Abstracts of Awards to Fiscal year 2011 NIST SBIR Program

Note: Certain non-ASCII characters may not be represented accurately in this document. In cases where there may be doubt,
please refer to the printed copy of the solicitation or direct your questions to sbir@nist.gov.

**FY 2011 Phase I Award**

**Topic:** CHEMISTRY/MATHEMATICS/PHYSICS

**SubTopic:** 9.02.01.63 Signal Processing Methods for High-Dimensional Microsensor Data Streams

**Title:** High Performance Signal Processing Tools with Fluctuation-Enhanced Sensing

**OU:** Material Measurement Laboratory Office

**FIRM:** Signal Processing, Inc.
13619 Valley Oak Circle
Rockville, MD   20850-3563

**Principal Investigator:** Dr. Chiman Kwan
**Phone:** 240-505-2641
**Email:** chiman.kwan@signalpro.net

**Award Amount:** $90,000.00

**Abstract:** We propose a high performance library of signal processing tools that incorporate a newly developed technique known as fluctuation enhanced sensing (FES) to enhance the novel microsensor developed at NIST. Our goal is to improve the performance of the NIST sensor from two angles. One is to apply our existing proven algorithms to the NIST data. The other one is to incorporate advanced FES concept to the tools. Besides the mean (steady state) sensor values collected at various temperatures, the key concept of FES is to use a low noise amplifier to enlarge the small stochastic fluctuations in the sensor. Features such as mean-square fluctuations, skewness, kurtosis, power spectrum, zero-crossing patterns, bispectrum images of the fluctuations will be extracted. The fluctuation signals contain rich characteristics about how the chemical agents are interacting with the sensors. Recently we have demonstrated that FES can significantly improve the sensitivity and selectivity of sensors.

**Commercial Applications:** Chemical and biological agent detection has many important applications, including homeland security (airports, office buildings, military bases, etc.) chemical/biological warfare in military applications, etc. Moreover, the demonstrations and real-time field tests at the end of this project will be extremely useful for us to market our technologies to companies outside the military sectors. We envision the market for hardware and software developed will be in billion dollars over the next decade.

 **FY 2011 Phase I Award**

**Topic:** INFORMATION TECHNOLOGY

**SubTopic:** 9.04.01.77 An Automated Test-bed for Assessing System-of-System (SoS) Assurance

**Title:** An Automated Test Bed for Assessing System-of-System (SoS) Assurance

**OU:** Information Technology Laboratory Office

**FIRM:** Devivo AST, Inc.
2225 Drake Ave., Suite 2
Huntsville, AL   35805-5189

**Principal Investigator:** Woody English
**Phone:** 256-585-2781
**Email:** woodyenglish@devivoast.com

**Award Amount:** $88,789.00

**Abstract:** As System-of-Systems (SoS) become more complex, interactions and latent emergent behaviors become difficult to identify and control. Unmanned Autonomous Systems (UAS) are a prime example of SoS that are both critical and difficult to assure. Drawing upon prior work into multi-criteria decision making (MCDM), DeVivo AST has developed TOP Score, a software tool that facilitates the modeling and analysis of complex UAS using decomposition and empirical testing. This approach for fundamental characteristic attribution using multiple confounded tests provides increased model power and predictiveness. Unlike traditional MCDM tools, TOP Score allows for the isolation of key characteristics, dimensions, or “-ilites’ of a system through regression even when those characteristics are confounded and/or difficult to measure independently.

**Commercial Applications:** The increasing complexity of System-of-Systems (SoS) in nearly every domain ensures that their modeling and assurance will see an increased importance. The difficulty of decomposing complex systems and SoS means that automated software tools must be accompanied by a certain level of expertise, which may be provided through a software-as-a-service business model. The TOP Score tool offers an extremely powerful and flexible tool for MCDM, comparative analysis, risk analysis, descriptive and prescriptive modeling, and assurance. Of particular interest to the United States Military are tools that facilitate development, verification and validation (V&V), and procurement of systems. TOP Score can assist the Test and Evaluation (T&E) community by providing a statistically rigorous process, ensuring the correlation of experimental results with operational performance.

