



US ARMY
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COMMERCIALIZATION BROCHURE

ARMY  **SBIR**
SMALL BUSINESS INNOVATION RESEARCH



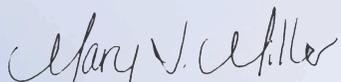


The United States and its allies continue to face an evolving variety of National security challenges on both international and domestic fronts. Helping the Army maintain the lead in this dynamic competition are the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) programs. These programs often provide cutting-edge, high-quality capabilities into our arsenal to the benefit of our Soldiers, citizens and allies worldwide.

These programs increase the incentive and opportunity for startups and small businesses. The Department of Defense welcomes proposals for research and development in all areas of engineering and science and related education. To these ends, the technologies must be highly-innovative with strong commercial potential and satisfy a market need.

SBIR and STTR are the Nation's largest sources of early-stage technology funding and have allowed thousands of businesses to market their ideas since congressional inception of the programs in 1982. Of course, the whole point of new ideas in defense is to equip our Soldiers with high-technology weaponry, allowing them to dominate in the virtual and physical battlespace. Our increasingly complex — and dangerous — world demands the best of this Nation, and the Army is committed to providing our Soldiers with premium tools; their sacrifices deserve no less. It is our hope that this brochure will inspire additional creative, high-tech small businesses to create new, highly-effective ways for our Soldiers to defend our National interests today and in the future.

On behalf of the many brave Soldiers and the Army leadership, I thank you for your dedication and contributions to our Soldiers and our Nation.



Mary J. Miller
Deputy Assistant Secretary of the Army
(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 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 Work with the small business to meet federal R&D needs.
- 3 Foster and encourage participation in technological innovation from socially and economically disadvantaged small businesses (SDBs), and/or 51 percent owned and controlled by women.
- 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 nonprofit research institutions.

Both the SBIR and STTR Programs use a three-phase program structure that reflects the technical risk involved in developing and commercializing cutting-edge technologies.

- 1 Phase I is a feasibility study that determines the scientific, technical, and commercial merit and feasibility of selected concepts. Phase I projects are competitively selected from proposals submitted against solicitation topics seeking specific solutions to stated government needs.
- 2 Phase II represents a major R&D effort, culminating in a well-defined deliverable prototype (i.e., a technology, product, or service).
- 3 Phase III expects the small business or research institute 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; \$100,000 max	6 Months; \$150,000 max
Phase I (Option)	4 Month option (government's discretion); \$50,000 max, to fund Interim Phase II efforts	No option
Phase II	2 Years; \$1,000,000 max	2 Years; \$1,000,000 max
Phase II Enhancement	Extends Phase II contract for up to 1 year (government's discretion); matches up to \$500,000	Extends Phase II contract for up to 1 year (government's discretion); matches up to \$500,000
Phase III	Unlimited time; non-SBIR funding	Unlimited time; non-STTR funding



“PROGRAMS TO PROVIDE OPPORTUNITIES”

SBIR AND STTR ELIGIBILITY REQUIREMENTS

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

- 1** An 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.
- 2** In the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative (except where the form is a joint venture), there can be no more than 49 percent participation by business entities in the joint venture.
- 3** 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 percent owned and controlled by another for-profit business concern that is at least 51 percent 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).
- 4** Has, including its affiliates, no 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 and a research institution. 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 percent of the Phase I and Phase II work. The research institution must perform at least 30 percent of the Phase I and Phase II work. Any part of the remaining 30 percent 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 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.

PHASE III & COMMERCIALIZATION

One 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.

The Army has instituted several programs to facilitate the transition of Phase II projects to Phase III. The following pages discuss each of these in detail:

- 1 Technical Assistance
- 2 Transition Support



Phase III represents the successful culmination of an SBIR/STTR project. SBIR Phase III refers to work that derives from, extends or logically concludes efforts performed under prior SBIR funding agreements, but is funded by sources other than the SBIR Program. Phase III work is typically oriented toward commercialization of SBIR/STTR-developed 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 be indicated by the marketing and selling of the products or services outside the SBIR/STTR programs. Sales can include cash revenue from the government, private sale of new products or non-R&D services embodying the specific technology and/or spin-off technology. Commercialization can include additional investments in activities that further the development and/or commercialization of the specific technology.



TECHNICAL ASSISTANCE

In accordance with the SBIR Reauthorization Act of 2000, Public Law 106-554; and the National Defense Authorization Act of 2012, Public Law 112-81, 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 working in a wide range of technologies. The objective 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, increased competition, productivity, and economic growth. The Army SBIR Program has strategically placed Technical Assistance Advocates (TAAs) across the Army to provide technical assistance to small businesses that have Phase I and Phase II projects.

Each TAA provides:

Expert advice and analysis to SBIR awardees to assist the firm with:

- 1 Improving technical decisions
- 2 Solving technical problems that arise during the performance on a project
- 3 Minimizing technical risks associated with the project
- 4 Developing and commercializing new commercial products and processes resulting from the project

Expert advice and analysis to the government with:

- 1 Technology transition planning and development of technology integration roadmaps through participation in Program Executive Office (PEO) requirements development
- 2 Technology assessment
- 3 Technology transition planning and management activities that facilitate relevant and timely technical advice to support small business concerns regarding integration of SBIR-derived technologies into DoD programs

In coordination with the government research manager, SBIR awardee, and any potential stakeholders, the TAA assists in formulating Phase III plans for Phase II projects. The Phase III plan must document the strategy, requirements and resources to transition the SBIR project to Phase III and into an acquisition program, larger science and technology effort, or a stand-alone product or service.



A skydiver in military uniform is shown from a high-angle perspective, holding a small dog. The skydiver is wearing a blue and red helmet, goggles, and a grey jumpsuit. The dog is brown and black. The background is a clear blue sky with other skydivers visible in the distance.

“INCREASE SBIR
TECHNOLOGY
TRANSITION AND
COMMERCIALIZATION
SUCCESS”

TRANSITION SUPPORT

Army SBIR currently provides transition support to companies awarded with Phase II funding to Phase III through the Phase II Enhancement Program.

The Army is currently structuring a permanent SBIR Commercialization Readiness Program (CRP) to incorporate best practices from the past seven years under the Commercialization Pilot Program, and to address Congressional intent as defined by the SBIR Reauthorization language. Once implemented, the Army SBIR Program will administer the CRP to increase SBIR technology transition and commercialization success. The CRP is still in transition, so Phase II companies interested in securing additional support and funding for transition of their technology during this transition period should follow the process established for Phase II Enhancements. Companies interested in pursuing Phase II Enhancement funding are encouraged to contact their Contracting Officer's Representative (COR) or their Technical Assistance Advocate (TAA) for additional information and assistance.

Phase II Enhancement:

The Army SBIR Phase II Enhancement Program provides funding to small businesses that require additional funding during their Phase II contract period. Instances where more funding may be required during 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 needed documentation and forward it to the Army SBIR Program Management Office (PMO) no later than six months prior to the end of the Phase II period of performance. The PMO will review and adjudicate all transition funding requests. 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. SBIR Phase II Enhancement and CRP combined funding will not exceed \$500,000 per request and is provided depending upon availability and is subject to a deliberate approval process. Small businesses interested in Phase II Enhancements and CRP should contact their COR.

PHASE II ENHANCEMENT DOCUMENTATION

Consists of the following:

- 1 A memorandum from the participating organization's Technical Director, Program Executive Office, or a designated representative to the Project Manager (PM) providing a compelling reason for the additional funding.
- 2 A concise statement of work for the additional effort to be executed with the SBIR Phase II Enhancement funds. The statement of work should contain adequate detail to be included in any contract modification.
- 3 A detailed cost proposal for the Phase II Enhancement. Matching funds are not required, but if available, include the 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 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.

Any 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. Once approved, all awards are subject to the successful completion of negotiations.



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SUCCESS STORIES





Creare LLC

Hanover, NH

www.creare.com

U.S. Army Armament Research,
Development & Engineering Center



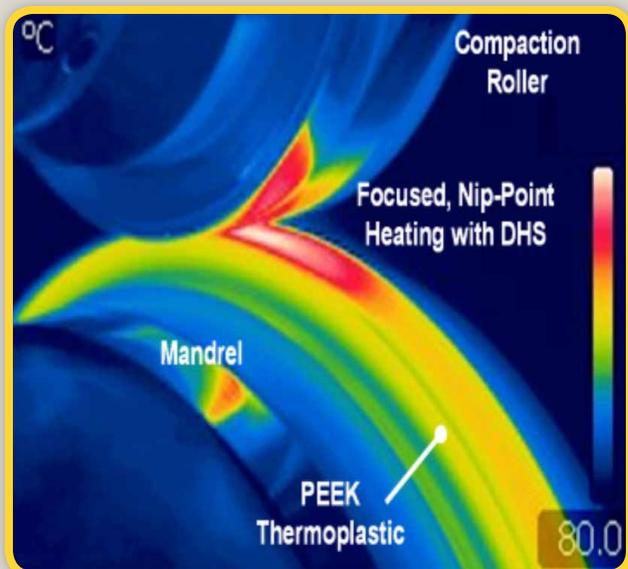
Laser-Assisted Consolidation and Curing of Composite Materials

Polymer matrix thermoplastic (e.g., PEEK/IM7) composites exhibit excellent toughness, fatigue strength, and strength-to-weight characteristics over their all-metal counterparts. These characteristics make them desirable for high-performance military structures such as artillery components for Mounted Combat Systems, forward fuselage sections of the F-22 fighter, and ring-stiffened hulls for underwater vehicles. The automotive industry is actively seeking ways to incorporate thermoplastic carbon fiber composites into structural automotive components. Currently, *in-situ* matrix heating, winding, and compaction of the thermoplastic composite prepreg tape onto mandrels are accomplished using off-the-shelf Automated Tape Laying (ATL) machines. Typically, a jet of hot nitrogen gas, directed just before the nip point, is used to heat the tape just prior to compaction onto the mandrel. The tape feed rates are limited by the current approach of heating using hot gas jets due to their low heating efficiency and poor effectiveness. New manufacturing technologies are greatly needed to significantly increase tape feed rates for the affordable production of thermoplastic components.

Creare's innovation is a Directed Heating System (DHS) that deposits focused and localized energy into the prepreg tape using lasers that can be easily and safely integrated with the fiber placement head on any ATL machine platform. Using a highly-controllable laser system to directly heat each layer of composite material during winding, this innovation enables local and efficient heating of the prepreg tape as it is wound onto the mandrel (illustrated in the thermograph below). Using this approach enables a factor of two or more increase in tape feed rates relative to the existing hot gas system. The DHS is integrated with non-contact temperature measurements and a feedback control system to ensure precisely controlled, uniform, and sustained heating during winding and compaction. Importantly, the DHS can be integrated onto any composite winding machine platform, minimizing the capital expenditures required to implement the technology on existing ATL machines.

TECHNOLOGY TRANSITION:

Due to technical advancements made during Phase I and Phase II, Creare's laser based approach received approximately \$1.5M in Phase III funding to transition this technology to the production of the F-35 aircraft. Specifically, the work completed on feedback control and system integration played a major role in securing Phase III funding. Currently, Creare is preparing for a technology insertion on the Fiber Placement System (FPS) of a Tier 1 supplier to Lockheed Martin Aeronautics Company for F-35 wing skins, to be followed by performance verification, demonstration, and production qualification. Creare is engaged with an FPS supplier to produce DHSs to support the manufacturing of carbon fiber for an automotive application.



