



NIST
National Institute of
Standards and Technology

SBIR

**SMALL BUSINESS INNOVATION
RESEARCH PROGRAM**

**ABSTRACTS OF PHASE I and PHASE II
AWARDS FOR FISCAL YEAR 2014**

INTRODUCTION

Abstracts of Awards for Fiscal Year 2014 SBIR Program

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

Fiscal Year 2014 List of Awardees

<u>Award Number</u>	<u>Company Name</u>	<u>Topic Areas</u>	<u>Phase</u>
70NANB14H289	Antara Teknik LLC	Cybersecurity	Phase I
70NANB14H303	En 'Urga Inc.	Health Care	Phase I
70NANB14H290	Grier Forensics	Cybersecurity	Phase I
70NANB14H297	High Precision Devices	Health Care	Phase I
70NANB14H296	Luminit, LLC	Manufacturing	Phase I
70NANB14H298	Luminit, LLC	Manufacturing	Phase I
70NANB14H292	Management Sciences, Inc.	Cyber-Physical Systems	Phase I
70NANB14H305	Phantom Laboratory	Health Care	Phase I
70NANB14H291	Physical Optics Corp.	Health Care	Phase I
70NANB14H301	Radiation Monitoring Devices, Inc.	Cybersecurity	Phase I
70NANB14H300	Seacoast Science, Inc.	Technology Transfer	Phase I
70NANB14H304	SouthWest NanoTechnologies	Manufacturing	Phase I
SB1341-14-CN-0022	Gener8	Cybersecurity	Phase II
SB1341-14-CN-0028	High Precision Devices, Inc.	Manufacturing	Phase II
SB1341-14-CN-0026	RadiaBeam Technologies, LLC	Manufacturing	Phase II
SB1341-14-CN-0029	SynTouch LLC	Manufacturing	Phase II

FY 2014 PHASE I AWARD

Topic: Cybersecurity

Subtopic: Cryptographic Acceleration for Border Gateway Protocol Security (BGPSEC)

Title: Cryptographic Acceleration for Border Gateway Protocol Security (CaBGPSEC)

OU: Information Technology Laboratory

Firm: Antara Teknik LLC
5233 Castlereigh Ct.
Granite Bay, CA 95746

Principal Investigator: Mehmet Adalier

Phone: 916-622-6960

Email: madalier@antarateknik.com

Award Amount: \$89,972.38

Abstract: Current Border Gateway System (GBP) does not include provisions for security features and is vulnerable to malicious attacks targeting the control plane. The Internet Engineering Taskforce is developing BGPSEC (BGP with Security) to provide path security for BGP route advertisements. The extension is meant to provide resiliency against route hijacks and Autonomous System (AS) path modifications. Given the large size of the global Internet BGP routing table and strict requirement for re-convergence time following router reboots, the security requirement causes a major adoption challenge since most currently deployed router control plane hardware does not have the processing power to handle BGPSEC's cryptographic-intensive computations. NIST is closely involved in BGPSEC protocol design and has developed a prototype implementation: BGP-SRx. Antara Teknik will modify NIST BGP-SRx and develop an optimal API with appropriate OS hooks to completely off-load all cryptographic operations to an off-board cryptographic accelerator incorporated to a PC-router platform. Antara Teknik will perform component level, system level, and algorithmic optimizations to architect and design a low-power, low-cost, efficient, and highly secure router. The proposed router will be commercially deployable in the near future and accelerate the adoption of BGPSEC to secure a key component of the Internet critical infrastructure.

Commercial Applications: Since most existing router engines will not be able to satisfy the additional security requirements, there is a substantial commercial opportunity and available market for a BGPSEC capable economically feasible router. The proposed Phase I work will determine the fundamental hardware and software design specifications in order to manufacture and commercialize low power, high performance and cost effective edge-routers with FIPS 186-4 compliant cryptographic capabilities during Phase II and beyond.