**FY 2011 Phase I Award**

**Topic:** INFORMATION TECHNOLOGY

**SubTopic**: 9.04.05.77 Development of a SCAP Content Creation Tool

**Title:** Enhanced Security Content Automation Protocol Editor

**OU:** Information Technology Laboratory Office

**FIRM:** G2, Inc.
302 Sentinel Dr., Suite 300
Annapolis Junction, MD   20701-1061

**Principal Investigator:** Matthew Kerr
**Phone:** 410-290-9710
**Email:** matt.kerr@g2-inc.com

**Award Amount:** $90,000.00

**Abstract:** G2 proposes to develop an intuitive, interactive SCAP content creation and editing utility that will provide a user-friendly operating environment. The promise of security automation offers the opportunity for great advances in software assurance, security governance/reporting, and ongoing monitoring activities. Hindering that promise is the fact that current data exchange protocols are cumbersome and complex, based on effective but difficult XML checklists, complicated definitions calling intricate tests from multiple repositories through evolving languages. The proposed product will include a local application supported by a database repository housing existing SCAP content, supporting a web-based interface where practical.

**Commercial Applications:** Previous research has demonstrated that providing the ability to create SCAP content results in significant commercial benefits. Commercial organizations and government customers will utilize the editor to task workers with creation of effective checklists, will increase the use of validated products that consume SCAP and will identify new security automation use cases that become possible with dynamic content creation. Commercial organizations will utilize the tool to create dynamic content on demand for a reasonable price and will help security auditors measure against broad frameworks (e.g. FISMA, PCI, SAS 70) efficiently.

**FY 2011 Phase I Award**

**Topic:** INFORMATION TECHNOLOGY

**SubTopic:** 9.04.04.77 Monitoring for Complex Information Systems

**Title:** Using Automated Abstractions to Classify System States for Software Health Monitoring

**OU:** Information Technology Laboratory Office

**FIRM:** Aries Design Automation, LLC
2705 W. Byron Street
Chicago, IL   60618

**Principal Investigator:** Dr. Miroslav N. Velev
**Phone:** 773-856-6633
**Email:** miroslav.velev@aries-da.com

**Award Amount:** $90,000.00

**Abstract:** In most critical software systems, a state that is partially visible through values passed across interfaces contains information that could determine the health of the software system, and whether a failure is likely in the future. Some of this information behaves in a continuous fashion, e.g., the available memory or disk space is easily interpreted to monitor system health. Other values are nominal and lack a simple quantitative interpretation, e.g., finite automation states in a protocol, IP addresses, pointer values, or file names The danger of failure in these cases may be observable only in complex relationships between state values, or depend on past history. We propose to apply ideas from run-time verification and software testing to extract strings abstracting nominal state, to which a machine learning algorithm can be applied to classify states by their probable proximity to system failure. Our primary goal will be to determine if methods that have been successful in other kinds of software analysis can be used to health monitoring.

**Commercial Applications:** The commercial potential for automated software monitoring is substantial. Many safety and mission critical software systems rely on logging and health systems that are custom-designed by teams of engineers. These systems are ripe for improvement in two fundamental ways: (1) They are seldom effective for indicating failures not anticipated by systems engineers at the time of design; even if other modes of failure are later revealed by testing, the indicators for these failures may be difficult to observe or use. (2) Interpreting complex and possibly non-numeric information in the system is a task for which system operators have only limited assistance. A software toolkit for using the information already visible at software interfaces and allowing application of off-the-shelf machine learning techniques to classify states by their potential for failure would be highly desirable in operation and testing of safety and mission critical systems. An automated approach applicable to many systems would free systems engineers to enhance system reliability in other ways, rather than forcing them to continually revise monitors in an ad hoc manner.

**FY 2011 Phase I Award**

**Topic:** MANUFACTURING

**SubTopic:** 9.05.07.68 A Common Platform for Microrobotics Research

**Title:** A Versatile Microbot Fabrication Platform

**OU:** Physical Measurement Laboratory Office

**FIRM:** AMT Nano, LLC
1500 Bull Lea Rd., Suite 009
Lexington, KY 40511-1266

**Principal Investigator:** R. Grant Stephens
**Phone:** 859-225-4521
**Email:** gstephens@amtnano.com

**Award Amount:** $90,000.00

**Abstract:** AMT Nano, LLC has developed innovative technology for achieving a versatile microrobot platform. The innovation relies on a unique micromolding process, which is low-cost and high-throughput, and high precison. The process achieves versatility by generating deterministic freeform shapes in polymers and nanocomposites. Several perceived benefits accompany the micromolding process. Due to the three-dimensional nature, designers can introduce continuous contours and curvatures that would prove formidable to conventional stratified techniques. Material can be applied with varying thickness and imparted with desired optical, electrical, and magnetic properties via nanocomposites. The overall microrobot size and shape is not constrained and the minimum feature size is comparable to current MEMS technology. This technique will foster innovation through novel microrobot designs generated by the research community. Commercialization of the technology will proceed using established methods for similar technology previously used by AMT Nano that include state grants, equity investment and industry partners.