Extracting Entities, Relationships and Actionable Intelligence from Unstructured Text Data Sources

Creating network graphs is a manual, time consuming process for an intelligence analyst, especially one dealing with unstructured text reports. Complicating the problem is too much unstructured text for an analyst to ever read; individuals are often referred to by multiple names and shifting titles as they advance in their organizations, and over time, quickly make simple string or phonetic comparison methods.

To address the Army's problem, Decisive Analytics Corporation developed a suite of capabilities that extracts entities, relationships, topics, and semantic concepts from unstructured text and multi-source datasets in order to automatically disambiguate entities and build relationship-rich entity network graphs through our Natural Language Processing (NLP) pipeline.

Meaning from text is extracted, indexed and made searchable to help analysts quickly accomplish their mission. The relationships and concepts, in which an entity takes part with surrounding context, are used as features within the entity disambiguation. A topic modeling component organizes content and entities into automatically learned categories to make evaluating whether two textual mentions refer to the same real-world entity, a tractable problem for our machine learning algorithms. Once Entity Disambiguation has clustered and resolved, it presents entity-resolution recommendations to the analyst, instead of the analyst having to manually tag and resolve each mention of an entity.



Decisive Analytics Corporation

Arlington, VA

www.dac.us

U.S. Army Research Lab



TECHNOLOGY TRANSITION:

Decisive Analytics Corporation was awarded \$4.2M in Phase III funding over the past four years from the U.S. Army Intelligence and Security Command G7 program. As a result, Army analysts are able to see automatically generated network graphs of disambiguated entities. This means textual mentions of relationships for an entity, which occur within separate documents but still refer to the same real-world person, place or location, can be resolved to the same entity node in the graph even if different spellings or titles are used. The resultant network graphs can be used by the analyst to vet the algorithm's results, allowing the analyst to quickly refer to the source material for each entity mention and relationship to ensure accuracy before approving and publishing the results into their targeting tool.





Technology Service Corporation

Silver Spring, MD

www.tsc.com

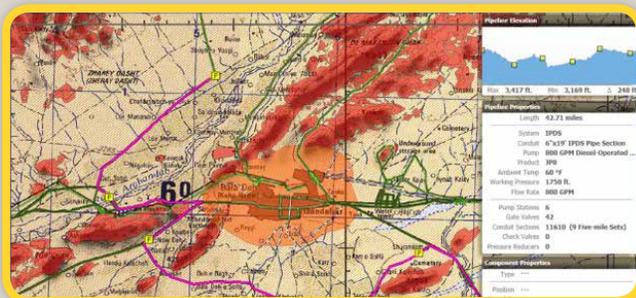
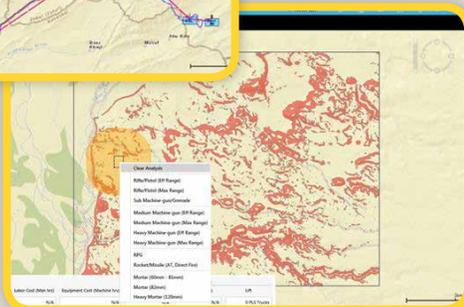
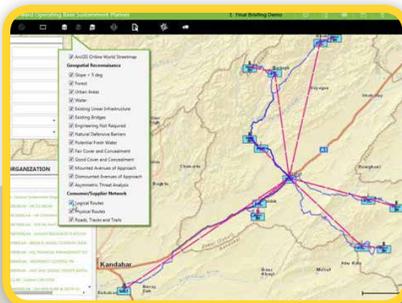
U.S. Army Research Laboratory



Logistical Decision Support and Planning in a Counterinsurgency Environment

The military sustainment process (from deployment, through day-to-day operations, and finally retrograde) has historically been problematic. Weather, terrain — particularly in austere environments — as well as lift and manpower assets typifies the primary issues that have impeded sustainment flow. As a result, the need for effective, near real-time decision support and planning capabilities that address, and in some measure mitigate, these sustainment threats is becoming increasingly apparent. The dynamic and highly-fluid nature of 21st century battle spaces has only heightened this need.

Through the U.S. Army Research Laboratory, Technology Service Corporation (TSC) performed groundbreaking research that combines geospatial analysis and decision support automation to plan operations that can mitigate operational constraints before they are realized. The resulting Army Logistics Planning and Counterinsurgency Analysis System (ALPACAS) decision-support framework represents a springboard for the development of focused tactical decision aids for the U.S. Army and Joint Department of Defense (DoD) community. The ALPACAS framework is map-centric (with embedded Commercial Joint Mapping Toolkit components) and includes a state of the art geospatial reconnaissance engine that can be used to identify local terrain constraints. As a part of this and other efforts, TSC has partnered with academia to integrate asymmetric threat (University of Virginia) and terrain ponding/soil moisture (Colorado State University) constraints with the ALPACAS framework. Via enhancements to this SBIR topic, TSC has partnered with Program Manager-Petroleum and Water Systems (PM-PAWS), the U.S. Army Tank-Automotive Research Development and Engineering Center (TARDEC) and the Combined Arms Support Command (CASCOM) to develop a Petroleum and Water Trace Locator (PAWTL) that automates component placement for the Army's Assault Hoseline System, Tactical Water Distribution System and Inland Petroleum Distribution System hoseline/pipeline programs of record.



The PAWTL, FOBS-P and COP/PB-P decision aids

TECHNOLOGY TRANSITION:

TSC is currently working with PM-PAWS/TARDEC/CASCOM to field the PAWTL tool through the Army Quartermaster School in Fort Lee, VA. A companion Fluid Cost/Benefit Analysis System is currently in development to address the acquisition and planning of future hoseline systems including the new Early Entry Fluid Distribution System. To date, TSC has developed a prototype Forward Operating Base Sustainment Planner (FOBS-P) for the U.S. Army Ammunition Research Development and Engineering Center and a prototype Combat Outpost/Patrol Base Planner (COP/PB-P) for the U.S. Army Engineer Research and Development Center — both based on ALPACAS technology. TSC is involved in an effort to develop decision support components for a Sustainment Planning and Optimized Resupply in Theater (SPORT) suite of tools for the U.S. Transportation Command. TSC has received over \$3.9M in Phase III funding from various DoD agencies with other contracts in development.

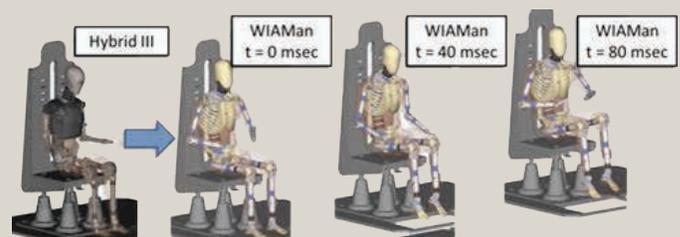
Next Generation Underbody Blast Injury Assessment Capability

Historically, Survivability Live Fire Tests, analysis, and evaluations have been conducted on tactical wheeled and combat vehicles use anthropomorphic test devices, injury biomechanics criteria, and data analysis standards developed by the automotive crash safety community. The best technology available has been used, but none of these tools were developed to assess the types of injuries experienced under the military conditions of vehicle underbody blast loading. The Office of the Secretary of Defense, through the Office of the Director for Operational Test and Evaluation, initiated a project to develop the next generation injury assessment capability for underbody blast through the Warrior Injury Assessment Mannequin (WIAMan) Project Management Office at the U.S. Army Research Laboratory. The project includes biomechanics testing to assess human response, injury modes and limits which can then be used to design and develop the injury assessment capability. One element of that capability is a robust, biofidelic test device structure that is suitable for use in Live Fire Test and Evaluation (LFTE) of vehicles under blast loading. To aid in the evaluation of the first concept WIAMan test device prior to fabrication, Corvid Technologies is using the same high fidelity computational physics (HFCP) methods and tools developed through SBIR and direct program funding for assessing the structural damage in vehicles under blast loading. Using predictive HFCP, Corvid is helping reduce risk and potential schedule slips by helping the WIAMan team make informed decisions on critical design features in the proposed test device.

Corvid is working with the Johns Hopkins University, Applied Physics Laboratory, to provide the WIAMan design team performance insight prior to concept build. Based on the technical data package for the full body technology concept test device, the modeling and simulation team has been applying component level (lower leg, pelvis, lumbar, and head and neck) up to full body test prediction. The focus for the initial analysis has been to highlight strength of design risks and provide assessment of material selection sensitivities. Future analysis potential includes leveraging Corvid's high fidelity modeling capabilities and full vehicle models, that have been thoroughly correlated with LFTE events through pre-test prediction and post-test analysis, to test WIAMan in a full system level environment well before the final design is complete.

TECHNOLOGY TRANSITION:

Corvid's HFCP, when integrated into the design cycle, is a technology that has been transitioned for the development of more survivable tactical wheeled and combat systems and is helping to design the next generation injury assessment device. WIAMan will ensure live fire testing provides the critical insight into vehicle and crew responses to understand the injury risks to warfighters as new technology and vehicle systems are fielded. Corvid is a two time Tibbett's Award winner, and received \$750K in Phase III funding from the Army Project Management Office WIAMan.

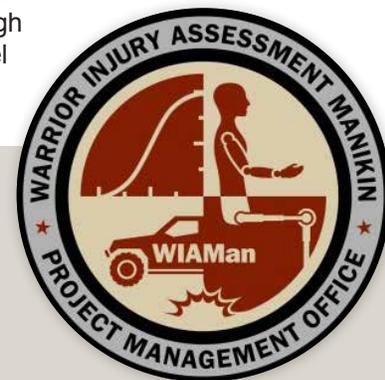


Corvid Technologies LLC

Mooresville, NC

www.corvidtec.com/index.html

U.S. Army Research Laboratory





Mainstream Engineering Corporation

Rockledge, FL

www.mainstream-engr.com

U.S. Army Research Laboratory



Low-Temperature, Extended-Lifetime, Fuel Cell Power System for Unattended Ground Sensors

Current unattended ground sensors (UGSs) are powered by parallel arrays of primary batteries, such as the BA-5590/U, packaged in a weatherproof bag that can be buried. These battery packs are large, heavy, and provide no state of charge indication. Mainstream Engineering has developed a direct methanol fuel cell (DMFC) power system to replace the antiquated bag of batteries. Mainstream's extended-lifetime Compact Fuel Cell Power (CFCP) system provides the energy of eleven BA-5590/U batteries at about one-quarter of the weight and three-quarters of the volume; making it ideal for UGSs, communication equipment, and Soldier-borne electrical loads. Capable of operating in ambient temperatures from -20°F to 125°F (-29°C to 52°C), this power system provides 3.5 W continuously (until fuel is exhausted) and 40 W intermittently (for up to 1 hr.). In contrast to batteries, this DMFC system provides stable power, without capacity degradation, over the entire operating temperature range. The system can be buried with the attachment of two $\frac{1}{4}$ -inch snorkel tubes. Refueling with methanol is simple, inexpensive and allows for additional runtime that is equivalent to another eleven BA-5590/U batteries (~ 2000 Wh).