Topic: Health Care

Subtopic: Instrument to Detect Aerosolized-Droplet Dose Delivery of Vaccines

Title: Combined Extinction/Fluorescence Absorption Diagnostics for Pharmaceutical Sprays

OU: Material Measurement Laboratory

Firm: En 'Urga Inc.
1201 Cumberland Ave.
West Lafayette, IN 47906

Principal Investigator: Yudaya Sivathanu

Phone: 765-497-3269

Email: sivathan@enurga.com

Award Amount: \$90,000.00

Abstract: This Phase I project will evaluate the feasibility of a pharmaceutical spray quality audit system. The spray quality audit system will estimate the mass distribution of active ingredients and droplet sizes in pharmaceutical sprays using combined fluorescence absorption and light extinction tomography. En'Urga will modify an existing instrument to simultaneously obtain full volume fluorescence absorption and light extinction in a spray containing a fluorophore. The existing user interface will be modified to calculate the full planar mass distribution of active ingredients in the plane as well as the planar drop sizes. The results will be validated using conventional methods.

Commercial Applications: The primary commercial application for the proposed fluorescence tomography system is in the quality audit of pharmaceutical spray nozzles. The quality of pharmaceutical spray nozzles is particularly important in inhalers and table coaters where the active ingredient has a time release profile. The uniformity of mass distribution, drop sizes, and the amount of active ingredient issuing from these nozzles is crucial for ensuring proper dosages in both inhalers and table coaters. The proposed system will enable pharmaceutical manufacturers to quickly evaluate the mass distribution and flux of the active pharmaceutical ingredients within sprays so as to meet a rigid quality audit protocol.

Topic: Cybersecurity

Subtopic: Secure Email Agent Using the Domain Name System (DNS) as a Trust Infrastructure

Title: Secure Email Agent Using the Domain Name System (SND) as a Trust Infrastructure

OU: Information Technology Laboratory

Firm: Grier Forensics
708 Lakeview Dr.
Lakewood, NJ 08701

Principal Investigator: Jonathan Grier
Phone: 443-501-4044
Email: jgrier@grierforensics.com

Award Amount: \$90,000.00

Abstract: Email is one of the most prevalent and critical forms of digital communication in use today. Ironically, it is also one of the least secure. Most email systems provide no means to authenticate the sender of a message, and is hence easily and commonly forged or spoofed, often used to penetrate networks via phishing attacks. Additionally, most email systems provide no means to ensure privacy or confidentiality. Although protocols for securing email have been available for over twenty years, these protocols, by nature of their use of asymmetric cryptography, require users to have the public key or certificate of their correspondents. We propose to develop technology to use the Domain Name System (DNS) to distribute such certificates and keys, making email secure, authenticated, and confidential, curbing the losses from phishing attacks and allowing all people to use email as a simple, readily available means of trustworthy communications.

Commercial Applications: Losses due to phishing attacks are estimated to be between \$2.4 and \$5.9 billion dollars yearly worldwide. Waste due to inability to use email for sensitive communications that must remain private, such as health and financial information, are likewise estimated in the billions. As email is already one of the most ubiquitous and critical means of modern communication, providing means to secure it can potentially create billions in prevention of losses, new value and productivity.

Topic: Health Care

Subtopic: Production of NIST/UCSF Breast Phantom for Magnetic Resonance Imaging (MRI)

Title: Optimization of the NIST/UCSF Breast Phantom for Quantitative MRI

OU: Physical Measurement Laboratory

Firm: High Precision Devices
1668 Valtec Lane
Boulder, CO 80301

Principal Investigator: Michael Snow
Phone: 303-447-2558
Email: msnow@hpd-online.com

Award Amount: \$89,995.54

Abstract: Magnetic resonance imaging (MRI) has become a primary diagnostic tool in scientific research and clinical imaging. Despite the excellent image quality that can be obtained with

today's MRIs, images acquired using different MRI systems and during longitudinal studies are not reproducible, and hence can be difficult, if not impossible, to compare. To address this issue, a standardized test of the performance characteristics of each MRI, detection coils, and operational procedures is necessary. High Precision Devices, Inc. proposes the development of a manufacturing process to provide cost effective and shelf-stable NIST-designed MRI breast phantoms for calibration of MRI systems used in breast cancer research studies and clinical settings.

