

CCAT-DHS

Summary Review

August 2014

DHS Responder Technologies Program



 **SAN DIEGO STATE UNIVERSITY**




Innovation For A Safer Nation

The Office of Interagency and First Responder Programs in the U.S. Department of Homeland Security Science and Technology (S&T) Directorate is responsible for managing the transition of near term technology enhancements to the operational components, directorates, and first responder communities. To meet the objective, the Office established the Responder Technologies (R-Tech) Program charged with identifying priority requirements and technology gaps and funding viable technologies that offer solutions to these requirements. Learning of the Center for Commercialization of Advanced Technology (CCAT), R-Tech Program staff initiated a project at San Diego State University in September 2010 to leverage the highly successful CCAT Program processes and resources along with the existing strong partnership SDSU has with the local government and first responder community.

Since 2010, the CCAT and R-Tech Program staffs conducted five nationwide solicitations to identify new advances in technology development and fast track them to the civilian population in support of disaster preparedness and response, enhancing emergency medical capabilities and law enforcement operations and providing protective equipment to firefighters and other first responder personnel involved in hazardous operations. Approximately 30 priority focus areas were identified by R-Tech and other DHS supporting organizations and included topics such as:

- Firefighting Accountability and Proximity Ranging
- Covert Surveillance Systems for Law Enforcement
- Protective Clothing and Equipment
- Networks Interface and Interoperability
- Bomb Threat Response and Disablement Capabilities
- Resource/Asset Management, Allocation and Tracking
- Patient Monitoring Systems for EMTs



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The CCAT-R-Tech team worked together to evaluate approximately 150 applications using independent subject matter experts from industry, academia, government, investment firms, and the first responder community as evaluators and panelists. Fourteen technologies, mostly from small business concerns, were selected and received commercialization support that included product development awards and business development services. Of these, nine technologies have achieved one or more of the success metrics: product sales, 3rd party funding, licenses, and partnerships within 18 months of the completion of CCAT project funding and services. In particular, three clients have introduced their products to the first responder marketplace with 4 additional clients having pending sales of over \$8 million. There also have been 2 partnerships and license agreements and investments of approximately \$14.7 million. Additional sales and partnerships are pending for several of the recently completed companies (see other articles). Overall the program has a success rate of approximately 64.3%.

DHS: Technology Solutions Address Priority First Responder Needs

The CCAT program with its proven technology commercialization processes and resources has assisted DHS S&T and the R-Tech Program in meeting their objectives. Since 2010, the applicants selected to receive funding and commercialization services to facilitate preparation of their technology solutions for operational field assessments and ultimate transition into first responder agencies, coordinated by DHS Responder Technologies (R-Tech), successfully realized those goals. Among those companies are:

Digital Barriers Services Limited – Arlington, VA: HD-SDI TVI Encoder **and** **Industrial Video & Control Co. – Newton, MA: High Performance, Low Light Level Surveillance** **Camera**

Two significant projects accomplished under the CCAT program resulted from the formation of a collaborative partnership between Digital Barriers and Industrial Video & Control. CCAT brought these two companies with complementary capabilities together to meet the requirements of the solicitation focus areas for a low-light surveillance camera system and high-definition IP Video Encoder with stereo audio inputs and processing capabilities. The HD encoder delivered by Digital Barriers represents a step change in performance and cost efficiency for video surveillance performed by the law enforcement community. The project also developed control of a set of very high performance cameras from Canon – the C100 and C300 – through additional interfaces provided by Industrial Video & Control (IVC). The collaboration CCAT cultivated between these companies resulted in development of three commercially available products, demonstrating that project management and coordination between the participants in this kind of project is critical to success.

Digital Barriers Services Limited. Digital Barriers addressed challenges faced by law enforcement officers related to video surveillance quality and cost efficiency. Critical video and audio evidence which is inadequate or missing due to low light conditions and image or audio degrading during transmission impedes criminal investigations.

The project accelerated production of a new Digital Barriers TVI Encoder that supports the streaming and archiving of HD video captured from HD-SDI cameras and a corresponding TVI Decoder that can generate an Open Network Video Interface Forum (ONVIF) compliant IP stream, HD-SDI video out, or HDMI out from a TVI stream. Additionally, the HD Encoder and HD Decoder will support dual channel audio to enable archiving and streaming of two audio sources. This product will provide law enforcement officers an IP encoder that meets their needs for covert court-authorized audio surveillance alongside high definition video over an encrypted stream for case integrity.