A number of innovations have been incorporated into the CFCP system. The DMFC membrane electrode assemblies (MEAs) include passive water recovery technology to minimize the size, weight, and power (SWaP) required for balance-of-plant (BoP) components. The custom electronics exhibit very high power conversion efficiencies and strategically cycle the power to BoP components to minimize parasitic losses. Advanced thermal control concepts have been incorporated to extend the operating temperature range well beyond what is typical for DMFCs. The CFCP system includes an automated hibernation mode to extend the operational duration, and SMBus state of charge communication, making it ideal for long-term unattended applications.

TECHNOLOGY TRANSITION:

Mainstream Engineering is working to transition the CFCP to a military product to power small-to-moderate electronic loads on the battlefield. The prototype CFCP unit, developed in Phase II, will be delivered to the Army for additional testing, and anticipate deploying five additional units for field evaluation in a Phase II enhancement effort prior to Phase III. Mainstream Engineering is a two-time Tibbett's award winning SBIR performer with a DoD commercialization index of 100. More than fifteen products have transitioned into the military or commercial sector through the SBIR program, and have received over \$13.2M in Phase III funding in the past. For this project, \$15,000 is committed to IR&D funding, and will spend \$185,000 FY15 IR&D funding working with State of Florida's funding of no less than \$50,000 (a total of \$250,000 as non-SBIR investment to the project). The goal is to mature the CFCP technology to a TRL of 8 over the next two years.



External and internal view of mainstream's CFCP system

Novel Degassing Technology for Powder Metal Conditioning and Process Monitoring

A Process Control Agent (PCA), such as stearic acid, is required in the production of nanostructured powders, but has to be removed prior to powder consolidation. Metal powders used in Additive Manufacturing (AM) need to be conditioned to remove impurities. Presence of residual impurities in the bulk results in inferior properties. Furthermore, a long degassing/powder conditioning cycle will cause a bottleneck for production of material in bulk form and add to the manufacturing costs. In the Powder Metallurgy (PM) industry, press & sinter is a low cost process used to produce high volume iron-based parts for the automotive market. A lubricant is mixed with the powder before die compaction and has to be completely removed before sintering. MATSYS has developed a technology to dynamically monitor the powder degassing and conditioning environments to reduce processing time, which will enhance the competitiveness of the U.S. manufacturing industry.

This Fluidized Rocking Bed Degassing Technology combines fluidization with a rocking motion to thoroughly de-agglomerate the powder particles and enable a reactant gas to be in close contact with the particles expediting the removal of impurities. The sensor system uses Non-Dispersive Infrared (NDIR) and thick film sensors to measure process gas concentration. This monitoring system significantly enhances the Process Engineer's ability to reduce processing time by providing accurate process tuning capability resulting in stronger process control and reduced energy costs. MATSYS has successfully demonstrated the effectiveness of this technology for degassing of nanostructured, lightweight powder alloys and for conditioning atomized powders for AM applications. MATSYS has collaborated with Gasbarre Products Inc. and Symmco Powdered Metal Inc. to successfully implement a system for monitoring delubrication to enhance and optimize the PM sintering process.



MATSYS Inc.

Sterling, VA

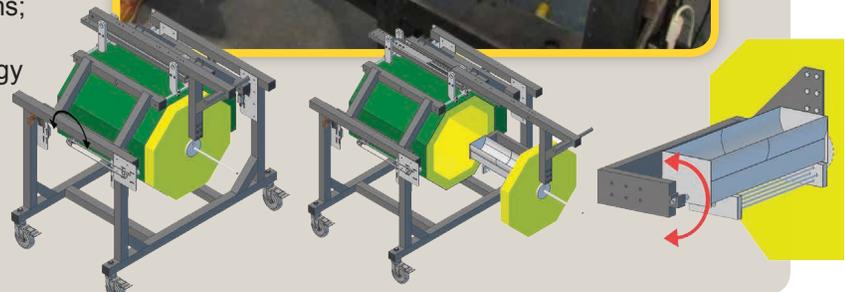
www.matsys.com

U.S. Army Research Laboratory



TECHNOLOGY TRANSITION:

MATSYS is working with several Department of Defense (DoD) agencies on the scale-up of a near-net shape manufacturing technology for fabrication of advanced fragmenting warheads. The technology developed under this project represents one processing step in our manufacturing process, and its transition will contribute to a more cost-effective manufacturing technology in support of several DoD sponsored programs: Air Force Research Laboratory's Flexible Weapon (GBU-X) program; Armament Research, Development and Engineering Center's Advanced Warheads programs; Office of Naval Research; and the Defense Threat Reduction Agency. In addition, the sensor technology is being introduced to the PM industry in cooperation with Gasbarre Products at the upcoming PM Conference. MATSYS has received \$1M in Phase III funding, and has a possible \$3M in contract negotiations.



Thermal Processing Fluidizing Rocking

Transitional and Rotational mechanism For Loading and Unloading Powder



Enig Associates Inc.

Bethesda, MD

www.enig.com

U.S. Army Research Laboratory



Electromagnetic Explosive Warhead for Scalable Lethal and Nonlethal Effects

As the U.S. Army looks to the future for longer-term solutions and providing warfighters with a range of effects, the development of a new class of multi-functional munitions is critical. Those desired effects span from lethal to non-lethal, result in low collateral damage, and are scalable and adaptive against targets. This objective research performed by Enig Associates Inc. (ENIG), has led to new advances in very compact explosive flux compression generator (FCG) technology to convert explosive chemical energy to electromagnetic energy with very high current output and superb energy conversion efficiency. This technology has led to the Electromagnetic Explosive Warhead (EMEW) and a wide range of concepts and approaches for integrating these technologies into a single, self-contained device capable of providing warfighters with focused lethal and non-lethal effects.

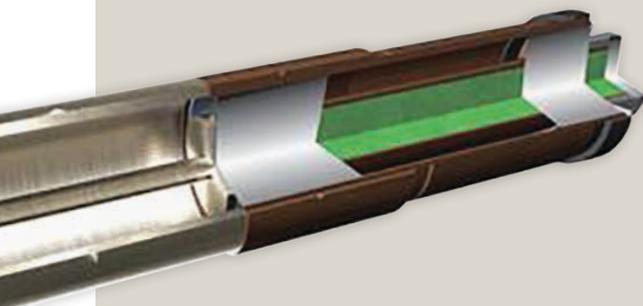
ENIG has developed collaborative partnerships with the Army, Navy, Air Force, Department of Energy, and Defense Advanced Research Projects Agency in an overarching research and development framework to use large-scale shockwave physics codes, magnetohydrodynamics codes; and in-house developed analytic codes for FCG design and analysis. ENIG has (i) identified conditions for optimum conversion of explosive energy to electromagnetic effects; (ii) determined efficacy and scaling parameters, including size limitations, for munitions configurations; and (iii) evaluated the most promising FCGs, load configurations and various critical technical aspects of integrated munitions. With leveraged Phase III funding applied to this program, ENIG and collaborative partners have had numerous successes in testing and demonstrating various FCG configurations with remarkable match to the theoretical model predictions.

TECHNOLOGY TRANSITION:

The technology being developed is rapidly spinning-off for future applications to a wide variety of gun-launched and missile launched weapons including:

- 1 Artillery and tank munitions
- 2 Urban and asymmetric environment munitions
- 3 Hand-held, crew-served, and fixed and mobile platform munitions, which include electromagnetic producing devices for non-lethal effects and electronics/sensor defeat.

Furthermore, this technology opens the potential for a new generation of controllable and dial-a-yield warheads and munitions. ENIG is a small business with the primary purpose of developing new technologies for government applications and spinning off these technologies as directed energy weapons products for commercialization. ENIG has received over \$3.1M in Phase III funding.



“...OPENS THE POTENTIAL FOR A NEW GENERATION OF CONTROLLABLE AND DIAL-A-YIELD WARHEADS AND MUNITIONS.”

Linguistic Geometry-Real-Time Adversarial Intelligence and Decision-making (LG-RAID)

The threat environment is increasing and becoming more lethal. In order to succeed in today's and future mission environments, the Army needs to develop and retain adaptive leaders with the appropriate cognitive skills. Linguistic Geometry-Real-Time Adversarial Intelligence and Decision-making (LG-RAID) provides a leader-centric training, planning, and rehearsal capability focused on combat operations. By estimating the enemy course of action using game theory and artificial intelligence techniques, optimized for computational efficiency, the tool provides a highly-useful training and mission planning application that can be accessed from a laptop, tablet, handheld device, or over the web. In a training environment, junior leaders are provided with an opportunity to learn, practice, execute and assess the results of mission planning and decisions to adapt their plans to the evolving situation against a highly-realistic threat. In a tactical environment, the simulation executes the leader's decisions by putting their operational orders into action, and provides periodic updates analyzed to decide if they must alter their plans. Altered plans can be inputted rapidly, and the process continues to iterate as the tactical situation develops.

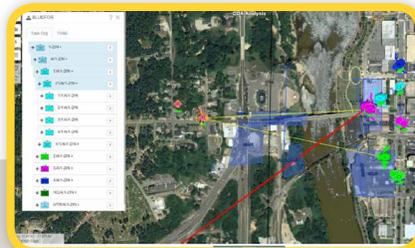


Stilman Advanced Strategies

Denver, CO

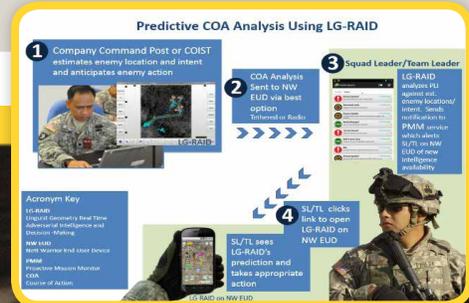
stilman-strategies.com

U.S. Army Research Laboratory



TECHNOLOGY TRANSITION:

As a result of previous and current experiments, Stilman has received over \$7M in Phase III contracts. The software was installed, tested, and matured at three different levels (or echelons) within a Mission Command technology demonstrator framework. In a live experiment, the users were able to go over several alternative schemes of maneuver for friendly forces and rapid war games against likely enemy tactics. All of the nodes were interfaced with the Mission Command software and used the Joint Battle Command-Platform (JBC-P) at Command Posts and in vehicles, while Nett Warrior (NW) software was used by dismounted Soldiers. Soldier comments provided high praise for LG-RAID: "Would love to see this tested in theater and view results", "This tool would be a great application for mission planning and rehearsals", "I can see this being an operational tool used in conjunction with an application that gives real world/real time enemy activity in the area of operation that you are using", and "Great tool for Course of Action (COA) development."





Research Network Inc.

Kennesaw, GA

www.resrchnet.com

U.S. Army Research Laboratory



Modeling Human Interfaces and Behaviors in Dismounted Soldier Training Environments

One of the most complex and challenging aspects of any Soldier training system is the human element within the virtual environment. The Army has made considerable investments in the use of virtual environments (VE) to train combat forces, evaluate new systems and operational concepts, and rehearse specific missions. These systems have predominately focused on training and simulation for mounted units, but there is a need to train dismounted Soldiers and VEs by immersing Soldiers directly in the simulations. The ideal system should allow teams and squad leaders the ability to use a suite of interface devices to control and interact with automated forces and the simulation environment. Small teams often use non-verbal communications to direct subordinates and these “gestures” are repeated by sub-commanders to other team members. The objective of this project was to design intelligent human interfaces such as voice recognition, hand signaling/gesturing and other multi-modalities for the command and control of computer generated forces.