Commercial Applications: Currently there are approximately 10,000 MRI units in the U.S. with an expected growth of 500 units per annum. Of the sites with MRI capabilities, 55% are capable of performing breast diagnostics equating to over 1 million procedures performed each year. Over 150 clinical research trials involving the use of magnetic resonance imaging to investigate the various aspects of breast cancer are currently being conducted. To ensure that new breast cancer treatments and procedures are properly conducted in medical settings, it will be necessary to provide a cost-effective and shelf-stable breast phantom as a calibration tool.

Topic: Manufacturing

Subtopic: Compact, Rapid Electro-Optic Laser Scanner for Absolute 3D Imaging

Title: Tunable Electro-Optic Laser Scanner (TEOLS)

OU: Physical Measurement Laboratory

Firm: Luminit, LLC
1850 W. 205th Street
Torrance, CA 90501

Principal Investigator: Xiaowei Xia
Phone: 310-320-1066

Award Amount: \$89,493.00

Abstract: In Phase I, Luminit will demonstrate Tunable Electro-Optic Laser Scanner (TEOLS) feasibility by conducting technical analysis and simulation and initially test a proof-of-concept prototype. In Phase II, Luminit plans to develop an engineering prototype TEOLS that can be incorporated into existing NIST LADAR imager hardware prototypes for testing and validation, leading to a rapid 3D LADAR imager design concept for commercial deployment.

Commercial Applications: Industrial markets are industry for machine vision and monitoring of manufacturing processes, automotive, semiconductors, electronics, glass, metals, wood and paper, pharmaceuticals and cosmetics, rubber and plastics, containers and packing, medical devices, printing, and food. Non-industrial markets are healthcare applications, telecommunications, military and defense.

Topic: Manufacturing

Subtopic: Erbium-Based DPSS Lasers for Remote Sensing

Title: Spectrally Pure Eye-Safe Laser (SPESL)

OU: Physical Measurement Laboratory

Firm: Luminit, LLC
1850 W. 205th Street
Torrance, CA 90501

Principal Investigator: Russell Kurtz
Phone: 310-320-1066

Award Amount: \$89,623.00

Abstract: To help with the detection of carbon dioxide, methane, and certain gaseous pollutants, NIST is seeking narrow linewidth, tunable and band-selectable, diode-pumped solid-state lasers in the wavelength region between 1550 nm and 1650 nm. Luminit proposes to develop the Spectrally Pure Eye-Safe Laser (SPESL). The SPESL is an Er:YAG laser, side pumped by semiconductor lasers in the erbium absorption band near 1475 nm, with an intracavity etalon and a switchable spectral filter. The etalon will reduce the laser linewidth to <50 MHz because, unlike traditional Q-switched short pulse lasers, the cavity-dumped SPESL circulates the photon flux through the etalon hundreds of times before sending it out. Cavity dumping also ensures constant pulse energy over a wide range of repetition rates, as low as 100 Hz and as high as 20 kHz (previous work indicates 100 kHz is achievable). The simple, automated system design ensure environmental ruggedness and ease of use.

Commercial Applications: Not only does the SPESL directly meet the needs of NIST, it also has immediate commercial applications in fields where Luminit has existing customers, such as tracking manufacturing equipment and as the illuminator for gesture-based tracking games and computing. It has application to fields as diverse as spectrometry, important to the U.S. Army, and long-range ice detection, important to the U.S. Navy.