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The new HD encoder allows the first responder community to perform surveillance with much higher degrees of accuracy and target identification and to provide more effective examination in legal proceedings due to higher quality video and audio. The encoder also assists with incident management and cost control of data traffic. Digital Barriers anticipates government orders for approximately 250 HD encoders during Summer 2014.

Industrial Video & Control Co. Wireless Internet-protocol (IP) video surveillance methods, once viewed by police and other law enforcement professionals as ad-hoc solutions with limited reliability, have more recently been embraced as IP video camera resolution and low light surveillance capacity improved. However, because these capacity issues continued to limit the effectiveness of law enforcement surveillance throughout the United States, IVC addressed IP camera resolution and low light surveillance capabilities to enhance law enforcement effectiveness.

Through participation in the CCAT program, IVC developed a high definition, ultra low-light PTZ surveillance camera to meet the needs of the law enforcement community by incorporating the sensor from a Canon C300 camcorder originally designed for the movie industry. Following the initial Canon C300 product demonstration for DHS, the camera product price range was discussed and determined to be beyond the resources available to many law enforcement communities. Since cost would seriously limit the market and access to many potential users, DHS initiated a second lower cost surveillance camera project which substituted the sensor module from the less expensive Canon C100 camcorder. IVC successfully completed the Canon C100 high resolution, ultra-low light, pan-tilt zoom surveillance IP camera project for law enforcement within 6 months.

Successful completion of the Canon C300 and Canon C100 projects required a number of innovative developments including: 1) a pan-tilt mechanism with a frontal pivot point; 2) control boards for remote control of the pan-tilt mechanism, the zoom lens, and camera functions using industry standard protocols; 3) a covert enclosure suitable for rapid deployment and enabling use of different lens options; and 4) integration with a high performance video encoder that can deliver high definition video over a low bandwidth cellular connection and enable use of this camera in the most widely used video management systems. IVC successfully accomplished the development of the lower priced camera, now commercially available to qualified purchasers. The low light performance of both cameras and the ability to transmit high definition video over low bandwidth exceeds any comparable commercially available surveillance cameras. In 2014, IVC expects U.S. government orders for approximately \$7.5 million initially. Additional sales to a Canadian government agency are anticipated.

Collaboration and Integration. IVC worked collaboratively with Digital Barriers to develop and integrate the IP encoder which was critical for success of the low-light camera surveillance system. CCAT awarded the grants to be used in conjunction, and effectively managed the coordination and collaboration of these projects. Ultimately, three distinct products were developed and delivered to the marketplace. The C100 camera system, while less expensive than the higher end C300 system, was significantly more advanced than existing systems used by law enforcement. In addition, the new HD IP Encoder, a standalone or integrated system, could be used with existing surveillance video and audio systems, providing enhanced capabilities. Both companies are currently negotiating procurement contracts with various government and other law enforcement agencies for these new products.

Christine Wireless, Inc. – Ellicott City, MD: Conventional Fixed Station Interface

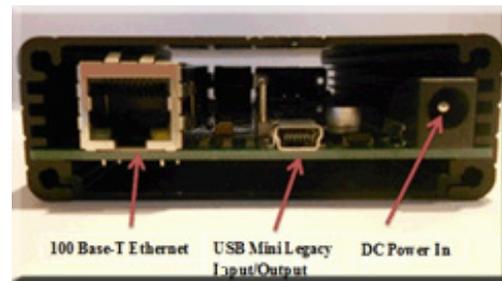
Despite the lessons of 9/11 and Hurricane Katrina, base station radio equipment used by many public safety officials and first responders lacks a standards-based dispatch console interface which hampers integration into networks, limiting interoperability with other first responders in emergency situations. Many systems render agencies and municipalities essentially “locked” into using only certain firms’ communication systems.

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Christine Wireless developed Conventional Fixed Station Interface (CFSI) technology which offers radio equipment interoperability to first responders when installed with Legacy Base Station Equipment. The industry open-standard CSFI interface design offers first responder organizations flexibility to use the Dispatch Console/Network configuration that best meets their performance goals and budget. CFSI provides rapid and flexible interconnection of multiple levels of first responder organizations.

Through this project Christine Wireless developed a product offering a significant competitive advantage and a major step forward in first responder on scene communication systems. The company enhanced the feature set of the product, created a production-ready design, and transitioned the design to a third-party support organization. The benefits of having the DHS CFSI technology applied to first responder communication systems are substantial and include saving first responder organizations millions of dollars on equipment upgrade requirements.