Research Network Incorporated (RNI) developed an innovative training system, using Soldier-worn equipment, to achieve all the various human interface modes for the virtual, live, and immersed soldier training application. Their research specifically looked at the dismounted Soldier simulation environment that made significant advances for the command and control of computer generated forces such as Blue Force and unmanned platforms. By doing so, RNI was able to develop a single man-worn system. This accommodates a Man-Wearable Dismounted Soldier Training System that is a small size, low weight, power and cost with no occlusion issues in multiple units or lighting sensitivity w/Indoor and Outdoor ops, long range telemetry, and fully self-contained configurations (mobile). The system modes include virtual-immersive training (game/virtual), live training, mixed reality training, inertial/UWB/GPS high accuracy redundant fused tracking modes, integrated wireless Hitbox Haptics, live or virtual locomotion support, suit-less configurations with avatar animation support, and real-time live/virtual bridging. Lastly, this system includes artificial intelligence dispositions, behaviors and formations of multiple NPCs (Non-Playing Characters) with multi-modalities including: voice recognition, gesturing and gesture recognition, fused intent recognition, and real-time bone manipulation.



TECHNOLOGY TRANSITION:

Based on Department of Defense and private industry interest, RNI has received over \$2M in Phase III awards from the Simulation & Training Technology Center to commercialize, miniaturize, update, and extend the capabilities of this system. The technology used by the DoD and commercial agents will be the man-worn motion capture and voice/gesture recognition systems. RNI has published four papers in I/ITSEC (2012, 2015) related to the Live/Virtual Bridge and Virtualization of Live Humans. In the Haptics area, the research performed on this effort has aided other commercial products such as the “Teslasuit” currently being marketed by Futurism.

Geospatial Correlation and Automated Testing Technologies

The modeling and simulation industry has long been plagued by errors in synthetic natural environment representations and services. These errors spawn from a wide range of issues including, design flaws, software errors, and miscorrelation between various representations, among others. These problems have widely been addressed through a mixture of accepting functional flaws, and extremely time consuming attempts to identify and fix issues. Numerous efforts at test automation or improvement have been conducted, but most were flawed in execution due to an excessive focus on a small slice of the problem area. In addition, many test applications have focused on only data without consideration of the functional effect of the data in a system context.

Dignitas Technologies, working with Army Research Laboratory (ARL) — Simulation and Training Technology Center (STTC), has leveraged existing connections with major Army programs; such as, Synthetic Environment Core, One Semi-Automated Forces, Close Combat Tactical Trainer, and Aviation Combined Army Tactical Trainer to establish a communication process which allows Dignitas to quickly respond to the testing needs of the Simulation and Training industry. The information gathered allowed Dignitas to draft a set of highly-relevant requirements and set the foundation for the design and development of the flexible architecture behind the Correlation Synergy (C-nergy) testing toolset.

C-nergy's flexibility allows it to evolve with the ever changing needs for different synthetic environment databases and tests, a framework that provides a user-friendly environment for manual inspection and allows automated testing of databases. C-nergy allows developers to readily add new database formats, new tests and to readily import or export test results for integration with other systems or toolsets. The introduction of C-nergy, within the development and testing processes of the aforementioned programs, has expedited the error detection and resolution process by providing the programs with a mechanism for directly comparing multiple sets of geospatial databases through visual and automated methods. This allows the programs to detect problems earlier in the database iteration cycle, translating to time and overall cost savings.



Dignitas Technologies LLC

Orlando, FL

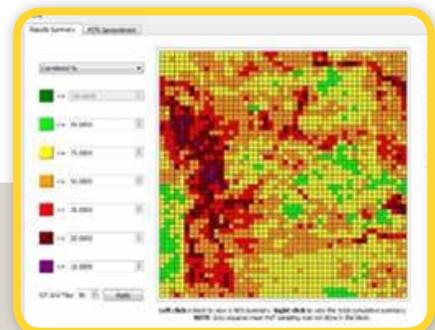
www.dignitastech.com

U.S. Army Research Laboratory



TECHNOLOGY TRANSITION:

C-nergy has been transitioned to Programs of Record, such as, Synthetic Environment Core Common Virtual Environment, and distributed to over 16 different organizations. The C-nergy application can transition to any organization working with synthetic environment databases. Users of synthetic environment databases will benefit by being able to verify the content of the databases they receive, as well as being able to better plan training scenarios, within areas that have been identified as having ideal correlation. The Correlation SBIR has received \$400K Phase II Enhancement funding which has been leveraged into \$940K in Phase III funding from supporting organizations.





OctaFlex Environmental Systems Inc.

Timber Lake, SD

www.octaflex.com

U.S. Army Research Office



Self-Contained Automated Vehicle Washing System

Combat vehicles must be completely decontaminated of any chemical, biological, and radiological threat to eliminate health and safety threats to military personnel. Federal and state regulations on the handling of hazardous materials and the transportation of equipment or materials that have been used in a foreign environment are becoming more stringent, resulting in a critical need for a self-contained, automated vehicle washing platform. The Department of Defense continues to implement new requirements for both “wash-down” and “decontamination” of equipment after its use on both foreign soil and in the United States. The Joint Service Field Manual 3-11.5, “CBRN Decontamination Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination,” describes the Detailed Equipment Decontamination (DED) process. The DED is a five station process with Station 1 being a high pressure, low volume vehicle wash down that requires two M26 high pressure washers and at least four warfighters to remove contamination and road grime. One serious issue in the conduct of the DED is the amount of water required, especially where water is scarce.

To address the military’s need for a portable, field deployable, closed-loop, easy to use washing system for large armored vehicles, such as the M1A1 tank, the Self-Contained Automated Vehicle Washing System was developed by OctaFlex Environmental Systems Inc. The washing system design allows for ease of deployment (the modular system can be assembled in 4 hours), eliminating the amount of pre-site development prior to deployment. The washing system efficiently cleans military vehicles in 13 minutes which includes an optional water reclamation cycle and allows customizable run times, sequences, and water pressures. Most critically, the system reduces the number of Soldiers needed to carry-out the DED process by 10-fold (approximately 40 Soldiers to 4 Soldiers). The wash system significantly reduces power, water consumption, manpower needs, logistics, and protects the Soldier from the dangers of chemical and biological warfare agents while returning vehicles to the battlefield more efficiently.



TECHNOLOGY TRANSITION:

OctaFlex was awarded more than \$1.39M in Phase III funding from the Joint Program Executive Office for Chemical and Biological Defense to assist the company in development and demonstration of a full size washing system prototype at Dugway Proving Grounds. The field system was deployed to Dugway Proving Grounds in June 2014, and initial testing compared the current vehicle decontamination line to a decontamination line using OctaFlex’s system. Compared to the DED process, the OctaFlex system only requires a single operator and significantly reduces wash time by replacing multiple wash stations with a single station. It is anticipated that all branches of the U.S. and Foreign Militaries requiring a wash facility would benefit from a system that is modularly deployable, solid, with a carbon filtration system that allows reuse of the source water, and environmentally friendly. The system was demonstrated at Dugway Proving Grounds at the end of 2015. OctaFlex has sold variations of the wash equipment integrated into the system, generating sales of \$500K.

Reagent-Free DNA Mimicking Barcode Tag and Reader (RDB)

There is a growing concern in the Department of Defense (DoD) and Army and Defense Logistics Agency (DLA) regarding counterfeit components in the supply chain. The National Defense Authorization Act (NDAA) of 2014, Section 818, specifically addresses the urgent issue of counterfeit electronic parts in the DoD supply chain and that prime contractors bear the financial risk of counterfeit escapes. To address this urgent Army/DoD need, ChromoLogic LLC (CL) developed and transitioned/commercialized a reagent-free deoxyribonucleic acid (DNA) mimicking Barcode Tag and Reader (RDB). The RDB system includes two biologically-inspired methods: an extrinsic tag consisting of DNA analogous material that is used to physically label and track material, and an intrinsic identification technique similar to fingerprinting that uses the inherent surface features to determine the authenticity of the material. Built on a core platform that provides an unambiguous, unforgeable and readily authenticating system for material traceability, the intrinsic identification technique, which is a key element of the RDB system expected to reduce the cost of microelectronic counterfeit mitigation by 40 percent.

The RDB technology includes numerous optical, mechanical and algorithmic patent pending innovations that directly address the threat posed by counterfeit electronics in the aerospace/military supply chain. The intrinsic identification and counterfeit screening capabilities of the RDB technology, under the product name "DTEK™", was shown to be effective at identifying specific high-risk electronic components that have been resurfaced and tampered. Furthermore, with additional support from the DLA and Missile Defense Agency, ChromoLogic has developed the next generation of this product, QuanTEK™, which enables full tag-less track and trace capability of components through the supply chain. Multiple DTEK™ units have been fielded at original equipment manufacturers (OEM) (The Boeing Company), Federal Institutions (National Aeronautics and Space Administration Jet Propulsion Laboratory (NASA-JPL) and other entities in the military supply chain. The QuanTEK™ system is currently entering pilot testing at numerous OEM, federal institutions and distributors. The DTEK™ and QuanTEK™ product lines are managed through our wholly-owned spin-off, COVISUS Inc., (www.covisus.com). DTEK™ is primarily used by our customers as part of their comprehensive inspection, testing and assurance for the authenticity of microelectronic components as part of NDAA 2012. The core testing capability of the DTEK™ system has been adopted by the SAE-AS5553 standards committee for "Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition."

TECHNOLOGY TRANSITION:

ChromoLogic was selected for a U.S. Army SBIR Phase II Enhancement award for \$615K to develop and validate the technology at multiple user facilities. Funds were provided prior to FY12 Congressional statutes which now limits transition support to \$500K. Based on the success of this project, an additional ~\$320K has been secured in commercial sales for pilot studies at multiple customer sites. ChromoLogic secured additional funding from the Defense Logistics Agency, Rapid Innovation Fund and Missile Defense Agency for further development and integration of the technologies.



ChromoLogic LLC

Monrovia, CA

www.chromologic.com

U.S. Army Research Office





ChemImage Biothreat LLC

Pittsburgh, PA

www.chemimage.com

U.S. Army Research Laboratory/
Army Research Office



Standoff Detection of Explosives

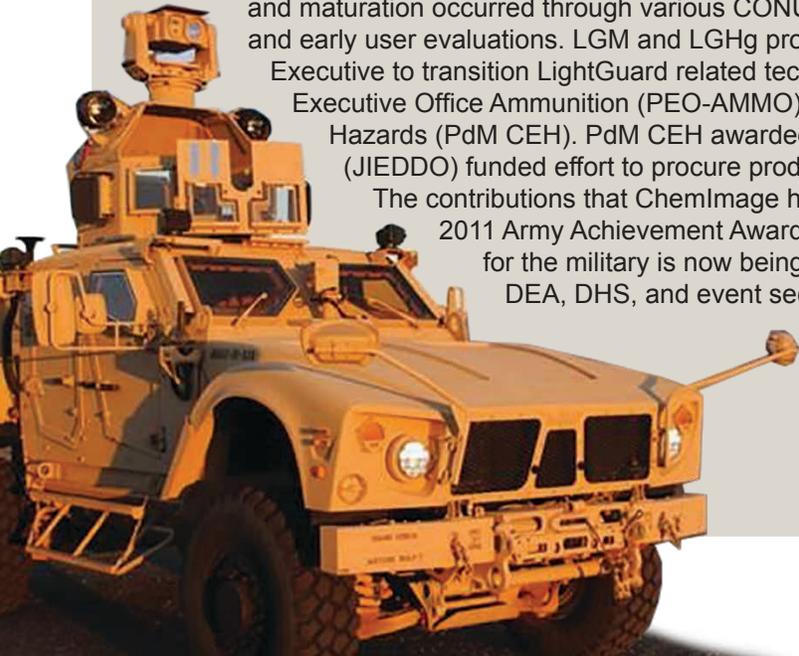
Improvised Explosive Devices (IED) are a constant threat to deployed Soldiers and for successful force protection, the Army requires stand-off detection of explosive residues associated with vehicle and person-borne IEDs, while stationary and in transit. Currently, fielded technologies are challenged by low area search rates, poor targeting efficiency, lack of sensitivity and specificity, eye-safety concerns, and the inability to operate while moving.