Topic: Cyber-Physical Systems

Subtopic: Residential Heat Pump Fault Detection and Diagnostic Datalogger

Title: Cognitive Residential Heat Pump Fault Detection and Diagnostic Datalogger

OU: Engineering Laboratory

Firm: Management Sciences, Inc.
6022 Constitution Ave., NE
Albuquerque, NM 87110

Principal Investigator: Kenneth Blemel
Phone: (505) 255-8611
Email: Kenny_Blemel@mgtsciences.com

Award Amount: \$89,987.78

Abstract: Millions of heat pumps are used to heat and cool homes and buildings year round. Continuous operation means that components wear out at a greater rate. As a result, maintenance of residential heat pumps is a major cost driver. Current methods focus on reduced use through control settings. Typically, demand has wide swings throughout the day and people are unable to customize controls. Inevitably, energy is wasted until a fault is discovered and a maintenance technician replaces a faulty part. MSI's patented user-programmable microcontroller module performs sensor data monitoring, datalogging, processing, control, and communications to smartphones and tablets. We propose to exploit this technology for increasing the efficiency of heat pumps and reducing maintenance costs by aggressive goal-seeking control and simultaneous real time monitoring for stresses, degradation, and equipment faults using deductive modeling. Our product vision is an easy-to-install, plug-and-play kit that connects to the existing equipment and household sensors. In Phase I, MSI will start with a cloud demonstration of the current technology in action at our current off-the-grid demonstration site. Next, we will perform research and value engineering to architect and produce a small, form factor prototype specifically for improving heat pump performance, safety, reliability, and ownership costs.

Commercial Applications: With energy and maintenance prices skyrocketing, there is pent-up demand for innovations that increase efficiency and provide for early detection and mitigation of faults in heat pumps wherever they are used. One important market is retrofit for upgrade of standard, non-monitored residential heat pumps that provide year-round heating and cooling for homes and recreational vehicles around the world. Another is licensing of the patented technology to original equipment manufacturers and to developers of 'smart' facilities.

Topic: Health Care

Subtopic: Production of NIST/UCSF Breast Phantom for Magnetic Resonance Imaging (MRI)

Title: Production of NIST/UCSF Breast Phantom for Magnetic Resonance Imaging (MRI)

OU: Physical Measurement Laboratory

Firm: Phantom Laboratory

Principal Investigator: Josh Levy
Phone: 518-692-1190
Email: levy@phantomlab.com

Award Amount: \$90,000.00

Abstract: This project involves the commercialization of the breast phantom designed by NIST and University of California, San Francisco (UCSF) for quantitative magnetic resonance imaging (MRI). The breast phantom consists of two independent phantoms, one focused on diffusion MRI measurements and the other focused on accurate measurements of fat and fibroglandular tissue properties. The proposed phantom is one of several recently developed to address the needs for reliable test tools for Quality Control in quantitative imaging work. The goal is take this carefully developed phantom and refine the design for manufacturing. Methods and processes to stabilize the reference solutions ensuring five years of measurement stability are required.

Commercial Applications: Successful completion of this project will have an impact on the utility of MRI in the evaluation of breast cancer and other related abnormalities. Beyond breast imaging, the development of manufacturing methods for good stable diffusion measurement tools will be of great value in numerous MRI applications.

Topic: Health Care

Subtopic: Instrument to Detect Aerosolized-Droplet Dose Delivery of Vaccines

Title: Aerosolized Vaccine Dose Analysis (AVIDA) System

OU: Material Measurement Laboratory

Firm: Physical Optics Corp.
1845 West 205th St.
Torrance, CA 90501

Principal Investigator: Chung-Yen Chao
Phone: 310-320-3088

Award Amount: \$89,957.00

Abstract: To address the NIST need for an instrument to detect aerosolized-droplet dose delivery of vaccines, Physical Optics Corporation (POC) proposes to develop a new Aerosolized Vaccine Dose Analysis (AVIDA) system based on the combination of planar laser-induced fluorescence, laser diffraction, microscope optics, and an advanced image processing algorithm. This system, using temporal image splitting, provides clearly focused fluorescence and scattering images of aerosolized droplets/particles. The innovation in the system architecture enables high-speed acquisition of both fluorescence and scattering images at <10 microsec per image. The

advanced algorithm can process images to extract and identify droplet/particle size and concentration of the active pharmaceutical ingredients (APIs) within each droplet. In Phase I, POC will demonstrate the feasibility of this system by designing, assembling, and testing an experimental prototype using microspheres and aerosolized API-laden solutions. In Phase II, POC plans to optimize the system design, improving performance, in terms of image acquisition rate, image resolution, response time, image processing capability of the algorithm, and user interface. At the conclusion of Phase II, we anticipate delivering a fully functioning prototype applicable to a wide range of healthcare technologies, and identifying the most promising commercial and government applications for the commercialization of the AVIDA system.