**Commercial Applications:** Potential uses of the resulting common MEMs device manufacturing platform for micro robots are extremely large for this emerging technology area. The manufacturing technology will be commercialized through a contract manufacturing and project development business model that is applied to many potential uses of the manufactured micro robotic device. These applications include: 1) Medical devices for health monitoring and drug delivery, where micro robots will be deployed to specific sites within the body to either gather information or deliver a concentrated drug therapy with little collateral damage.

**FY 2011 Phase I Award**

**Topic:** MANUFACTURING

**SubTopic: 9**.05.02.73 Decision Support Tools for Sustainable Manufacturing

**Title:** An Integrated Decision Support Framework for Sustainability CAE

**OU:** Engineering Laboratory Office

**FIRM:** BIMCON Inc.
2957 Brentwood Road
W. Bloomfield, MI   48323

**Principal Investigator:** Krishna Murthy
**Phone:** 248-875-6591
**Email:** kmurthy@bimcon.com

**Award Amount:** $89,979.00

**Abstract:** The objective of this proposal is to establish the feasibility of developing an integrated decision support framework that transforms the current time-consuming and reactive (post completion of final design) sustainability assessment into a proactive CAE approach that enables the ability to revise designs based on performance against selected sustainability targets in the product design process, i.e., enables design optimization for sustainability. This framework, called Sustainability CAE (SCAE) will leverage the latest advancements in open standards and software capabilities, capture lifecycle-wide information relevant to sustainability and its assessment and organize and integrate it in a usable form with the analysis phases. In this Phase I project, we shall focus on: (a) requirements analysis to determine the constituents of information for CAE analysis, (b) the formalization of integrated data models to describe how data should be stored, linked, and accessed and interoperated with design activities, and (c) a proof of concept prototype for the demonstration of the utility of the information model for CAE with goal of analyzing sustainability.

**Commercial Applications:** By integrating sustainability targets and status of information with the existing product creation information, our framework – Sustainability CAE (SCAE) – will deliver a one-stop access to structured, real-time information. The availability of this information in a timely and accurate manner, in turn, will enable the development of value-added, vertically specialized tools for activities such as material usage monitoring, energy monitoring and recyclability analysis. The holistic management of sustainability would be possible because now sustainability can be managed as a “vehicle attribute” from both business and functional perspectives. This project will develop tools and information models to define, assess and manage sustainability metrics during product development phases involving analysis and simulation, which will enable major OEMs and key Full Service Suppliers (FSS) to “truly” manage sustainability as a “key product attribute”. The development of “predictive” analytical tools to assess sustainability metrics is a focus of this project and this has been identified as a significant shortcoming at Ford and other OEMs.

**FY 2011 Phase I Award**

**Topic:** MANUFACTURING

**SubTopic:** 9.05.11.73 Dynamic Six Degree of Freedom (6DOF) Vision System

**Title:** An Extensible 6DOF Vision Framework for Accurate Location and Pose Estimation in a Scene Graph Context

**OU:** Engineering Laboratory Office

**FIRM:** RoadNarrows LLC
125 East 5th St., # 102
Loveland, CO   80537

**Principal Investigator:** Robin D. Knight
**Phone:** 800-275-9568
**Email:** robin.knight@roadnarrows.com

**Award Amount:** $90,000.00

**Abstract:** RoadNarrows proposes a novel architecture to be implemented in a 6DOF vision system with applications in autonomous robotics. The system will report objects of interest along with location and pose information to a supervising computer. This system will be built around an advanced 3D vision platform that can deliver multiple video streams and 3D spatial measurements. The sensors will deliver high-resolution real-time spatial data which will be incorporated into an innovative framework for creating a scene graph approximation of the environment. Each set of measurements received from the sensor will be used to refine this scene graph model. The scene graph will contain important information about all objects of interest in the environment such as: estimated location, pose, and velocity. This approach, which builds and refines a coherent model of the environment, has significant advantages over simpler vision systems that analyze data frame by frame.