Over the last eight years, ChemImage has developed and refined Short Wave Infrared Radiation (SWIR) technology that enables the real-time detection of explosive residues at standoff distances. This technology combines hardware, advanced processing, and software that has been supported by numerous SBIR awards. One of the products of these efforts is the Real-Time Toolkit (RTTK), a software package and accompanying multi-core distributed processing environment for threat detection data. The RTTK includes advanced algorithms that provide robust and accurate identification with a highly-intuitive user interface that allows the user to quickly comprehend the level of threat and make rapid decisions. The RTTK is adaptable to field use, independent use, and easily operated by untrained personnel. The use of the ChemImage standoff sensing technologies has been demonstrated via numerous government sponsored field trials and been deployed Outside the Continental United States (OCONUS). This technology improves safety to the Soldier by increasing the standoff distance between the Soldier and the threat. This new capability has proven adaptable to a variety of environments, including a concept of operations (CONOPS) for a vehicle mounted on-the-move, and a stationary sensor/moving target CONOPS. ChemImage technology provides rapid times to detect, low limits of detection and low false positive rates.

TECHNOLOGY TRANSITION:

ChemImage was awarded Phase I, Phase II, and Commercialization Pilot Program funding for Real-Time Chemometrics and sensor fusion. This work was instrumental in ChemImage being awarded \$47M in follow-on funding for related LightGuard Minotaur (LGM) and LightGuard Mercury (LGHg) programs. Space and Missile Defense Command/Army Forces Strategic Command's (SMDC/ARSTRAT) Technical Center funded a total of \$36M through multiple contract actions under a Phase III contract. LightGuard technology development and maturation occurred through various CONUS tests, multiple OCONUS operational demonstrations and early user evaluations. LGM and LGHg programs gained support from the Army's Acquisition Executive to transition LightGuard related technologies from SMDC/ARSTRAT to the Program Executive Office Ammunition (PEO-AMMO) and Product Manager of Counter Explosive Hazards (PdM CEH). PdM CEH awarded \$11M under a Joint IED Defeat Organization (JIEDDO) funded effort to procure production type LGHg's, in support of OCONUS efforts.

The contributions that ChemImage has made in this area have been acknowledged with a 2011 Army Achievement Award and 2014 Tibbett's Award. The technology developed for the military is now being commercialized in new arenas such as law enforcement, DEA, DHS, and event security.



Enhanced Field Expedient Body Wearable Antenna (BWA)

Wearable electronics are of significant interest for several military and commercial communication systems in the very high frequency (VHF) band. Specifically, there is a high demand for a field-expedient, body-borne antenna solution for the Single Channel Ground and Airborne Radio System (SINCGARS), operating in the VHF-FM radio frequency (RF) band. Many of the current antenna solutions for this radio system have a very large visual signature that exposes the user to enemy fire and possible entanglement with low hanging vegetation in the forest or jungle, and low hanging wires in an urban environment. One solution was an adaptable antenna worn in/on a Soldier's battledress or vest, but provided less communication range, and bandwidth. The goal for a field-expedient body wearable antenna is to jointly address the high visual signature and encumbering characteristics of large whip solutions, as well as inefficiencies and potential safety risks of conformal torso-mounted solutions.



FIRST RF Corporation

Boulder, CO

www.FIRSTRF.com



TECHNOLOGY TRANSITION:

FIRST RF Corporation was awarded a Phase I contract to develop a prototype body wearable antenna for use by the Soldier with their Soldier radio. The Phase I effort showed two proofs of concept. This led to a Phase II effort to develop a Soldier worn antenna allowing the Soldier to communicate effectively with another Soldier, while both were in the prone position, and at extended communications range. At the conclusion of Phase II, FIRST RF delivered the field-ready hardware, in low quantities, for final demonstrations and evaluations, making the transition to full rate production the next step forward for Phase III. The technologies developed under the Phase II contract have been shown to improve performance in existing Soldier communications systems. CERDEC demonstrated to an Army combat infantry division that remoting this body wearable antenna away from the Soldier, by hoisting it into the trees, could increase the communications range for small units operating in jungle environments. The end state of this technology is a commercial product sold to the U.S. military to establish performance and production quantities, and then to civic users including police, SWAT, fire rescue, security forces, and homeland security.





Conformal Omni-directional Antenna Design for Unmanned Aerial Vehicle (UAV)

The Army requires a conformal vertically-polarized Omni-directional antenna installed aboard the RQ-7 Shadow UAV, which covers the SINCGARS and LOS/EPLRS bands. These antennas are to be used as part of an airborne relay system, where the airborne node fills the gap between distant ground-to-ground nodes. However, a general need exists for VHF antennas for UAVs, particularly with the ubiquitous RQ-7 Shadow.



FIRST RF Corporation

Boulder, CO

www.FIRSTRF.com

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



TECHNOLOGY TRANSITION:

Under Army CERDEC Phase II, the RQ-7 Shadow Communications Relay Platform (CRP) antenna has been modernized to include additional waveforms beyond SINCGARS. FIRST RF Corporation has qualified a Multi-band Wingtip Antenna, integrated with the AN/PRC-152 radio, to provide the increased capability to the CRP on the Shadow UAV. This provides capability requested by Networking Brigades, the United States Marine Corps, and operations within the National Airspace. These capabilities are necessary for improved situational awareness, and for Air Traffic Control. One of the key features of this antenna is that it incorporates several important frequency bands used for networking with availability on the next generation software defined radios: SINCGARS, Air and Marine; HAVEQUICK, and Public Safety. In addition, new waveforms, Soldier Radio Waveform (SRW) and Adaptive Networking Wideband Waveform (ANW2) are included in this antenna. This new CRP antenna system provides the capability for the relay of voice and data within a band, and the cross banding of voice between different bands (e.g. SINCGARS to SRW). All frequency bands are supported by one antenna housing on each wing tip of the RQ-7 Shadow.



**“NECESSARY FOR IMPROVED
SITUATIONAL AWARENESS, AND
FOR AIR TRAFFIC CONTROL”**

3 KW Lightweight Efficient Generator

CERDEC technically supported and managed the Project Manager Expeditionary Energy & Sustainment Systems (PM-E2S2) SBIR effort focused on a fuel-conditioning system that integrates with Commercial Off The Shelf (COTs) gasoline-driven engines. This enables operations with JP-8 and DF-2 fuels which work with existing Original Equipment Manufacturer (OEM) controls, adapted thermal management techniques, and packaging materials. This effort is one of two executed by CERDEC and is focused on determining the feasibility of using JP-8 and DF-2 fuels in spark ignited (SI) engines to develop a practical, manufacturable design for integration with a high power density COTs engine driven power systems. Adaptation of COTs equipment was targeted to enable rapid transition to manufacturability and reasonably priced hardware. The dual design approach reduced technical risk and ensured a seamless transition of resulting technology assessments, learned information, and test data to the PM E2S2 in support of its upcoming procurements. The development of these fuel conditioners and controls for integration into small COTs power systems provide a significant performance leap in the areas of weight reduction, fuel consumption, volume, reliability and signature suppression compared to existing military and COTs power systems. The results of these efforts enable the Army to fill the power gap between the biggest battery and the smallest generator set. This reduces Soldier dependence on extra batteries, procurement costs and maintenance through the use of COTs engines, and the logistics footprint with improved fuel efficiency. This increases the operational reliability of small power systems, and enhances military readiness and operations in forward operating and expeditionary based efforts.



Novatio Engineering Inc.

Waltham, MA

www.novatioengineering.com

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

NOVATIO
ENGINEERING, INC.

TECHNOLOGY TRANSITION:

Phase I focused on designing, developing and fabricating a fuel conditioner that could be placed onto any commercially available SI engine driven generator set to change JP-8 fuel into a form the SI engine could use. The fuel conditioner, designed to be a plug and play solution, is based on an innovative mechanism that aerosolizes liquid JP8 or DF2 into a mist of fuel that can readily be mixed with air during the intake of Otto cycle operations (Gasoline Engines) and burned to generate power. This approach takes advantage of existing OEM manufacturing set-ups, and strong competition between SI engine driven systems ensuring an affordable solution that does not adversely impact the reliability, life, or the cost of COTs gasoline engine driven system that uses this fuel conditioner. Phase II focused on the optimization of the fuel conditioner and its integration into a COTs SI engine driven generator set by enabling it to start, stop, and operate on JP-8, gasoline and DF-2 without modifications to the OEM engine, system controls, power electronics, or alternator. Efforts focused on one size range (3kW) but technology developed has been transitioned to other size ranges. The 0-900W system has successfully demonstrated start and operation between -25°F and 125°F, and a hot swap fuel capability that enables an OEM engine to operate on any fuel mixture and allows the addition of fuel (gasoline, JP-8, DF-2) to the existing contents of the fuel tank without having to turn off the engine-resulting in optimized performance- while extending the life of the engine. To ensure a cost effective, robust solution, this approach leverages highly-engineered and proven designs with established supply chain logistics. The design has been integrated with engines manufactured by Honda, Yamaha, Hyundai and others, proving to be engine manufacturer independent and easily transferred to other manufacturer's COTs SI engines of varying horsepower sizes. The results of this work have been transitioned to PM-E2S2, and Novatio has teamed up with a manufacturing and commercialization partner with plans aimed at developing the next generation of small 500-3000 Watt power systems.

Novatio multi-fueled
0-3000W generator



Novatio ruggedized
0-2000W generator



Novatio/Fidelity Technologies
0-900W generator





Precision Combustion Inc.

North Haven, CT

www.precision-combustion.com

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



Advanced Small, Lightweight Multi-Fueled 1,000 – 1,500 W Variable Speed Load Following Man-Portable Power Unit

The U.S. Army Communications Electronics Research & Development Engineering Center (CERDEC) is the Army’s lead in research, development, and application of advanced power and energy technologies with integration leading to solutions that address the Army’s unique power requirements. CERDEC has investigated two alternative combustion augmentation solutions with tailored control schemes to determine the feasibility of using JP-8 and DF-2 fuels in lightweight spark ignited (SI) engines to ensure a practical, manufacturable design was developed for integration with a high power density Commercial Off The Shelf (COTs) engine driven power system. The dual design approach reduced technical risk and ensured a seamless transition of technology assessments and test data to the Project Manager Expeditionary Energy & Sustainment Systems (PM E2S2) in support of upcoming procurements in 2016.