NanoSonic, Inc. – Pembroke, VA: High Dexterity, Hydrophobic HybridShield® Fire Protective Gloves



Existing fire-protection gloves are bulky, made of rigid shell materials that are difficult to remove and don when wet, and impede the ability to perform actions requiring dexterity. Firefighters and first responders need gloves that provide enhanced flexibility in cold and wet environments, laceration protection, puncture resistance, superhydrophobic water repellency, and improved fire and blast resistance.

Using HybridShield® fabric technologies, NanoSonic and partner Shelby Glove constructed two 3D and one 2D fire glove assemblies that meet the NFPA 1971 standards. Through rigorous finger/hand dexterity and donnability evaluations, ideal spacing patterns and geometries were identified for NanoSonic's next set of HybridShield® hollow spacer, patterned fabrics.

Product optimization efforts included a spatial increase in hollow cylinder spacing for the back of the hand, insulative fabric within both 2D and 3D gloves, and a reduction in circular diameter for interfinger forechets fabrics employed within 3D gloves. NanoSonic milled these customized dimensions within thermoplastic masks used to construct the patterned fabrics. The final prototype of the glove showed significant improvement with outstanding thermal and puncture properties. Firefighter focus group feedback indicated donnability and flexibility were comparable or superior to the best conventional glove. The final version iteration focused on further improvement of these characteristics, which benefit first responders, EMTs, fire fighters and safety workers. NanoSonic and Shelby Glove commenced formal NFPA 1971 glove certification of this pioneering glove ensemble with the goal of widespread availability to fire fighters and first responders by Summer 2014.

As a related outcome of this project, NanoSonic's HybridShield® Thermal Array technology is currently under investigation for use as an innovative fire blocking, thermal protective interlayer that has immediate utility within flame and heat protective garments, equipment, shelters, and vehicles. Compared to state-of-the-art insulative spacers and energy absorbing materials, HybridShield Thermal Arrays afford higher temperature resistance in compression, negligible water absorption, improved impact protection, minimal smoke toxicity, and enhanced flexibility for improved user comfort and protection.

(The NanoSonic project completed in late 2013. CCAT continues follow-up with awarded technology for eighteen months following project completion to capture successes.)

Sotera Wireless, Inc. - San Diego, CA: Non-Invasive, Body-Worn, Wireless Patient Monitor for Emergency Medical Service (EMS) First Responders

During ambulance transport, paramedics and clinicians working in advanced life support (ALS) typically monitor patients with sophisticated cumbersome machines that are often large, heavy, connect to the patient by a combination of cables that can get in the paramedics' way and hinder patient care, and cost about \$30,000 each. Due to limited budgets, many emergency medical technicians (EMTs) and clinicians working in basic life support (BLS) lack access to even this type of vital sign monitoring equipment.

At the request of the EMS community, DHS initiated a program to improve the effectiveness of emergency medical first responders by providing a light weight, multi-parameter, patient worn wireless vital sign monitor for on-scene patient assessment. As part of the program objective, Sotera is currently developing a non-invasive, body-worn, wireless patient monitor for Emergency Medical Service (EMS) first responders, utilizing the FDA cleared ViSi Mobile platform which is currently available for use in hospital settings. ViSi EMS development incorporated ViSi Mobile platform modifications and additions suggested by the first responder assessment team composed of EMTs, paramedics and other medical personnel following an operational field assessment of the prototype and other requirements specific to vehicular transport.



ViSi EMS continues in development and includes a patient-worn device (PWD) that continuously measures and transmits vital signs (e.g. blood pressure, heart rate, respiratory rate, CO₂, and skin temperature). The PWD transmits vital sign information to a mobile tablet computer (MTC) Toughbook via a wireless connection facilitating early detection of patient condition fluctuations. With eight gigabytes of memory, the MCT serves as a Wi-Fi hotspot and server, and can store at least 12 hours of data. The MTC can display numerical and waveform data from the PWD, a 12 lead ECG, a light weight, battery powered automatic external defibrillator, and a CO₂ monitor. An EMS first responders work flow information display is also available. From the field or en-route to the emergency receiving facility, first responders can send snapshots of patient data in secure PDFs via cellular interface, enabling emergency physicians to properly prepare for patient treatment. Upon patient arrival, physicians at the receiving facilities can download the patient's stored monitoring data from the field.

