Federal Laboratory Consortium Award for Excellence in Technology Transfer

Acoustic Physiological Monitoring Sensor

Michael Scanlon, Army Research Laboratory

The acoustic physiological monitoring sensor is a breakthrough technology with the potential to save many lives. Marketed as the Sudden Infant Death Syndrome Monitor and Stimulator (SIDSMAS), the sensor employs a fluid-filled bladder with a hydrophone inside that matches the acoustic impedance of an infant in contact with the pad. By removing impedance mismatches, excellent acoustic coupling of heart and breath sounds-as well as vocalizations and movement noises-is achieved. Scanlon's designs provide heat, soothing sounds and vibrations to help the child fall asleep and, with transmitter/alert functions, can be useful in nurseries, hospitals, day-care centers, and homes. A single acoustic sensor can collect information concerning heart, lungs, and digestive tract functions, or detect changes in voice or sleep patterns, motor activity, and mobility. The data collected and processed by Scanlon for this technology has been recognized by surgeons and research physiologists as outstanding, and is believed by many to be the basis for next-generation stethoscopes and long-term health monitoring.

The sole inventor and developer of the SIDSMAS, and the acoustic technology behind it, Scanlon holds three U.S. patents for the technology, and has three foreign applications pending. The primary beneficiaries of Scanlon's technology are infants, adults suffering from sleep apnea, and those who monitor their bodily processes during exercise. As additional licenses are initiated in the future, other recipients whose quality of life will be improved include the infirm, hospital patients, and the elderly. As many as half to three-quarters of the U.S. population stand to benefit from Scanlon's technology.

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Digital Eye Screening - Today's Technology for the Public's Health

Wayne Davenport - U.S. Army Aviation and Missile Command Missile Research, Development, and Engineering Center (MRDEC)

Refractive photography has been used to diagnose eye diseases for years. The problem with this process is that the quality of a picture is uncertain until the film is developed. If the film is unsatisfactory, another photographic session has to be scheduled for the patient. Also, the entire process-from photographic session to analysis-can take several weeks. In 1997, Vision Partners of Memphis, Tennessee, visited the U.S. Army Aviation and Missile Command's MRDEC to investigate automating and improving the refractive process using advanced imaging and signaling processing. Wayne Davenport, an expert in digital imaging and optics who is also

knowledgeable in the mechanics of the human eye, immediately went to work on the problem.

Through a CRADA with Vision Partners, Davenport designed a system that is significantly smaller and lighter, provides real-time feedback, and increases accuracy versus standard 35-mm systems. Called the iScreen, the device is capable of screening both children and adults in a matter of seconds for eye diseases such as amblyopia, strabismus and cataracts and refractive problems such as myopia, hyperopia, and astigmatism.

Once the iScreen device was developed, Davenport constructed five of the photo-screening devices himself, eventually transitioning the construction process to SPARTA, Inc. of Huntsville, Alabama. Since then, SPARTA has successfully assembled 100 units. Currently, 35 units are being tested in doctors' offices, with another 250 units available for doctors' offices and schools. A patent will be issued for the iScreen sometime this year.

The immediate beneficiaries of this technology are the young children nationwide who undergo mandatory screening by pediatricians. However, the general public will benefit from the iScreen as well since children will be able to be screened through state-run programs that will make the process more affordable.

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High Temperature FPE Dielectric Tech Transfer Program

Sandra Fries Carr and Dr. Robert Monter - Air Force Research Laboratory (AFRL) Propulsion Directorate

Sandra Fries Carr and Bob Monter developed a new high temperature, high performance dielectric film for use in aircraft capacitors-devices that store electrical charges. The film, called Fluorene Poly Ester (FPE), can be used at temperatures ranging from -55º Celsius to 227º Celsius. This technology fills a need in that state-of-the-art aircraft capacitors are considered to be the weakest link in the power electronic system due to their limited operating temperatures.