Development of these fuel conditioners and controls for integration into small-scale COTs power systems provides a powerful performance leap in the areas of weight and fuel reduction, physical size, reliability, noise, and infrared suppression compared to existing military and COTs power systems. Results of these efforts enable the Army to fill the power gap between the largest battery and smallest generator set. Correctly sized power systems reduce Soldier needs for additional batteries. The use of COTs based engines in power systems for missions requiring lower power levels helps reduce procurement costs, maintenance requirements, and reduces the logistic footprints because of improved fuel efficiency. Efforts increased operational reliability of smaller power systems while improving military readiness and operations during forward operating and expeditionary based efforts.

TECHNOLOGY TRANSITION:

Precision Combustion Inc. was awarded a Phase I contract to design and develop a proof of concept fuel conditioner that would enable the fueling of lightweight SI engines with military JP-8 and DF-2 fuels. Lab tests demonstrated the functional and operational feasibility of the design and verified the Army’s goals for system weight and power could be met. The Phase II focused on the optimization of the fuel conditioner and integration to produce a single man liftable, multi-fuel capable (JP-8/DF-2/gasoline/propane) generator set with a switch selectable continuous output of 900 Watts, 120 V-ac, 60 Hz at sea level or a continuous dual output of 600 W-dc and 300 W-ac. Since the approach requires only fuel-inlet modification, the fuel conditioner design can easily be used in other engine families. To ensure a cost effective and robust solution, this approach leverages highly-engineered and proven designs with established supply chain logistics. The results of this work have been transitioned to PM-E2S2.



Digital IF Architecture Developed for Military Satellite Communications

Both televisions and telephones have transitioned from analog to digital technology, and now Military Satellite Communications (SATCOM) is making the same transition under a research and development effort spearheaded by The U.S. Army Communications Electronics Research & Development Engineering Center (CERDEC). The purpose of the Future Advanced SATCOM Technologies (FAST) program at CERDEC is to work with industry to develop a standard for Digital Intermediate Format (IF) SATCOM that would allow any company to integrate its SATCOM products into a common digital IF architecture. The digital IF architecture and Open Standard Digital IF Interface (OSDI) allow the government to modernize and upgrade SATCOM communications. Digital IF technology enables more flexible switching and routing while improving signal fidelity and reducing operation costs compared to current legacy systems.

TECHNOLOGY TRANSITION:

Welkin Sciences was awarded a Phase I contract to develop prototype components for proof of concept and to inform the development of the OSDI effort. The Phase I effort led to one Phase II effort to develop a Wideband Signal Processor and another award to develop the Digital Conversion Subsystem prototype. After a series of successful technology demonstrations, Welkin Sciences was awarded a \$9.9M contract to commercialize the technology with CERDEC and the Defense Information Systems Agency (DISA) both contributing to the funding with plans to upgrade SATCOM ground terminals and long-haul transport applications in the near future. A multi-vendor demonstration of a FAST-compliant system was conducted, in October 2015, for representatives of the Army and DISA with Welkin Sciences' Digital Converter System (DCS) and Wideband Signal Processor (WSP) operating with digital IF modems developed to the OSDI standard by Comtech EF Data and Harris Corporation. The Comtech modem was using a DVB-S2 waveform and Harris' demonstration unit was sending a hopping signal. The FAST OSDI specification is currently in the ANSI/TIA standardization process as ANSI/TIA-PN-5041 and is expected to be published in 2016.

Welkin Sciences is working on another Phase II with the Air Force to develop a Legacy Modem Data Converter. This product will allow the Department of Defense to integrate legacy analog modems into the FAST OSDI architecture, preserving the large investment that the government already has in analog modems while new digital modems are developed. Welkin Sciences offers a FAST Interface Firmware Core (FIFC), which enables digital modem developers to mitigate risk and accelerate the development of FAST OSDI-compliant equipment.



Welkin Sciences LLC

Colorado Springs, CO

www.welkinsciences.com

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



www.welkinsciences.com



Natural Process Design

Winona, MN

www.naturalprocessdesign.com

Materials Research Development Center



Self-Repairing Composites for Ballistic Panels

Natural Process Design (NPD) addressed the U.S. Army's challenge for force protection-basing by delivering increased threat protection, with decreased manpower requirements for outposts and bases via multiple-impact ballistic reusable panels and stanchion wall systems. The field test ready, self-repairing and self-sensing composite protective system, addressed the Army's challenge for improved force protection for combat outposts and patrol bases. Technology capability, demonstrated with aligned manufacturing readiness, was ensured through collaborative work between two composite manufacturing companies.

All panels (controls and self-repairing) remained intact after a series of three full blast tests, completed in numerous operations. Data, including blast pressures, wrap around pressures, high-speed photography, mortar, and ballistic testing, reveals that the self-repairing panels retained some ability to stop projectile impacts. The controls did not reveal the same results. While moving up the manufacturing readiness levels, NPD made self-repairing panels at two companies. The most interesting finding was that the self-repair system is easily inserted into the pultrusion process.

TECHNOLOGY TRANSITION:

NPD's self-repairing composites for ballistic panels received \$3M in Phase III funding from the U.S. Army Rapid Innovation Fund. Potential military and commercial applications for this product include protective walls, building infrastructure, body armor, and vehicle/aircraft materials and armor.

“IMPROVED FORCE PROTECTION FOR COMBAT OUTPOSTS AND PATROL BASES”



High Performance Rechargeable Li-ION Conformal Battery

Portable power for Soldiers' electronics systems is a critical logistic commodity carried onto the battlefield. To meet the challenge of lightening the physical load borne by Soldiers, it is highly-desirable to have energy storage solutions that deliver maximum battery capacity from lighter, smaller form factors that conform to a Soldier's body. To unburden the Soldier load and improve Soldier mobility, EIC has used the principles of human factors engineering (ergonomics) and has relied on engineering anthropometry to successfully design a conformal battery. Conformal batteries can be shaped like an armor plate and can fit into the same location in a Soldier's vest. A conformal battery with a body-hugging slim profile will distribute weight over a wider surface area and will increase Soldier mobility.



EIC Laboratories Inc.

Norwood, MA

www.eiclabs.com

U.S. Army Natick Soldier System Center



TECHNOLOGY TRANSITION:

EIC has been awarded an additional \$4.3M from Phase III and other DoD funding to develop and start a Low Rate Initial Production of 18V/28V conformal batteries and 28V aircraft batteries. EIC has achieved direct sales in conformal and aircraft batteries of \$1.4M to DoD and \$2.3M to the commercial market. EIC has started a spin-off company, Avion Power LLC, to handle the direct military and commercial sales.



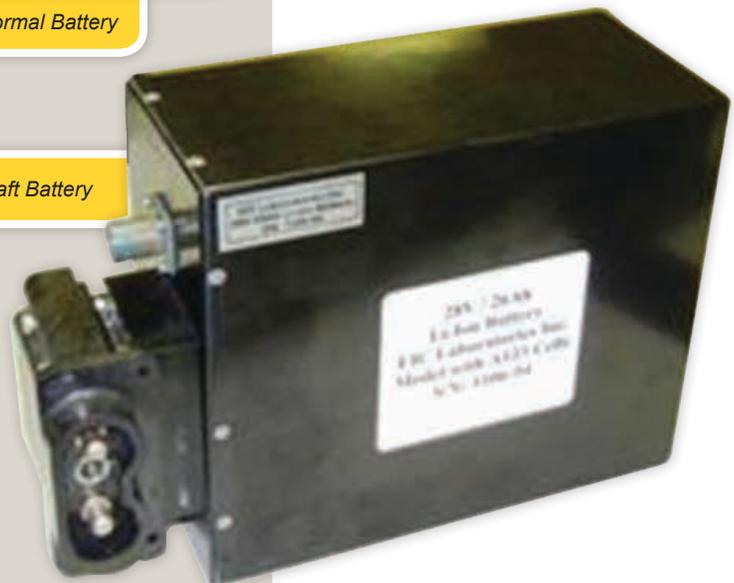
18V/10Ah Conformal Battery



18V/28V Conformal Battery



28V/30Ah Aircraft Battery



“PORTABLE POWER FOR SOLDIERS’ ELECTRONICS SYSTEMS IS A CRITICAL LOGISTIC COMMODITY CARRIED ONTO THE BATTLEFIELD”



Primordial Inc.

Plymouth, MN

www.primordial.com

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

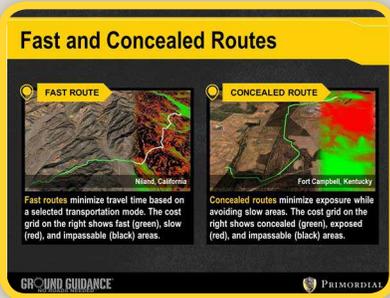


Ground Guidance® Patented Off-Road Route Planning and Terrain Analysis Software that Accelerates Mission Planning and Enables Dynamic Re-planning

Ground Guidance® is patented software developed under contracts with the Army Geospatial Center (AGC), Communications-Electronics Research Development and Engineering Center (CERDEC), Defense Advanced Research Projects Agency (DARPA), Natick Soldier Research Development and Engineering Center (NSRDEC), and Product Manager (PM) Movement Tracking System (MTS) that enables small unit leaders to perform rapid terrain analysis, load planning, and route selection. Ground Guidance® supports planning multiple fast and concealed routes both on- and off-road for dismounted and mounted Soldiers. Ground Guidance® enables Soldiers to perform line of sight analysis, predict future movements based on past sightings, and route around threats such as possible sniper nests or historic improvised explosive device locations. Primordial has integrated Ground Guidance® into several mission planning platforms including FalconView, Google Earth, Nett Warrior, Ringtail, Tactical Ground Reporting (TIGR), TerraExplorer, and X-Plan.

Without Ground Guidance®, mission planning/execution platforms are limited to generating straight-line routes between waypoints. As a result, Soldiers waste hours performing manual terrain analysis and placing hundreds of waypoints before a mission. Ground Guidance® dramatically accelerates mission planning, facilitates on-the-fly re-planning, and improves route quality by automatically generating fast and concealed routes through on- and off-road terrain. Ground Guidance® provides route metrics such as distance, duration, elevation change, maximum slope, energy expenditure, and exhaustion level that enable Soldiers to plan accordingly and reach their objective ready to fight.

Primordial has six issued and two pending patents for Ground Guidance®. In 2012, the United States Army acquired a government-wide license for Ground Guidance®, so the software is now government owned. In 2013, Polaris Industries acquired Primordial.



TECHNOLOGY TRANSITION:

In the last three years, Primordial has secured \$6.6M in Ground Guidance® contracts from the Army. The Army acquired government purpose rights for Ground Guidance® in 2012. The Army funded integration of Ground Guidance® into FalconView, Google Earth, Nett Warrior, Ringtail, TIGR, TerraExplorer, and X-Plan. Primordial has also secured Ground Guidance® contracts with major defense contractors including General Dynamics, Rockwell Collins, Lockheed Martin, and Raytheon. The Army fielded Ground Guidance® with FalconView in Q1 of 2016.

Modeling Task-Related Encumbrance Effects of Ground Soldier Systems on Soldier Performance

To improve the accuracy and functionality of present military modeling and simulation software, such as the Infantry Warrior Simulation (IWARS); Technology Solutions Experts (TSE) researched, developed, and implemented methodologies and algorithms to address impacts of encumbrance on Soldiers and Small Units (SSUs). Task-related encumbrance is the impact equipment, systems, environmental, and operational factors have on SSU task performance and mission effectiveness.