**Commercial Applications:** A product resulting from this research has extensive applications in industrial robotics. It can be used to augment existing robotic systems to improve operational capabilities. It will also be a key component in the next generation of robotic systems for agile manufacturing. In addition to industrial applications, a commercial 6DOF vision system will accelerate the rate of advanced robotics research, and make robotics more accessible to small businesses and academia. Researchers will be able to quickly develop advanced robotics applications by having a commercial off-the-shelf vision system available without the need to develop custom hardware and software in-house, as is currently typical in research laboratories. This system will be competitive to currently available laser scanner sensors, but provide a richer 3D image and data set for intelligent applications.

**FY 2011 Phase I Award**

**Topic:** MANUFACTURING

**SubTopic:** 9.05.08.68 Production of ISMRM/NIST MRI Calibration Phantoms

**Title:** Production Methods and Software for NIST Calibration Phantoms

**OU:** Physical Measurement Laboratory Office

**FIRM:** Sigma-K Corporation
511 Clayton Rd
Durham, NC   27703-3513

**Principal Investigator:** Paul Douglas Kirven
**Phone:** 919-971-4287
**Email:** dkirven@sigma-k.com

**Award Amount:** $90,000.00

**Abstract:** Currently, there are over 10,000 MRI scanners used in the US alone. US citizens today are mobile and many times medical treatments may require MRI scans from several different facilities. Images from MRI scanners can also drift over time. There is a tremendous need for all medical imaging scanners to be on the same level. Sigma-K will develop the commercialization of the ISMRM/NIST MRI Calibration Phantom. Sigma-K will develop a manufacturing technique that will produce a phantom that is consistent and accurate over the phantom life of five years. Our production system will allow these phantoms to be sold at the target price of $2000 with a minimal annual sales of 100 units. Sigma-K will also provide a software package to accompany the phantom that will allow the user to easily make quantitative measurements of the scanned data.

**Commercial Applications:** Sigma-K will work to make this calibration phantom a standard. These phantoms will be needed for all MRI scanner systems. The 10,000 MRIs scanners in the US alone may require 5000 phantoms. With a five year calibration life for the phantom, the US market is 1000 phantoms per year and growing. The market potential is $2 million in sales annually for the US market. Globally, the total potential market is $20 million annually.

**FY 2011 Phase I Award**

**Topic: MATERIALS SCIENCE**

**SubTopic: 9.06.05.63 Development of a MEMS Oscillatory Parallel-Plate Rheometer**

**Title: Optical Instrumentation for MEMS Oscillatory Parallel-Plate Rheometer**

**OU:** Material Measurement Laboratory Office

**FIRM:** Agiltron Incorporated
15 Cabot Rd.
Woburn, MA   01801-1003

**Principal Investigator:** Anton C. Greenwald
**Phone:** 781-935-1200 x158
**Email:** agreenwald@agiltron.com

**Award Amount:** $89,990.85

**Abstract:** Leveraging Agiltron&&#35;39&#59;s industrial leading developments for optical measurement of motion in MEMS devices, we propose to use electro-optical sensors for measuring the displacement and gap in the NIST micro-rheometer. No electrical connections are required to the moving parts. All electronics and optics are removed from the chip so that it is inexpensive and disposable. A fixed, simple micro-fluidic channel is added to cover plate to allow automated calibrated filling of the sample volume. The technical approach will be proved in Phase I through the numerical analysis, design and experiments. Complete drawings will be delivered to NIST at the end of Phase I. A portable prototype instrument with multiple, disposable sensor chips will be fabricated in Phase II for testing and delivery to NIST.

**Commercial Applications:** The sensor is seen as a small, portable instrument with disposable sampling chips that can be used to rapidly characterize fluids for quality control.