Commercial Applications: The AVIDA system will provide a reliable method to quantitatively detect the API dose during pulmonary delivery of drugs and vaccines. In addition to aerosolized drugs and vaccines, this system is applicable to all aerosols to determine their sizes, concentration, and contents. Other significant applications include those in the healthcare industries, law enforcement, Homeland Security, chemical and petroleum industries, food and beverages industries, and spray and jetting industries, as well as environmental analysis, and analysis of climate change.

Topic: Cybersecurity

Subtopic: Silicon Single-Photon Avalanche Diodes with Detection Efficiency that Exceeds 95 %

Title: Low-Noise, High-Efficiency Geiger Photodiode for Quantum Cryptography

OU: Physical Measurement Laboratory

Firm: Radiation Monitoring Devices, Inc.
44 Hunt Street
Watertown, MA 02472

Principal Investigator: Erik B. Johnson

Phone: 617-668-6886

Email: EJohnson@rmdinc.com

Award Amount: \$89,997.00

Abstract: The mechanics of single photons can be used to entangle information carry quantum states, allowing for quantum computation or random number generation. Quantum communication utilizes the quantum nature of single-photons to retain information, particularly in the form of quantum key distribution protocols. High-efficiency, low-noise single photon detection at high efficiency is critical for the application of new systems utilizing the power of quantum mechanics. Existing Geiger photodiodes provide single photon resolution with excellent timing characteristics and low dark count rates but has limited detection efficiency.

This program will develop a Geiger photodiode for quantum cryptography with an efficiency greater than 98% in the visible wavelength range.

Commercial Applications: The major contribution of this work will seed advance photodetectors for various low-light applications. RMD develops radiation detectors and components such as scintillation and semiconductor materials. The Geiger photodiode to be developed in this program will be immediately implemented into a solid-state photomultiplier design, then we will utilize our contacts in academia and industry to develop optimal designs for medical imaging, physics detectors, and dosimetry. A solid-state photomultiplier developed within this program provides a viable alternative to the traditional photomultiplier tube for spectrophotometry, PET and SPECT imaging, gamma and x-ray cameras, radioluminescent assays, flow cytometry, DNA sequencers, and radiation monitors.

Topic: Technology Transfer

Subtopic: NIST Tech Transfer

Title: Thermo-focusing Chromatography - High Sensitivity Chromatography for Chemical Analysis

OU: Technology Partnerships Office

Firm: Seacoast Science, Inc.
2151 Las Palmas Dr.
Carlsbad, CA 92011

Principal Investigator: William Tolley

Phone: 760-268-0083

Award Amount: \$90,000.00

Abstract: Seacoast Science will license, for the purpose of technology transfer, the NIST patent “Recirculating Temperature Wave Focusing Chromatography,” with the goal of successfully implementing the method into a unique, low-cost gas chromatograph for environmental pollution monitoring. In the U.S., there are over 425,000 brownfields and 1,320 Superfund sites where noxious chemicals have been used and unhealthy levels of noxious chemicals may remain in the soil and subterranean water. The noxious vapors, most of which are considered carcinogens; pass through the soil and groundwater into homes, schools, businesses, watersheds, aquifers, and municipal water systems on or near these formerly contaminated sites. EPA estimates that cleanup and redevelopment programs leverage \$14 billion in economic benefit and support 60,917 jobs. Thus, the objective is to develop means to monitor remediated sites to achieve productivity while assuring a healthy environment.

Commercial Applications: Seacoast proposes to develop a vapor intrusion monitor (VIM) capable of detecting petrochemical and chlorinated solvent vapors resulting from vapor intrusion.