Each ViSi EMS system can simultaneously monitor up to eight PWDs transmitting patient information. Using Wi-Fi, each ViSi EMS system can link to other ViSi EMS systems at battery-powered axis points using commercial off the shelf hardware. During a Mass-Casualty Incident, setting up multiple axis points could allow first responders using ViSi EMS devices to monitor and determine medical intervention for a large number of patients simultaneously from a central location.

Sotera expects to complete, test and submit the ViSi EMS system for FDA clearance in 2014. A ViSi EMS Basic Life Support (BLS) application is scheduled for commercialized in 2014. Advanced Life Support (ALS) and Mass Casualty Incidents (MCI) system applications are forthcoming.

(The Sotera project completed in late 2013. CCAT continues follow-up with awarded technology for eighteen months following project completion to capture successes.)

PaymentCard Services – North Richland Hills, TX: Electronic Recovery and Access to Data

Prepaid debit cards, designated by Financial Crimes Enforcement Network (FinCEN) as Prepaid Access Cards (PAC), are financial services cards that are global cash, not tied to any one currency. PACs can be issued in one country, processed in another country, and used for ATM transactions in a third country, in a time period of three to five seconds. Mobile phones

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combined with PACs makes the movement of fund from anywhere in the world to another location anywhere in the world possible within seconds. Over \$650 billion in cash is being loaded on prepaid debit cards annually with that amount projected to increase to \$2 trillion worldwide in 2015.

This technology leap provides an ideal opportunity for an array of criminal activities to launder money globally, unregulated by current laws. Cash seizures from illegal activity by law enforcement have declined significantly as criminals migrate from cash to prepaid debit cards. The IRS confirmed that criminals who used a stolen identity to file a false tax return loaded over \$4 billion of those fraudulent tax refunds on to PACs in 2013 by using the PAC issuers routing and transit number. The value loaded to PACs from illicit sources is estimated at \$50 billion annual.



Utilizing DHS funding provided via CCAT, PaymentCard Services created a processing methodology and a VeriFone VX-680 loaded with ERAD patent pending software operating on wide area wireless network or web based platforms which could allow law enforcement to obtain prepaid card balances and seize funds if typical patterns of illegal use are present in the prepaid card history. In addition, the company developed a systematic approach to freeze and seize prepaid card funds and establish an electronic chain of custody for accounting, legal, and audit purposes. The system can be operational globally.

PaymentCard Services continues to explore the legal and legislative challenges to implementing this technology. Consumer financial privacy is the primary issue under debate by prepaid debit card and other card vendors. PAC funds are held by a bank and owned and held in a bank owned account, so this debate applies to very few of the many cards used by criminals. Financial privacy rules are only applicable to situations when the name on the card matches the name of the person being arrested. Resolution of regulatory issues, through a final FinCEN rule release adding PACs in excess of \$10,000 to the list of items to be declared to U.S. Customs at borders, will enable government law enforcement agencies to implement electronic prepaid card search and seizure in appropriate situations.

ERAD has also seen the need for a credentialing solution that is able to actually authenticate a badge in the field rather than just a visual screening, all in real time. ERAD-ID is a solution that offers Emergency Management (EM) Agencies the option of both a fully vetted PIV-I (Personal Identity Verification – Interoperable) card and a CIV (Civilian Identity Verification) program. Key to the ERAD-ID solution is the same ERAD terminal used to read PACs, with another unique ERAD software solution. The terminal is used to authenticate the card once inserted into the terminal, as well as provide the Incident Commander the ability to control access to a perimeter during a disaster event. This ID solution is combined with a MasterCard branded PAC to facilitate the immediate loading of funds to the card's account, rather than the issuance of a paper check for travel.

The ID solution operates in sync with the PAC solution to maximize the utility of the terminal by law enforcement and EM staffs. Texas EM is working with ERAD to ensure that the optimum program is provided to Texas, and later other states with credentialing needs. ERAD has secured a Strategic Partnership with MasterCard International to work together to expand our current marketing efforts. For example, Jack Williams is speaking with a Texas EM person at the National State Controllers and Treasurers convention in August about the ERAD –ID solution and how it can reduce costs of deployment disbursements, and authenticate those seeking access during a disaster event.