**FY 2011 Phase I Award**

**Topic: MATERIALS SCIENCE**

**SubTopic: 9.06.06.63 Development of Anion Exchange Resins for Chirality-Based Separation of Single Walled Carbon Nanotubes**

**Title: Anion Exchange Resins for Chirality-based Separation of Single-wall Carbon Nanotubes**

**OU:** Material Measurement Laboratory Office

**FIRM:** Sepax Technologies, Inc.
9798 Coors Blvd NW Bldg. B
Albuquerque, NM   87114-3301

**Principal Investigator:** Ke Yang
**Phone:** 302-366-1101
**Email:** xhuang@sepax-tech.com

**Award Amount:** $89,999.00

**Abstract:** Single chirality of single-walled carbon nanotubes (SWCNTs) is critical for their superb mechanical, thermal, optical and electronic properties. All known methods for producing nanotubes give mixtures of tubes with different chiralities. Physical separation of SWCNT by chirality is thus an enabling step for many potential applications and fundamental studies. The existing anion exchange resins are only partially effective for SWCNT chirality separations, with low recovery (30%) and short column life time (20 injections). Sepax Technologies, Inc. proposes to develop a new anion-exchange resin to drastically improve chirality resolution of SWCNTs. Sepax will apply its proven surface technology to in-house made uniform non-porous polystyrene/divinyl benzene beads to obtain resins with well-controlled density and distribution of charged functional groups and hydrophobic/hydrophilic characteristics, then pack into columns to achieve two technical objectives: 1) separation recovery of SWCNT samples higher than 85%; 2) resolving in a single pass (9,1) and (6,5) chirality tubes from commercial SWCNT starting materials with narrow diameter distribution.

**Commercial Applications:** Potential commercial application of this research arises in three areas. First, Sepax will collaborate with NIST to produce a wide range of single-chirality SWCNT tubes in commercial quantities as the standard materials for worldwide research community to study and discover new properties of those materials. This is the near-term market for single chirality SWCNTs which will be predominantly in academic and big industrial research labs. A large number of research labs will generate an attractive business. Secondly, Sepax will provide commercial ion-exchange resins and LC columns for analytical and preparative separations of SWCNT to research community and industry. Third, if a particular single-chirality SWCNT material is found of great value for certain commercial applications, Sepax will provide the resin or the whole separation set-up for large-scale separation. Those two areas will open two potential businesses: 1) separation media, columns and process chromatography equipments; 2) products of single-chirality SWCNTs and the application products based on single-chirality SWCNTs.

**FY 2011 Phase I Award**

**Topic:** MATERIALS SCIENCE

**SubTopic:** 9.06.01.73 Environmental Chambers for an Integrating Sphere-based Weathering Device

**Title:** Environmental Chambers for and Integrating Sphere-based Weathering Device

**OU:** Engineering Laboratory Office

**FIRM:** Measurement Analysis Corporation
23850 Madison St.
Torrance, CA   90505-6009

**Principal Investigator:** John P. Sparks
**Phone:** 310-378-5261x4240
**Email:** jsparks@macorp.net

**Award Amount:** $88,834.00

**Abstract:** Using a new concept for humidity control, based on a proprietary saturated air source, MAC will develop a design for an environmental chamber for use with NIST’s SPHERE UV source, in weathering or other UV degradation studies. The chamber will interface to the exit port of the SPHERE, maintaining the material coupons, mounted in a standardized sample holder, at a programmed temperature and relative humidity, within specified tolerances, for the duration of testing. The design will include the novel humidity source and evaluate a new humidity control scheme for possible inclusion or adaptation.

**Commercial Applications:** Primarily intended to support the eventual installed base of SPHERE sources, over a range or IR to UV, the chamber design will also be adaptable, where practical, to other sources, such as commercially available Solar Simulators, and other controlled environment applications with very small air volumes. The underlying technology can be adapted to temperature and humidity changes where the thermal and/or humidity loading is relatively small, such as material studies, precision manufacturing applications, microbiological studies. The technology is not applicable where large humidity control inputs are required, such as greenhouse environments.

**FY 2011 Phase I Award**

**Topic:** MATERIALS SCIENCE

**SubTopic:** 9.06.02.63 High-Accuracy Relative Angle Monitoring Apparatus

**Title:** Interferometric Angle Measurement

**OU:** Material Measurement Laboratory Office

**FIRM:** Optical Physics Company
26610 Agoura Rd., Suite 240
Calabasas, CA   91302

**Principal Investigator:** Chien Chung Chen
**Phone:** 818-880-2907 x231
**Email:** cchen@opci.com

**Award Amount:** $89,951.00

**Abstract:** Optical Physics Company is proposing to implement an interferometric angle sensor for the purpose of determining the relative angle between the two diffracting crystals. Two approaches can be pursued, namely (1) the dual grating interferometer, and (2) the angle interferometer. The estimated cost of materials for building the angle sensor in quantity ranges between $2K and $12K. The expected accuracy is better than 0.1 arc seconds across a range of 0.25 degrees. The design meets all requirements named in the solicitation, including size, weight, bandwidth and lifetime. The Phase I work will build and test a prototype interferometer which will confirm the design and prepare for fabrication of a deliverable unit in Phase II.