The team developed the technology under a partnership between AFRL and the Wright Technology Network. The technology transfer process was innovative, coupling technical assistance with a marketing "push-pull" mechanism. The technology was "pushed" into the marketplace by aligning all of the supplying manufacturers of FPE resin and introducing them to potential capacitor manufacturers. The technology was then "pulled" into the marketplace by supplying technical and lifetime test data to major capacitor manufacturers and introducing them to the supplying manufacturers.

Since the partnership was formed, in-depth interactions have taken place among numerous companies concerning in the development of the FPE resin, film, or capacitor

fabrication. Ultimately, the companies that became involved in the partnership included Ferrania, which manufactures FPE resin and a thicker film; TPL, which developed the casting parameters for two-to-six microns thick film; and Brady and Rexam, which commercially produces the thinner FPE films.

The initial beneficiaries of this technology will be the military and other government agencies such as NASA. However, FPE has the potential to be successfully applied in commercial settings such as oil well drilling, automotive, commercial aircraft ignition systems, and medical defibrillators. This is a true success story, in that the transfer of technology from the AFRL to the commercial sector resulted in numerous companies establishing business opportunities and new alliances.

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Polyhedral Oligomeric Silsesquioxane (POSS) Nanotechnology: The Next Generation of Polymers

Dr. Shawn Phillips, Dr. Joseph Lichtenhan, Dr. Joseph Schwab, Michael Carr, Dr. Timothy Haddad, Dr. Rusty Blanski, Dawn Hilton, Traudi Walker, Patrick Ruth, Justin Leland - Air Force Research Laboratory Propulsion Directorate

To meet the Department of Defense's demand for a new generation of lighter weight, higher performance polymeric materials, the team pursued the development of new chemical feedstock technologies based on POSS nanotechnology. The result is a revolutionary new material composition, which is a chemical hybrid between inorganic and organic systems. POSS is the first new chemical feedstock to be developed for the polymer industry in 40 years. Its incorporation into polymers and plastics enhances their properties by increasing their use and decomposition temperatures-thus providing greater strength and oxidation resistance-and by reducing flammability. The result is a radical upgrade of the thermal and physical properties of most plastics.

The technology transfer took the form of a CRADA between AFRL and Hybrid Plastics LLC-a company formed for the express purpose of commercializing POSS technology-and the licensing of previously assigned Air Force patent rights to a third party. To produce POSS chemical feedstocks on a commercial level, Hybrid Plastics transitioned the technology from the AFRL lab to its own production facilities. In return, Hybrid Plastics provided expertise, resources, and facilities to aid the AFRL's investigation of POSS polymer properties.

Since signing the CRADA, AFRL has negotiated with several third-party companies, including Aldrich Chemical Inc. and Gelest Inc., to provide them with materials and technical information. In addition, Hybrid Plastics is earning a profit in only its second year of business and has reduced the cost of certain POSS monomers. Other results from this technology transfer include a $2 million Advanced Technology Program grant from NIST and the creation of eight patents.

Primarily developed to meet military needs such as lighter weight, higher performance rocket motor insulation, POSS has the potential to significantly influence-and even revolutionize-the $140 billion American plastics industry. Commercial chemical companies now sell and distribute POSS monomers, and 25 specialty firms in the polymer industry are incorporating the material into their manufacturing processes.

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The LASFORM Rapid Prototyping System

Walter Roy, Daniel Snoha, Robert Dowding, Walter Roy, Frederick Stenton, Dr. Frank Arcella, Dr. Donald Krantz - U.S. Army Research Laboratory

A team of ARL and AeroMet Corporation engineers has successfully transferred a new rapid prototyping technology-the LASFORM laser forming system. This technology is a flexible, one-step process method by which a precursor material (usually a powdered metal introduced into a laser beam) is deposited as molten droplets onto a metallic substrate located beneath the focused beam. Through computer instructions, a multi-axis positioning system drives the substrate in motions reproducing a horizontal layer, or slice, of the part as described by a computer-aided design (CAD) model. After the initial layer has been deposited and fused to the substrate, the beam and powder delivery subsystem are indexed in the vertical direction by an amount equal to the layer thickness. A layer-upon-layer deposition sequence is then repeated until the desired density is achieved. Although other rapid prototyping processes are available, none has the size capability of LASFORM and the properties of their prototyped parts do not have sufficient strength or toughness to be used in the field.