VIM will be used as part of a comprehensive remediation program to assure noxious vapors do not return following reoccupation of a remediated area as well as allowing environmental restoration teams to perform long-term soil vapor and vapor intrusion studies. Market research estimates a market for approximately 10,000 such instruments generating gross revenues of \$50MM. The lower monitoring cost possible through VIM will allow remediation experts to track pollutant plumes and remediation progress in real time.

Topic: Manufacturing

Subtopic: Technology for Separation of Carbon Nanotubes

Title: Scale-Up of ATPE Technology to Produce Highly Enriched Semiconducting SWCNTs

OU: Material Measurement Laboratory

Firm: SouthWest NanoTechnologies
2501 Technology Place
Norman, OK 73071

Principal Investigator: Youngquiang Tan

Phone: 405-809-6213

Email: tan@swentnano.com

Award Amount: \$89957.00

Abstract: Single-walled carbon nanotubes (SWCNTs) have unique material properties making them very attractive for use in a variety of electronic applications. However, as-grown SWCNTs contain a mixture of tubes with heterogeneous optical and electronic properties. The chiral species must be separated in order to maximize the desired properties. To date, no large scale separation process has been accomplished. This Phase I project seeks to extend the promising technique developed at NIST to demonstrate single-chirality CNT separation, at laboratory scale.

Commercial Applications: Given their remarkable properties, semiconducting SWCNTs can potentially be used to replace or complement traditional and organic semiconducting materials in devices such as integrated circuits, optical switches, field-effect transistors, thin-film transistors, chemical sensors, and biomedical therapeutics. This project will demonstrate the feasibility of a process for producing high-purity semiconducting SWCNTs in quantities required for these applications.

FY 2014 PHASE II AWARD

Topic: Cybersecurity

Subtopic: Bragg Grating Enhanced Narrowband Single Photon SPDC Source

Title: Bragg Grating Enhanced Narrowband Single Photon SPDC Source

OU: Information Technology Laboratory

Firm: Gener8
535 Del Ray Ave.
Sunnyvale, CA 94085

Principal Investigator: William Bischel

Phone: 650-940-9898

Email: bbischel@gener8.net

Award Amount: \$299,967.00

Abstract: Spontaneous Parametric Down Conversion (SPDC) is currently an active research area in quantum communications (QC) to develop entangled single photon sources. However, the bandwidth of current SPDC sources is too broad for many applications. NIST researchers have modeled a solution to this problem that reduces the bandwidth by >50 . We propose to fabricate a prototype of the NIST device by developing an innovative fabrication method for a Bragg grating with a $\pi/2$ phase shift over the SPDC periodically poled waveguide in lithium niobate. The project goal is to demonstrate significant narrowing of the SPDC spectrum. We anticipate that the result of this Phase II project will be a design for a highly integrated SPDC source that will enable new fundamental QC research.

Commercial Applications: The development of a novel Bragg grating fabrication process that has a π phase shift at the center is important for the development of many devices in addition of the SPDC application. For example, it can be used in the development of novel designs for new external cavity stabilized diode lasers. The SPDC single photon source proposed to be developed in Phase II will have a significant market in the scientific community studying advanced quantum communications applications. In our Commercialization Plan, we are targeting the optical source market for both fiber-based and free-space Quantum Key Distribution.

Topic: Manufacturing

Subtopic: Flowing Water Optical Power Meter for Laser Measurements

Title: Flowing Water Optical Power Meter for Laser Measurements

OU: Physical Measurement Laboratory

Firm: High Precision Devices, Inc.
1668 Valtec Ln.
Boulder, CO 80301

Principal Investigator: Joshua West
Phone: 303-447-2558
Email: jwest@hpd-online.com

Award Amount: \$299,650.00

Abstract: High Precision Devices, Inc. (HPD) proposes to continue and complete development of the 25 kW Flowing Water Optical Power Meter for Laser Measurements begun under a Phase I SBIR award. In the proposed Phase II work described, HPD will complete mechanical and electrical subsystems, apply a ceramic carbon nanotube coating to the internal surfaces of the optical head, complete development of control software and test the integrated power measurement system. A significant set of objectives include design refinements that will yield: reduced production costs, improved manufacturability, user interface enhancements, and additional safety features (e.g., safety interlocks in hardware and software).