**Commercial Applications:** The main application targeted is the one NIST is most interested in, namely X-ray diffraction instrumentation. At the same time, this project’s market potential overlaps with that of an ongoing NIST SBIR Phase II project which is building a three-axis interferometer for measuring linear displacement resolution with an accuracy of 0.1 nm and angular resolution with an accuracy of 0.1 arc-second across a range of 100 arc-seconds. Deploying two high precision instruments at NIST can distinguish OPC from other competitors in the eyes of many potential customers and hence open up new markets and applications. Most of these involve manufacturing of planar nanosystems that utilize metrology frames as part of semiconductor manufacturing tools. Sample applications are lithography mask (reticle) writers, scanners/steppers, CD metrology tools, pattern placement and overlay metrology tools, circuit and mask repair tools, coordinate measuring tools, and diamond turning machines.

**FY 2011 Phase I Award**

**Topic:** NANOTECHNOLOGY

**SubTopic:** 9.07.01.68 3D Tip Characterization and Surface Reconstruction Voiding

**Title:** 3D Tip Characterization and Surface Reconstruction

**OU:** Physical Measurement Laboratory Office

**FIRM:** Nanometrology International, Inc.
302 Woodbridge Ct
Allen, TX   75013-3683

**Principal Investigator:** Gregory A. Dahlen
**Phone:** 805-569-8886
**Email:** dahlen@nanometrology.net

**Award Amount:** $90,000.00

**Abstract:** NMI proposes to demonstrate the feasibility of 3-dimensional characterization of nanoscale objects using scanning probe microscopy with a measurement uncertainty of less than 0.7 nm. To accomplish this task, we propose a novel method of 3D tip characterization and use of an innovative surface reconstruction algorithm recently introduced by NIST and the Illinois Institute of Technology. The crucial next step is implementation into systems useful to the industry. Our team comprises experts in tip characterization and image reconstruction, and critical dimension reference metrology. Specifically, this includes the co-developer of the dexel method together with the first individual to introduce CD 2D image reconstruction and then integrate the methods into a commercial instrument - X3Dand InSight. Successful demonstration of feasibility will be built on the innovative technology introduced by NIST, our novel 3D characterization technique and the core expertise of our team. Once the feasibility of 3D tip characterization and surface reconstruction is demonstrated, technology development will be implemented in Phase II commercial development of characterizers and software.

**Commercial Applications:** The means to remove 3D image distortion from general SPM does not currently exist. CD SEM and OCD both need calibration and bias correction, however, there is no 3D reference metrology available for this task. CD AFM is capable of meeting 1 nm measurement uncertainty of lines and trenches only, but is not capable of dealing with holes, line ends, elbows and contours without the proposed enabling technology. Thus, the immediate application area is nanoelectronics with larger, future applications in nanoscience, nanotechnology development and nanomanufacutirng. Considering just the installed customer base of existing CD AFM users in nanoelectronics, our licensing estimates over $1M/year revenue in fees with a lifetime return of over $7M. Following feasibility research in Phase I, alpha characterizer hardware and software will be developed in Phase II. Sales of alpha product will fund beta release software and characterizers. As part of our larger strategy, the NSF has projected the nanoscience, technology and manufacturing market to be over $1 trillion dollars by 2015. From this, depending on market development, we estimate that the specific market for our software and characterizer system to be in the $10s of millions.

**FY 2011 Phase II Award**

**Topic:** INFORMATION TECHNOLOGY

**SubTopic:** 9.05.02.4-R Analysis of New WWVB Modulation Schemes for Future Broadcast

**Title:** A Novel Enhanced-Performance Low-Cost Receiver and a Modified Modulation Scheme for WWVB

**FIRM:** XW, LLC dba Xtendwave
7920 Belt Line Road, Suite 1000
Dallas, TX   75254

**Principal Investigator:** Oren Eliezer
**Phone:** 972-290-0967 x111

**Award Amount:** $300,000.00

**Abstract:** This Phase II project targets the completion of the development of an improved system for the broadcasting of the WWVB signal, as a direct continuation of the Phase I project, which successfully validated the proposed approach through a feasibility study and analyses. Objectives of this project include the design of the new modulation scheme and protocol, the development of a new time-code generator to be used in place of the existing one, and the development and demonstration of a receiver prototype that can validate the expected improvement in the performance, as well as low-cost manufacturability. The novel receiver architecture, relying extensively on digital processing, is to be realized in a CMOS fabrication process, allowing it to be integrated with many types of CMOS system-on-chip products, including microprocessors for remote metering applications, clocks, MP3 players, and many more. Additionally, new structures of low-cost antennas for various applications are targeted, to replace the commonly used ferrite-rod antennas, and more specifically to avoid directionality and nulls in the antenna pattern.