The transfer effort is being executed through a CRADA between ARL and AeroMet (a subsidiary of MTS Systems Corp.) of Eden Prairie, Minnesota. AeroMet was founded in 1997 with the sole purpose of commercializing LASFORM, as well as capitalizing on ARL's vision and direction in rapid prototyping. To that end, AeroMet installed and is now operating the large-scale laser-forming system in its 16,000-square-foot facility. A number of companies are now evaluating the technology for reducing the cost of traditionally cast and forged components. Nontraditional partnerships have also been formed with companies such as General Electric and Wyman Gordon to share data and reduce the cost of exploiting new manufacturing processes. Also, AeroMet was awarded a $160,000 contract from Boeing, as part of a larger effort with the Navy, to demonstrate the viability of the LASFORM process in producing and repairing hard-to-get titanium spares for aircraft and ship applications.

LASFORM has produced benefits for AeroMet, which now can produce traditionally high-cost parts for both commercial and Department of Defense aerospace applications. Other users such as the Navy are seeing the cost of parts production decrease as much as $50 million.

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A Maximally Secure Computer Network for Processing Highly Sensitive Data

Ross Seybold, Stephen Bouthillier, Robert Sulkowski, Dana Kellogg, Brian Dodge, Randall Morse, Sydney Blowers, Kenneth Wesche, John Seybold, and James Pinnell - Naval Air Warfare Center Weapons Division

Information is precious. To the government, private sector businesses and financial institutions, the information that resides within a computer or server is often the organization's most valuable resource, its very lifeblood. In 1997, NAWCWD entered into a CRADA with Market Central, Inc. and Radionics, Inc., two leading companies in the information/physical security field. The purpose of the agreement was to investigate methods for achieving very high levels of computer security within a flexible system architecture adaptable to any computer-intensive industry.

The CRADA partners used a hardware approach to complement and extend - rather than duplicate - such widely used security techniques as encryption and firewalss. The result of this cooperative effort was the development of two security products now being marketed by the commercial partners - the Readykey Information Security System for Computers by Radionics, and the SecureSwitch Information Security System (SSISS) by Market Central - as well as seven licensed inventions.

The systems developed under the CRADA use an access card and a code, or PIN number issued to each user. The system is configurable to give varying degrees of access. Access rights can range from physical entry into the computer facility only, to use of select computers and servers, to blanket access to an entire corporate system. The system maintains a detailed log of user access. If a user attempts to gain access to an unauthorized area, computer, or server, the consequences can range from simple access denial to security alarm activation and armed response.

A unique aspect of the system is that until access authorization has been determined by the security system, the computers and servers are physically isolated by unique electronic switches. Under the CRADA, Market Central and the Navy co-designed and developed three computer-platform switches to control electrical power and network connections. Radionics provided the hardware/software expertise to interface the three switches with existing Radionics access-control products.

This CRADA provided a framework for the successful transfer of cutting-edge security technology to the private sector. Ultimately this cooperative effort will result in a higher level of security throughout the information-technology infrastructure, thereby benefitting industry, government, and consumers.

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Representative of the Year Award
Cynthia E. Gonsalves, DoD Technology Transfer Program Manager

Ms. Gonsalves has been instrumental in increasing awareness of technology transfer in the DoD. She was involved in the extensive revision of the agency Web site, increasing the number of site traffic to thousands of hits a week from internal and external users. In addition, Ms. Gonsalves demonstrated an unflagging committment to a congressionally funded effort to transfer DoD technology to organizations in the Northwest U.S. through the TechLink Center.

An active participant in numerous FLC activities, Ms. Gonsalves has extolled the benefits of tapping into FLC resources to agency representatives, laboratory directors, and ORTAs. Highly regarded and respected by her peers, Ms. Gonsalves is singularly proactive in identifying, initating and completing efforts to benefit every member agency and laboratory of the FLC.