Commercial Applications: There is no laser power meter commercially available today for continuous wave high power lasers with accuracy of 1% or less and that is traceable to a NIST primary standard. This research will result in such a power meter becoming commercially available.

Topic: Manufacturing

Subtopic: Angularly Sensitive Detectors for Transmission Scanning Electron Microscopy

Title: Digital Micromirror Device Detection Scheme for Transmission Scanning Electron Microscopy

OU: Material Measurement Laboratory

Firm: RadiaBeam Technologies, LLC
1717 Stewart St.
Santa Monica, CA 90404

Principal Investigator: Bryce Jacobson
Phone: 310-822-5845
Email: jacobson@radiabeam.com

Award Amount: \$300,000.00

Abstract: Accurate quantitative characterization of materials is crucial for a wide range of industrial and research applications. New transmission scanning electron microscopy (t-SEM)

methods have the potential for high-resolution imaging similar to transmission electron microscopy (TEM) with a less expensive, more widely available SEM system. In Phase I, RadiaBeam Technologies demonstrated the feasibility of a novel t-SEM detection scheme based on digital micromirror device technology. In Phase II, a prototype detector will be developed and integrated into a standard SEM system. Its synchronization with the scanning beam, as well as its ability to perform transmission electron diffraction imaging, dark-field imaging, and angular selection will be demonstrated and characterized.

Commercial Applications: The demand for effective nanoscale material characterization is steadily growing, in large part due to the increasing need for accurate failure analysis across a wide range of industries. As a result of this demand, the global market for electron microscopes is expected to surpass \$1.6 billion in annual global revenue by the year 2017, with SEM comprising the largest portion of this market. SEMs are about four times more common in the private sector than in public research institutions and universities. Therefore a likely potential customer for our detector would be a manufacturing company looking to upgrade the detector system on its SEM in order to achieve better material characterization in industries ranging from semiconductors to cosmetics. After our prototype is complete, we plan to partner with a large SEM manufacturer in order to quickly and efficiently bring the detector to market.

Topic: Manufacturing

Subtopic: Advanced Tactile Sensing Technology for Robotic Hands

Title: Advanced Tactile Sensing for Dexterous Robot Hands in Industrial Automation and Assembly

OU: Electronics Laboratory

Firm: SynTouch LLC
2222 South Figueora St.
Los Angeles, CA 90007

Principal Investigator: Jeremy Fishel
Phone: 213-493-4400
Email: jermey.fishel@SynTouchLLC.com

Award Amount: \$299,760.00

Abstract: Robotic actuators exceed human speed, accuracy, and strength, but human hands are regarded as the ultimate in dexterity. We propose this is due absent human-like tactile sensing and intelligent reflexive behaviors in robots. We've created multimodal compliant tactile sensors that mimic the sensory ability of the human fingertip and algorithms that fill this absence. In this research we will integrate these with the Schunk Dexterous Hand (SDH). Working with NIST and our partners we will develop measures of robotic grasper dexterity and use them to evaluate

our new tactile sensory technology with the older tactile sensors of the SDH. This will lead to a new level of dexterity, enabling advanced applications in industrial automation and assembly.

Commercial Applications: Since early beginnings within the automotive industry, the market for robots has continued on a rapid growth trajectory. As the concept of mass production slowly gives way to a mass customization model and robots are employed for a wider variety of functions, robots need to adapt to environments in which tasks are continually changing. And, they need to be able to incorporate these changes with minimal tooling requirements in order to maintain desired efficiencies. We have proposed a technology to meet these needs. The use of tactile sensing in robotic applications is not only anticipated to improve robotic dexterity, but this necessary feedback mechanism permits for the reduction in precision requirement of robotic arms and thusly presents a substantial cost savings to the end user.