maintained. The power electronics developed under this project also have direct application to high performance, high-density power conversion for aircraft power, hybrid wind-diesel, wind, micro-hydro, hybrid energy storage, and self-balancing multi-source micro-grids.



U.S. Army Communications-Electronics Research, Development & Engineering Center

ShapeDNA - Character Restoration and Enhancement for Captured Documents

Polar Rain Inc.
San Jose, CA
www.polarrain.com

The Department of Defense has millions of captured but degraded documents that have been collected in operations around the world that await human processing because Commercial off-the-Shelf (COTS) optical character recognition (OCR) systems cannot read them. Available automatic document recognition solutions yield very poor performance on degraded documents; however, these particular documents have the potential to influence current military operations or affect long

term strategy. An automated process to restore and read these documents in near real time is needed. Polar Rain Inc. designed and developed a document cleaning and restoration technology, named ShapeDNA, to effectively clean and restore degraded printed and handwritten documents in less than 10 seconds. Polar Rain's ShapeDNA technology makes unreadable documents readable and helps obtain actionable intelligence in real time. ShapeDNA allows very quick deployment of new language,



typically in less than 2 hours, when new unknown language support is needed. Innovative design allows third party OCR products to seamlessly integrate ShapeDNA with their existing solution. ShapeDNA significantly increases performance (35%-75% word recognition increase on the average) of existing COTS Arabic OCR systems to obtain actionable intelligence and reduces operation costs as fewer people are needed to process documents.



U.S. Army Communications-Electronics Research, Development & Engineering Center

Efficient JP-8 Burners for Portable Stirling Power Generators

Precision Combustion, Inc.
North Haven, CT
www.precision-combustion.com

Electricity runs the advanced technical systems and processes that support Army tactical operations. Readily available electric power on the mobile battlefield is essential to mission performance as is the need for lightweight quiet power generating systems in the 100 We to 2 kWe range that are efficient across wide turndown ranges and can be fueled by available logistics fuels. Using logistics fuels such as sulfur-containing JP8 is especially challenging.

Precision Combustion, supported by the U.S. Army Communications-Electronics Research, Development and Engineering Center, developed a novel, compact, high efficiency catalytic JP-8 burner with a balance of plant components and controls for a 160 We Stirling engine-based power generator. The system was hybridized with a BB 2590 rechargeable battery and as a battery charger. Working with a system integrator, efficient JP-8 to electricity conversion was



demonstrated with a dry system weight of 12.5 kg and silent watch capability. The burner design is modular, scalable, and adaptable to other fuels and to a range of small and higher kWe generator applications. This is a remarkable improvement over conventional approaches and broadens the potential use of Stirling and other small generator systems.



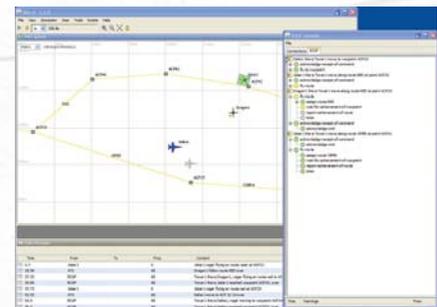
Program Executive Office Aviation

Air Traffic Control using Enhancing Computer Generated Forces (ECGF)

Soar Technology, Inc.
Ann Arbor, MI
www.soartech.com

While Computer Generated Forces (CGFs) used in virtual environments are able to emulate some aspects of human behavior (e.g., flying simulated aircraft), they still require a great deal of management by human operators. In this project, Soar Technology has developed a software system called the Universal Controller, an intelligent user interface that lets the simulation operator focus on higher-level CGF tasking, while the software manages the low-level details of invoking individual CGF-specific behaviors.

With the Universal Controller, an operator can issue spoken commands to a CGF, and the system translates those commands to the CGF's native primitive behaviors. The Universal Controller also monitors CGF behavior and issues spoken reports back to the operator as needed. The result is that legacy CGFs are more human-like in their ability to carry out tasks and interact with the operator. This increases the realism and robustness of simulation, lets an operator manage more entities with less work, and decreases



the amount of simulation-specific training required. The Universal Controller works with a wide variety of CGFs, including Program Executive Office, Simulation, Training, and Instrumentation's (PEOSTRI) OneSAF, using existing communication channels, and without modifying their software. It supports various use cases including simulation-based experimentation, control of multiple unmanned systems and air traffic controller training.



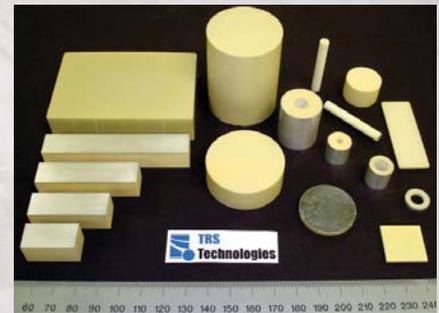
U.S. Army Space & Missile Command

New Ferroelectric Components for Ferroelectric Generators

TRS Technologies, Inc.
Stage College, PA
www.trstechnologies.com

TRS Technologies is developing energy storage ceramics for explosive power supplies used in advanced munitions. Its technology — a ferroelectric material designated TRS Shock-HV — is being incorporated into a new class of electromagnetic pulse (EMP) weapons designed to disrupt or destroy the electronic circuits and components used in improvised explosive devices (IEDs) and suicide bombs. This technology provides two to three times more

power output than state-of-the-art materials by using advanced processing methods to fabricate high density ferroelectric ceramics with significantly increased energy storage capabilities. This processing method also results in devices that are small enough to be man-portable, yet powerful enough to disrupt electronics over significant ranges. TRS's materials are enabling EMP weapons to move from the laboratory to the battlefield, which will help save



Soldiers' lives by allowing them to remotely defeat IEDs and suicide bombs in a less than lethal manner with limited collateral damage. TRS's technology is being transitioned into a device being developed by the U.S. Army Space and Missile Defense Command.



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