ERAD has not merged or sold a portion of the company ownership at this time. ERAD has however contracted with Unisys to represent the ERAD systems to potential Federal Agencies using their existing contracts to speed implementation. Oberthur, the largest card vendor for chip based card technology has executed a strategic partnership to jointly market the ERAD solution

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to the EM Agencies in all states. The MasterCard strategic alliance will allow for the introduction of the ID solution to states and countries such as Canada. VeriFone continues to support our programs with various terminal solutions, including our upcoming ERAD reader incorporated into an Android or iOS mobile handset. First Data continues to work with our Agency partners to provide a full array of card processing options.

ERAD is very encouraged by the strong reception of the ERAD solutions that assist law enforcement and emergency management agencies to be successful. We are most grateful for the invaluable assistance provided by CCAT during the term of the Agreement.

(The PaymentCard Services project completed in late 2013. CCAT continues follow-up with awarded technology for eighteen months following project completion to capture successes.)

Applied Research Associates – Albuquerque, NM: First Responder Support Tools (FiRST) Sharing Service

The FiRST Sharing Service (FSS), developed with funding from DHS and managed through the CCAT program, is a subscription service commercially available to large and small First Responder Support Tools (FiRST) user organizations. Through FFS, FiRST users can post IED and Hazmat incident data to groups they belong to and get alerts to retrieve incident data that others have posted for incident management and training purposes. Applied Research Associates hosts, maintains and administers this organizational level integrated solution which requires no hardware or software purchase by the user.



The over 6000 FiRST current users can choose to share incident GIS data with other users via FSS. Map-based improvised explosive device (IED) standoff distances, hazardous materials (HAZMAT) spill evacuation areas for over 3000 chemicals, user location relative to an incident area, nearby schools, hospitals and government facilities, current winds as applicable to HAZMAT, GPS optimized roadblocks capable of isolating the road networks near an incident, and mandatory evacuation and shelter-in-place zones defined by the user or DHS defined based on the FEMA 426 for IED types and IED range-to-effect data for injury and damage are examples of GIS data which can be shared by FiRST users through FSS.

FSS subscribing organizations control user access, specify sharing preferences, delete incidents, and provide access to a group specific geospatial data feed (kml) of group postings. Organizations may also share incident data with external systems like Virtual USA. FSS marketing through online advertising, Google, Facebook, and the FiRST program website is focused on the 18,000 local and state law enforcement agencies in the United States with a need to share IED and Hazmat response activities.

(The Applied Research Associates project completed in late 2013. CCAT continues follow-up with awarded technology for eighteen months following project completion to capture successes.)

TRX Systems – Greenbelt, MD: Firefighter Accountability and Proximity System

The TRX Firefighter Accountability and Proximity System project successfully demonstrates the feasibility of developing a low cost system to improve the safety of firefighters and other emergency personnel fighting fires or performing rescues inside burning structures where GPS is unavailable or unreliable and visibility is obscured. The system prototype provides firefighter proximity, elevation and homing information which allows incident commanders and team leaders to monitor first responder teams inside a structure and sounds an alert if members of a team become separated, supporting quick location and assistance of disoriented or injured first responders. Reference Anchors may be deployed during operations or search to provide a systematic mechanism for narrowing the estimated search area based on ranging and trilateration.

Over one million career and volunteer firefighters in the United States are the initial market targeted for this easy to use and maintain system. Sales efforts will focus on a combination of direct sales to early adopter fire departments with a vested interest in location systems and distribution partnerships with large well respected companies.

(The TRX project completed in late 2013. CCAT continues follow-up with awarded technology or eighteen months following project completion to capture successes.)



Advanced EMS Designs – DeBary, FL: Board Armor® (aka Advanced EMS Designs Backboard Cover)



Board Armor® is a patented disposable backboard cover that minimizes potential contamination of patients, first responders and healthcare providers in contact with spine boards used for patient transportation in emergency and other pre-hospital situations. Advanced EMS Designs, a group of career firefighter paramedics, identified this critical need and created the solution with funding and support from the Science and Technology Directorate of DHS and the CCAT program. A recent research study, performed with the University of Miami, indicated that 100% of the test sample backboards, including hospital scrubbed In Service backboards, were contaminated with blood, urine, feces, vomit, petroleum products and a variety of fatal illness inducing microorganisms. Board Armor® , which utilizes the same material as hazmat suits, is a critical component in reducing exposure to infectious bacteria frequently found on backboards and risk of potentially fatal secondary infections, particularly in

mass casualty situations. Board Armor® is manufactured and marketed online by CSI Medical and distributed internationally through medical equipment partners.

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