TSE delivered the Performance Suite™ (PS™): A set of physiological representations for military modeling and simulation applications, to enable researchers to study and answer critical questions about human performance, and assess the operational costs of encumbrance. The PS™ includes PS Trek™, an interactive web application that uses military algorithms and methodologies to calculate the maximum speed an agent can move while carrying a load; PS Charge™ which calculates power usage and the total equipment and battery weight carried during a mission; PS Fixate™ which calculates the error associated with determining the location of a sound; PS Exhaust™ which predicts the impact of encumbrance on task performance; PS Heat™ which computes the temperature of an agent based on environmental and human characteristics over time; and PS TRED™ an online database for capturing links between tasks, encumbrances, and supporting references.

PS™ representations implemented in simulations, such as the PS Tred™ implementation of speed and load regulation in IWARS, have improved the accuracy of physiological representations in constructive simulation and reduced the time required for analysts to build physiologically accurate scenarios.



Technology Solutions Experts Inc.

Natick, MA

www.tseboston.com

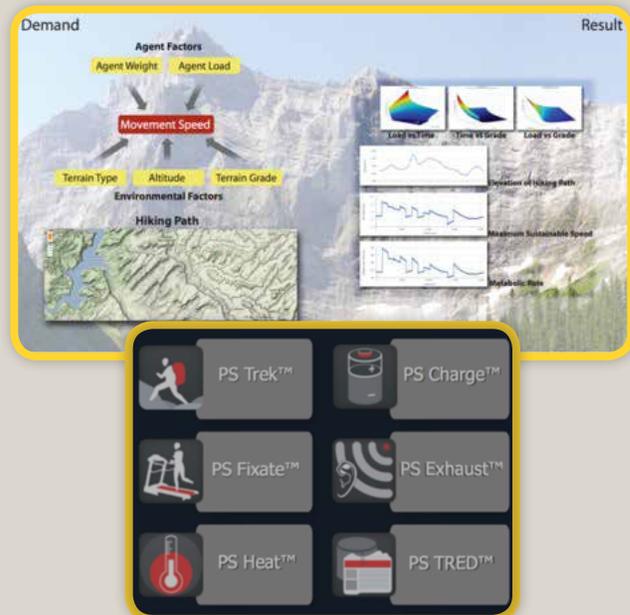
U.S. Army Natick Soldier Research, Development & Engineering Center



TECHNOLOGY TRANSITION:

TSE was awarded \$1.1M in Phase III funding from Natick Soldier Research, Engineering and Development Center to extend capabilities for analyzing encumbrance and task performance. TSE also received \$85K for integrating the Soldier load model into IWARS and customizing PS Charge™ for the Naval Surface Warfare Center at Dahlgren for a U.S. Marine Corps study on handheld radios. TSE continues to transition technologies to other military and governmental agencies, as well as the mobile industry for commercialization.

TSE implemented its encumbrance methodologies in an Android application, Hikester™, offering a predictive analytics platform that enables high-resolution search, trail analysis, military-inspired, and innovative methodologies to provide nature enthusiasts planning outdoor adventures with a decision-making tool.





A Development and Run-time Environment for Aviation Mission-tasking and Mission-management (DREAMM) for Manned-Unmanned Teams

DREAMM will support Army system developers, tacticians, and aviators in defining and tailoring cockpit automation, aiding, and intelligent tasking associated with mission planning, coordination, and execution to facilitate effective use of unmanned systems in coordination with manned platforms within an evolving mission context. The goal will be a system that supports configuration of new avionic capabilities by this team of war fighting and system experts who may not be expert in underlying technologies. The focus is on creating a design environment, which aids the aviator to effectively employ sensors and payloads of both air and ground unmanned systems throughout the mission — from planning to after-action review — can be defined, implemented, evaluated, and exported to operational planning and Command-and-Control (C2) systems, both on-board and off-board aircraft.



Perceptronics Solutions Inc.

Plymouth, MN
 Sherman Oaks, CA
 www.percsolutions.com
 U.S. Army Applied Aviation
 Technology Directorate



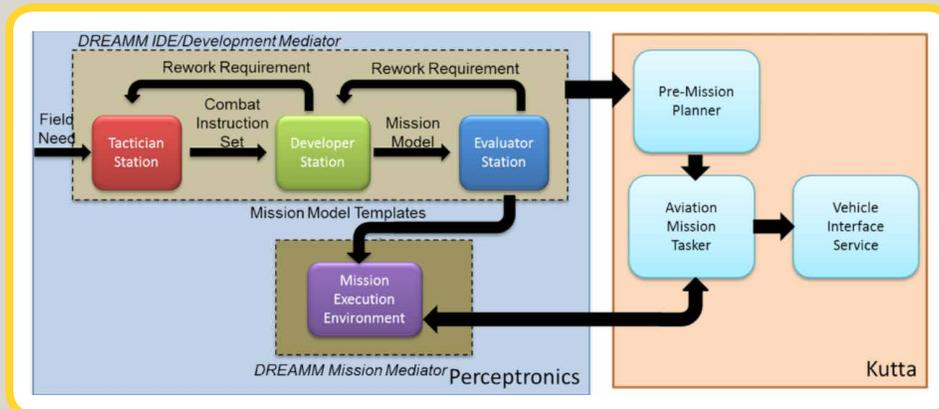
DREAMM makes use of intelligent mediators to:

- 1 Assist behavior authors in creating machine interpretable scripts that direct unmanned assets in the execution of the tactical activities of interest, and configure the human supervisory controller's user interface to support mixed initiative situational awareness and direction while limiting workload to manageable levels.
- 2 Direct the autonomous execution of mission behaviors by multiple unmanned platforms collaborating to accomplish defined mission goals.

The end product is a powerful new capability to extend the sensory reach and effects delivery capacity of manned platforms within the available workload limits of the aircrew.

TECHNOLOGY TRANSITION:

DREAMM will find application in future generation aviation programs to include the Joint Multi-Role Rotorcraft and Future Vertical Lift family of systems. Immediately, DREAMM is becoming a centerpiece for the Aviation Applied Technology Directorate/National Aeronautics and Space Administration Synergistic Unmanned Manned Intelligent Teaming Simulation (SUMIT), being developed for the Army Aviation Development Directorate, in which advanced concepts in decision aiding and human interface concepts are being evaluated for these future initiatives. To date, SUMIT has received \$540K in Phase III funding for further research and development of the DREAMM effort.



SUMIT Mission Tasking Architecture

Mission Tasking System (MTS) Selected as the Future for Manned/ Unmanned Teaming (MUMT)

Kutta Technologies' next-generation MUMT technology, known as MTS, allows U.S. Army aviators to simultaneously control multiple unmanned systems using advanced cognitive decision aids, head-tracking and gesture recognition, all while improving the survivability of the manned system.

The MTS is one of the first products of its kind available to help facilitate the teaming of both manned and unmanned assets, and represents a significant step forward in how aviators use the growing number of Unmanned Aircraft System (UAS) platforms and/or piloted intelligence, reconnaissance and surveillance aircraft. The system is North Atlantic Treaty Organization Standardization Agreement 4586 compliant with the latest Department of Defense (DoD) interoperability profiles and allows aviators Level 3 (sensor/payload control) and Level 4 (autonomous air vehicle waypoint navigation) control. Aviators can now use the UAS to scan ingress or egress paths for potential threats and get real-time updates of the landing zone before arriving on station with a few simple clicks of a button or a hand gesture. The route nomination feature even allows pilots to easily scan a road in support of a wheeled-convoy escort mission and follow the convoy's Blue Force Tracker feed autonomously. The end result is a seamless link between the pilot and unmanned system that can significantly extend mission range and increase standoff distances, while maintaining the safety of the pilot and the manned platform at all times.

The new technology is a comprehensive mission management solution that is innovative, open, and yet cost efficient to develop and certify to aviation standards (e.g., DO-178C). The technology provides a highly-adaptable open architecture based on the DoD's UAS Control Segment Working Group, open message protocols, and a toolset for creating modular Human-Machine-Interfaces for research and development. This architecture allows for rapidly developing innovative display technologies that enhance MUMT capabilities for the Warfighter, shortening development cycles, and reducing the overall cost of related programs for the U.S. Army.

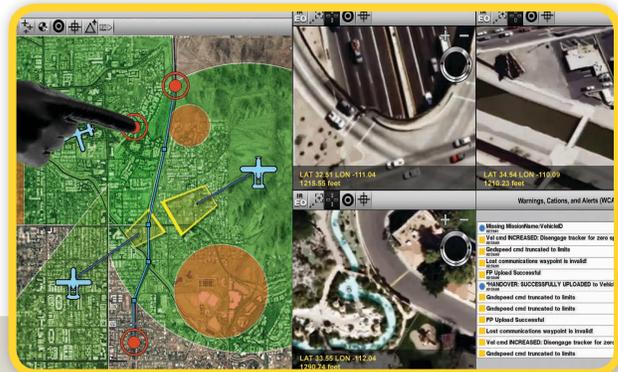


Kutta Technologies Inc.

Phoenix, AZ

www.kuttatech.com

Program Executive Office Aviation



TECHNOLOGY TRANSITION:

Kutta Technologies has been awarded up to \$9M in Phase III funding from the Applied Aviation Technology Directorate to assist in the integration of MTS with the Synergistic Manned/Unmanned Intelligent Teaming Simulation. The project will continue to expand the capabilities of manned aircraft by teaming with their unmanned counterparts, streamline Human Machine Interfaces, and advance autonomous Unmanned Aerial Vehicle technologies being developed for both current and future army aviators and ground Soldiers. UH-60 Blackhawks, Apache variants and Future Vertical Lift vehicles are being explored as potential markets for the technology.



Numerica Corporation

Fort Collins, CO

www.numerica.us

U.S. Army Space and Missile
Defense Command



Advanced Electronic Protection Composite Tracker

A major responsibility of the U.S. Army is to maintain situational awareness, decision capability, and the ready force necessary to protect U.S. Forces and allies from a wide range of threats. A key capability in this mission is the ability to identify and track multiple air and space targets in hostile operating environments with the dependability required to coordinate forces to take appropriate action. Integrated air and missile defense provides coordinated and collaborative use of multiple distributed sensors by network communication and offers substantial improvements in tracking, combat identification (CID), and resource utilization over federated approaches. With funding from multiple DoD organizations over the past 20 years, Numerica has developed a distributed multiple sensor composite tracking system with associated sensor and battle management capabilities. These capabilities are deployed across the DoD supporting several major systems. The composite tracking technology that has been developed is currently being incorporated into the Army's Integrated Air and Missile Defense Battle Command System (IBCS). While this technology provides operators and system components with a high level of track picture clarity and accuracy, operation in an Electronic Attack (EA) environment will require additional capabilities. With funding from the Army SBIR Program, Numerica has developed new, sophisticated Electronic Protection (EP) techniques that leverage information available at the composite tracking level to maintain system performance in hostile environments. Some of these capabilities have already been incorporated into IBCS and others still being matured. The purpose of this SBIR Phase III program is to accelerate the development and transition of the new EP composite tracking technology to enhance the capabilities of IBCS and other DoD elements.

TECHNOLOGY TRANSITION:

Transition of the technology is being supported by a commercialization contract in the form of a five year IDIQ, with an \$18.3M ceiling. This funding will support tailoring of the technology to the needs of specific programs and optimizing the algorithms and software for tactical use. The SBIR Phase III Program will allow Numerica to assist with the continued evaluation of the technology in both live and simulated environments and to support the DoD's evaluation of the impact of the technology in the joint warfighting environment. Successful deployment of the technology will significantly advance warfighter capability in hostile anti-access area denial (A2AD) air and missile defense environments.