**Commercial Applications:** A very wide range of potential commercial applications exist for the enhanced performance and features offered by Xtendwave’s technology being developed under this SBIR project. These include virtually any electronic device that could benefit from a time stamp or display. The wider geographical coverage allowed by the enhanced sensitivity and improved interference robustness, will make possible virtually ubiquitous use of NIST’s WWVB broadcast signal. The new modulation approach and protocol will also allow additional information, such as emergency alerts. The incorporation of time-dependent energy-saving features into various appliances will be a major benefit. Xtendwave’s CMOS compatible design will enable straightforward SoC integration, and combined with a compact, low-cost antenna, will result in a low cost, highly integrated solution compared to existing products. Xtendwave’s products will result in a US generation that will never think about setting any type of clock anymore than winding one.

**FY 2011 Phase II Award**

**Topic:** INFORMATION TECHNOLOGY

**SubTopic:** 9.05.04.9-TT Technology Transfer of Multimodal Biometric Application Resource Kit (MBARK)

**Title:** Distributed MBARK Based Mobile Face Recognition

**OU:** Information Technology Laboratory Office

**FIRM:** Ad Harmony
15 Ross Ave.
Staten Island, NY   10306-2215

**Principal Investigator:** Bob Gupta
**Phone:** 609-230-4262
**Email:** bobg1966@gmail.com

**Award Amount:** $300,000.00

**Abstract:** The technical objective of this project is to develop a prototype of a face recognition application in a cloud computing environment utilizing MBARK as the middleware. The application will have a client piece that will run on a mobile device such as a laptop and a server piece that will run on a higher-performance computing cluster. The specific objectives of this development project can be enumerated as follows: 1. Implement a distributed MBARK system that allows local functions, such as data capture and filtering, to pass data and control streams to/from remote server functions such as compute-intensive analysis and database matching.

**Commercial Applications:** A Commercial Mobile Face Identification and Face Matching System may potentially result from this research. Mobile, cloud, and video capture enablement of MBARK will allow for proper interface to a commercially available Face Recognition SDK. This concept could be extended to other mobile biometric identification systems in the future. Cloud enablement means that complex and compute intensive processes can be easily supported. Future mobile biometric/security systems could also take advantage of the biometric diversity built into MBARK to commercialize systems that input data from a variety of sensor system.

**FY 2011 Phase II Award**

**Topic:** MANUFACTURING SYSTEM INTEGRATION

**SubTopic:** 9.07.01.2-R Decision Support Tools for Sustainable Manufacturing

**Title:** Decision Support Tools for Sustainable Manufacturing

**OU:** Engineering Laboratory Office

**FIRM:** BIMCON Inc.
2957 Brentwood Road
W. Bloomfield, MI   48323

**Principal Investigator:** Krishna Murthy
**Phone:** 248-875-6591
**Email:** kmurthy@bimcon.com

**Award Amount:** $299,620.00

**Abstract:** Our vision is that of an integrated decision support solution that transforms the current time-consuming and reactive (post-design) sustainability assessment of a product into a proactive approach available in the early design phases. This solution called Sustainability Integrated into Early Design (SIED) will deliver lifecycle sustainability data into early design processes and focus primarily on the key area of target cascading, which does not exist for sustainability metrics, such as carbon footprint. The objective of this SBIR Phase II proposal is to extend our Phase I research and findings toward the development of a fully functional prototype that forms the basis of future commercialization. Phase II work focuses on developing specialized information representations and a set of procedures/algorithms fundamental to the working of this framework with significance focus on developing a fully functional prototype that will be deployed and tested at our industry collaborators.