Thermoplastic Elastomer (TPE) Honeycomb Materials System for Advanced Combat Helmet Pads

Traumatic brain injury (TBI) is recognized as an acute problem for today's military. The objective of this Small Business Innovation Research program was to significantly increase the level of blunt impact protection provided by the Advanced Combat Helmet (ACH) suspension system. TIAX's technology is a thermoplastic elastomer honeycomb structured pad suspension system, optimized through materials characterization, simulations of system behavior, and dynamic testing. In the Phase I program, TIAX developed and demonstrated a pad concept based on the notion that the directionality of the honeycomb structure improves the impact performance of the pads. Test results showed that TIAX's TPE honeycomb pad concept can be effective for use in helmets for blunt impact resistance. The TIAX prototype pad outperformed all of the existing pads that it was compared against. TIAX continued to optimize the prototype pad system in Phase II with an emphasis on improving crush performance while reducing the suspension system weight. Complete pad systems were integrated into the ACH and put through standard test protocols for evaluation of impact performance as well as human factors evaluations. Once the design was optimized, TIAX worked with commercialization partners to develop a cost-effective method for manufacturing pad sets.



TIAX LLC

Lexington, MA

www.tiaxllc.com/

Program Executive Office Soldier



TECHNOLOGY TRANSITION:

Primary military markets for this technology are the Army Advanced Combat Helmet, Enhanced Combat Helmet, and Soldier Protection System Integrated Head Protection System. There are numerous opportunities in the commercial sector: helmets for motorcycles, cycling, skiing, football, baseball and a host of additional sports that require head protection. In addition, the technology can be applied to other types of protective equipment including knee and elbow pads, chest protectors, shin pads, etc.

TIAX was awarded \$1.4M through the Army Rapid Innovation Fund to bring the technology to a technology/manufacturing readiness level 8, in June 2014. The Army plans to leverage the technology in current and future systems.





Prototype Productions Inc. (PPI)

Ashburn, VA

www.protoprod.com

U.S. Army PEO Soldier,
PM Soldier Weapons



The Intelligent Rail® – Weapon Accessory Power and Data Connection

The Mil-Std-1913 mounting rail (“Picatinny” Rail) provides a standard mechanical mounting interface for all weapon-mounted accessories, enablers and optics. Since becoming the standard in 1995, the Picatinny Rail has been widely deployed on M4 carbine and M16 rifles in the U.S. Army, other Services, and within North Atlantic Treaty Organization (NATO) militaries. This mounting platform has allowed our warfighters to configure their weapons with the latest advanced equipment, such as aiming lasers, night vision devices, thermal imagers, reflex sights and combat optics. However, it has also created unintended consequences in terms of excessive battery weight and costs, multiple control switches, and weapon imbalance. A 2011 Army study of battery usage in Iraq and Afghanistan found that a platoon required over 400 pounds of spare batteries for a 72-hour patrol, with other reports and studies estimating re-supply costs alone for these batteries in the \$50,000 range per Soldier/per year.

The Intelligent Rail® (“I-Rail®”) technology intends to address these shortcomings by consolidating to a single battery type (“AA”) and by providing a sealed, ruggedized power and data connection through the Picatinny Rail that provides central power and data communications for all weapon-mounted accessories. Through a replaceable battery pack in the butt stock or pistol grip, power is supplied to the I-Rail® equipped Picatinny Rail, and battery weight is shifted rearward, improving overall weapon balance. I-Rail® connectors embedded in each accessory’s mounting attachment allow accessories to connect, draw power and communicate with the user and other accessories. A 3-button control module can be placed anywhere on the Picatinny Rail, allowing the shooter to control all of the devices with the off-hand. Legacy accessories can connect to the I-Rail® system with battery compartment I-Rail® adaptors. The I-Rail® design was selected by NATO as the standard for the NATO Powered Rail Standardization Agreement (STANAG).

TECHNOLOGY TRANSITION:

PPI was awarded more than \$1.5M in non-SBIR funds during its Phase II Enhancement contract to incorporate advanced fire control and next generation optics, and to exploit the data communications capability for connection with other fielded devices and the overall tactical network. PPI is currently supporting testing and evaluation by various user groups in the Department of Defense and in civilian law enforcement. PPI has received over \$5M in Phase III investments from commercial investors to support commercialization efforts, IP protection, advanced development, and sales and marketing. PPI, through its commercialization subsidiary T Worx Ventures, is preparing for commercial product launch of the M4 I-Rail® kit in 2nd Quarter 2016.



Air-Activated Self-Contained Ration Heater

Providing nutritious and satisfying field rations is key to maintaining our military's front-line readiness. The standard Meal, Ready-to-Eat (MRE), currently includes a chemical heater, the Flameless Ration Heater (FRH). In addition to requiring the addition of water in use, the current FRH releases up to eight liters of hydrogen per MRE, which limits its use in enclosed spaces (like tanks and airplanes) and in consumer applications. The Army has been seeking a cost-effective alternative that can eliminate the need to carry water and improve safety during use.

RBC Technologies has developed the air activated ration heater (AARH), which delivers upon the promise of *Safe Heat Anytime, Anywhere™*. During Phase III, scale-up from laboratory quantities to the tens of millions to support the potential U.S. military application was demonstrated. Test samples have been submitted for performance and storage qualification.

The RBC self-heating technology has subsequently been developed far beyond the version developed for the military. Three product lines are in the process of being commercialized:

- 1 Exothermix® for medical and industrial products.
- 2 Cook Pak® for food and beverage preparation.
- 3 Hot-on-the-Go™ for take-out and other consumer applications.



RBC Technologies

College Station, TX

www.rbctx.com

U.S. Army Training and
Doctrine Command



TECHNOLOGY TRANSITION:

RBC Technologies received \$1.1M in Phase III (Manufacturing Technology Program) funding from the U.S. Army Natick Soldier Research Development and Engineering Center to support manufacturing development and follow-on transition to product.

During Phase III, significant safety advances and scale-up improvements were realized. Subsequently a number of medical, food and consumer products companies have been engaged to develop applications using RBC's technology for commercial consumer products such as heated meals, personal care items and medical devices. In mid-2013 RBC began shipping RapidSplint™ with Exothermix® heaters in partnership with DJO Global, and by the end of 2014, the product was commercially available in five countries. The splint product is of interest mainly for in-field/away from infrastructure use, ranging from sports medicine to first responders. RBC's Hot-on-the-Go™ heated bath wipes have been specially designed for use in the Army Health and Comfort Pack, and are awaiting requisition.





Silvus Technologies

Los Angeles, CA

www.silvustechologies.com



Short Range, Wide Bandwidth Radio Technology for Army Command and Control Vehicles

When the Army sought to improve the ability of Soldiers to pass data, video and imagery across the operational space, they turned to the SBIR office for innovative ideas. Beginning in 2009, the Program Executive Office Command, Control and Communications-Tactical (PEO C3T) began a Phase I SBIR to address this need. Silvus Technologies answered the call and was awarded a Phase I contract and a Phase II contract with radio technology capability that showed promise. The technology uses recent advances in multiple-input, multiple-output (MIMO) wireless communications with a dual-band, multi-antenna design. The design delivers high-throughput at short ranges (C-Band) and low-throughput at long ranges (UHF Band). This creates rapid, same-time sharing and dissemination of information including cached high-resolution intelligence, surveillance and reconnaissance (ISR) data, imagery, video, and additional content among a group of local users. The flexibility to deliver data, video and imagery at varying distances over a content-rich operational space, enables network links to adapt as the environment or mission changes.

TECHNOLOGY TRANSITION:

As a result of positive development, Silvus Technologies was able to successfully transition this radio technology to more than \$2.8M in government and commercial sales with additional third party investments.



STTR SMALL BUSINESS TECHNOLOGY TRANSFER





NuCrypt LLC

Evanston, IL

www.nucrypt.net

U.S. Army Materiel Command,
U.S. Army Research Office

NuCrypt

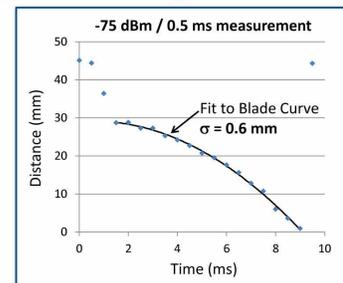
GHz Gated Single Photon Detection Enables New Measurements Including High Speed Lidar Ranging

One of the most fundamental measurements is the measurement of optical electromagnetic waves, known as light. From non-contact vibrometers to cameras, measuring light is pervasive in science and technology as well as our everyday lives. The smallest light signals are measured at the single photon level, and many important applications, like ranging with light (lidar), use single-photon detectors (SPDs). Unfortunately the quality of practical SPD technology varies considerably with wavelength, and practical SPD performance is more limited in the eye-safe 1550 nm band; a band that has risen to importance in part due to its huge technology base gained from being the primary telecommunications wavelength. NuCrypt has recently developed a new SPD system that is sensitive in this important wavelength band. Our proprietary technology allows the SPD to be gated (turned on and off) at very fast gigahertz rates, which allows for both faster measurements and better accuracy on localizing the arrival time of the photons. We have demonstrated its use in a Lidar system by ranging a moving fan blade with sub-millimeter precision on a sub-millisecond time scale at received power levels consistent with long distance remote sensing. This enables applications like high resolution three-dimensional imaging at long standoff distances.

TECHNOLOGY TRANSITION:

This SPD technology can be applied for long range imaging, target tracking, and non-contact sensing. Other military uses could include quantum key distribution systems, to securely distribute cryptographic secret keys and ghost-imaging, which allows for imaging a target without the optical signal hitting the target to ever interact with a camera. Direct sales of NuCrypt's detection systems to government and university research laboratories exceed \$400K. An additional \$200K in Phase III funding has been secured from other government sources to further develop the technology.

NuCrypt High Speed Lidar



OUTREACH AND SOURCES OF INFORMATION

ARMY SBIR/STTR WEBSITE: www.armysbir.army.mil/

OUR MISSION

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs allow small, high-tech U.S. businesses (less than 500 employees) and academia the opportunity to provide innovative research and development solutions in response to critical Army needs. By capturing the tremendous and agile talents of the U.S. small business community, the SBIR and STTR programs benefit the Department of Defense (DoD), the private sector, and our national economy. This portal provides all the information necessary to participate in these programs.

The Army SBIR /STTR Programs conduct an aggressive outreach program to increase small business awareness of broad opportunities provided by the Army. Army SBIR/STTR personnel participate in national, regional, and local conferences across the country. This provides small businesses with face-to-face contact with people who are knowledgeable about Army needs and the SBIR/STTR process.

General SBIR/STTR information

- Changes and new program requirements
- Points of Contact and links to other Army programs
- Proposal submission procedures
- Recent Army SBIR/STTR awards
- Searchable database of past awards
- Phase III Success Stories

Past Commercialization Brochures

For more information, the past Commercialization Brochures can be found on the Army SBIR/STTR website for download.

www.armysbir.army.mil/Commercialization/PhaseIIIBrochures.aspx





RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND (RDECOM)

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Photos courtesy of the U.S. Army, www.defense.gov