**Commercial Applications:** By integrating sustainability target and status information with the existing product creation and business process information using open standards, the SIED tool will deliver a one-stop access to structured, real-time information. BIMCON will develop products in the area of Bill of Material and Attribute Management tools (including sustainability), which will be commercialized. These products are: Sustainability Decision Tools, the standard portable BOM, and corresponding Integration Tools. Once that data has a place to be stored and managed, we are also developing tools to deliver the data via existing commercial applications to decision makers in a transparent and seamless interface. This will ensure that sustainability and other metrics are given their due importance in product development, which will make compliance to regulations more robust and eliminate costly re-design.

**FY 2011 Phase II Award**

**Topic:** MICROELECTRONICS MANUFACTURING

**SubTopic:** 9.10.02.1-R Massively Parallel High Temperature Probe System for Wafer-level Reliability Testing

**Title:** Massively Parallel High Temperature Probe System for Wafer-level Reliability Testing

**FIRM:** Celadon Systems, Inc.
14763 Energy Way
Apple Valley, MN   55124-5762

**Principal Investigator:** John Dunklee
**Phone:** 503-505-0247
**Email:** johnd@celadonsystems.com

**Award Amount:** $300,000.00

**Abstract:** Historical methods of reliability assessment are less and less effective as device sizes shrink. Larger sample sizes and longer duration tests are increasingly needed. At the same time, efforts to continue scaling semiconductors to ever smaller geometries is leading to an explosion of new device structures, materials and processes. The cost of testing these innovations is becoming a major barrier to their commercialization. The NIST Phase I project demonstrated that existing reliability test systems cannot reduce the cost of test significantly for these long duration tests, but concluded that a tightly integrated system offers the potential for a 10-fold reduction in test costs. However, a tightly integrated system introduces risks and unknowns due to the thermal, mechanical and electrical interaction of system components. The objective of this Phase II effort is to explore interactions between a broad range of feasible alternative identified in Phase I and develop the best possible combination into an integrated system.

**Commercial Applications:** Understanding the reliability of advanced semiconductor devices is at the forefront of the industry. The need for a cost effective method to test thousands of devices increases every day. The new technologies being developed require massively parallel reliability tests to fully understand the fundamental physics, develop new models, and determine their reliability with much higher accuracy and precision. Operating in this industry, we can see this need to increase sample sizes and significantly reduce the cost and time to obtain the data every day. The successful introduction to the industry of this type of testing capability is needed to continue the fast pace of innovation. Beyond reliability testing, the reduced cost and flexibility of operating over a wide temperature will make the resulting integrated test system extremely useful in a wide range of other semiconductor test applications including device characterization, process monitoring and some wafer level reliability.

**FY 2011 Phase II Award**

**Topic:** OPTICS AND OPTICAL TECHNOLOGY

**SubTopic:** 9.12.08.5-R High Speed and High Sensitivity Quadrant Photodetector

**Title:** High Speed and High Sensitivity Quadrant Photodetector

**OU:** Material Measurement Laboratory Office

**FIRM:** Radiation Monitoring Devices, Inc.
44 Hunt Street
Watertown, MA   02472-4699

**Principal Investigator:** Richard A. Myers, Ph.D.
**Phone:** 617-668-6818
**Email:** Rmyers@RMDInc.com

**Award Amount:** $299,995.00

**Abstract:** To further advance the characterization and utility of microcantilevers, next generation optical detectors with higher frequency response, improved displacement resolution and lower noise for weak signal detection are needed. Consequently, Radiation Monitoring Devices, Inc. (RMD) will develop a turnkey optical detector module for use in characterizing the displacement and resonant frequencies of microcantilevers used in scanning probe microscopes and sensing applications. This module will meet desirable detector specifications, including a bandwidth of at least 50 MHz, displacement resolution of 0.1 microns and high responsivity to wavelengths in the visible and near-infrared. At the end of the Phase I effort, a working prototype was delivered to NIST for test and validation. The Phase II effort will highlight further performance enhancement and refining the module design for commercial production.

**Commercial Applications:** Microcantilevers are currently being utilized to help characterize and map the structure of nanomaterials as well as used as chemical, biological and environmental sensors. The quadrant array module proposed here will resolve the microcantilever movement with greater precision, produce richer spectral information about nanomaterials, improve molecular recognition and allow studies of interaction chemistry that have, to date, been inaccessible. Significant markets for this technology include homeland security concerns, environmental monitoring, material manufacturing and health screening. Beyond monitoring the movement of microcantilevers, the advanced quadrant array module would also be useful for position sensing, tracking and LADAR-related applications.