NATIONAL SCIENCE FOUNDATION

MATCHMAKER PROGRAM

TECHNOLOGY PROSPECTUS

FISCAL YEAR 2008

SMALL BUSINESS INNOVATION RESEARCH (SBIR) &

SMALL BUSINESS TECHNOLOGY TRANSFER RESEARCH (STTR) PROGRAM

www.nsf.gov/eng/iip/sbir

I am pleased to offer all potential investors our portfolio companies for your consideration. These small businesses are conducting leading edge research in advanced technology areas including biotechnology, electronics, information technology, advanced materials, manufacturing, and chemical processes. Abstracts of research along with contact information are grouped by technology areas. I sincerely believe you will find in this portfolio, high quality researchers pursuing excellent business opportunities.

We at NSF are offering you a service to match your interest with those small businesses that have expressed interest in seeking investors and strategic partners. This is referred to as MatchMaker. Enrollment requires a simple email. Details regarding enrollment appear in the introduction page. Meanwhile, you are welcome to contact them directly if you wish.

I hope you will take advantage of this opportunity to get to know small businesses supported by NSF with exciting technologies with potential for commercial use.

Dr. Kesh S. Narayanan
Director Industrial Innovation & Partnerships
National Science Foundation

MATCHMAKER PROGRAM PROSPECTUS BOOKLET

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Introduction

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer Research (STTR) Program stimulates technology innovation in the private sector by transforming the federally supported research into commercial application leading to wealth creation and societal benefit. NSF is one of ten federal agencies supporting the SBIR/STTR Program. NSF manages over 400 research grants annually to small business firms with an annual R&D investment of over $100 million each year. These grants are competitively selected for their high-risk technological challenges and high potential for commercial applications. In all, less than 20% of all applicants are selected for research towards commercialization.

The research areas of the SBIR/STTR Program cover a broad range of topics in

- Biotechnology,
- Electronics,
- Information-Based Technology,
- Advanced Materials, Manufacturing and Chemical Processes.

To achieve a robust ROI on federal investment, NSF has launched a new initiative called the MatchMaker Program. The primary intent is to create a win-win opportunity for investors/strategic partners and NSF funded small business firms. It is intended to help potential investors and strategic partners identify these companies whom they wish to invest in or partner with based on the technology being pursued. Typically, NSF has managed research conducted by each small business firm for at least 3 years. Therefore, NSF is in a strong position to identify the small business firms that best match the interest of investors and strategic partners.

The FY 2008 MatchMaker Program Technology Prospectus catalogues over 100 technologies NSF has invested in through the SBIR/STTR Program in fiscal year 2008. In addition, the name of the company and principal investigator performing the research is included for ease of contact.

The NSF SBIR Program is presenting a unique investment opportunity by introducing you to pre-selected, high technology emerging businesses in our portfolio that have each secured nearly $1 million dollars to develop and advance their early-stage, cutting edge research.

We welcome active participation from Venture Capital Firms, Angel Investors and Strategic Industrial Partners and encourage you to sign up in the MatchMaker Program to take advantage of this unique investment and partnering opportunity.

MatchMaker Enrollment

To participate, please send us an email at SBIRmatch@nsf.gov with the following information about your organization:

- Organization Name
- Organization Contact Person
- Phone Number, Email and Mailing Address
- Web-Site Address
- Technology Preference
- Regional Preference
- Range of Typical Investment
- Stage of Typical Investment

For additional information, please contact

T. James Rudd, Program Director (Expert), Industrial Innovation and Partnerships at 703-292-4759 or via email tjrudd@nsf.gov

Kesh Narayanan, Director, Industrial Innovation and Partnerships at 703-292-7076 or via email knarayan@nsf.gov.

Biochips/Biosensors

Title: SBIR Phase II: Multi-Marker Prognostic Test for Breast Cancer Outcome

Award Number: 0750452
Program Manager: Gregory T. Baxter

Start Date: June 1, 2008
Expires: May 31, 2010
Total Amount: $481,960

Investigator: Steven Linke, slinke@predict.net
Company: Prediction Sciences, LLC
9404 Genesee Ave Suite 210
La Jolla, CA 92037
Phone: (858) 404-0404

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to continue the validation of a set of markers for predicting recurrence and guiding the selection of treatment in stage I-III breast cancer patients. Upon removal of their primary stage I-III operable tumors, breast cancer patients must decide whether or not to receive adjuvant therapy such as chemotherapy, or hormone therapy. Currently, the physician and patient can arrive at the decision by relying on several published guidelines whose accuracy is limited by the fact that they are based on general clinicopathologic data such as tumor size and grade. Thus the majority of patients are recommended to receive adjuvant therapy, although only a small fraction of them benefit from it. Availability of a set of reliable markers that can predict recurrence of tumors would allow tailoring of adjuvant therapy for each patient and is thus likely to reduce the chances of under-treatment and over-treatment. As such, it would be of great benefit to cancer patients, as well as to oncologists.

Title: SBIR Phase II: Vertical Perifusion System for Cell Culture and Monitoring

Award Number: 0750508
Program Manager: Gregory T. Baxter

Start Date: April 15, 2008
Expires: March 31, 2010
Total Amount: $495,224

Investigator: Michael Varney, mvarney@tautheta.com
Company: TauTheta Instruments LLC
2100 Central Avenue, Suite 107
Boulder, CO 80301
Phone: (720) 226-0614

Abstract:

This Small Business Innovation Research (SBIR) Phase II research develops tools to monitor live cells in a model system capable of maintaining the cells over extended periods in near normal conditions. The perfusion chamber allows one to interrogate the metabolic response of cells in real-time in a non-invasive manner. Potentially, this technology could open a number of tissues to examination in further detail for research and as an alternative to live animal testing. The broader impacts of this project include significant advances in the science of cell physiology and behavior, mechanistic pathways of diseases, and improved understanding of cellular signaling, growth and death. Rational design of more effective drugs depends on ever improving fundamental knowledge of cellular mechanisms. Commercially this innovation will lower the cost of drug development, testing and clinical trials, thereby providing broad benefit to the US healthcare industry.

Title: SBIR Phase II: Early Growth Metabolic Responses of Mycobacteria

Award Number: 0750054
Program Manager: Gregory T. Baxter

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $429,080

Investigator: Ronald Rieder, Ronald, rieder@biosensetech.com
Company: BioSense Technologies Inc.
4 Arrow Drive
Woburn, MA 01801
Phone: (781) 933-3635

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project develops a new rapid, nonmolecular method for quickly testing the drug susceptibility of Mycobacteria tuberculosis, the bacterium causing the epidemic disease tuberculosis (TB). Currently, all measurements for determining drug susceptibility - essential for prescribing effective treatment - rely exclusively on detecting changes in the slow growing bacterial population after exposure to drugs known to kill the bacterium. Phase I demonstrated this technology's approach to drug susceptibility testing provides commensurate information without time consuming measurements of growth. Susceptibility results were obtained in only a few hours compared to currently used methods requiring several weeks to obtain the same information. In addition, resistant strains were easily distinguished from sensitive strains inferring the ability to identify drug resistant TB infections in only a few hours time. With this information in hand quickly, physicians will be able to prescribe antimicrobial therapies with confidence because the treatments will be targeted and not empirical. The broader impacts of this research are the reduced spread of drug-resistant infections, increasing of the effective lifespan of drugs now known to cure disease, and lower healthcare costs associated with more successful patient outcomes. Rapid testing will enable better control over the spread of tuberculosis and the management of effective domestic and global policies. This will leave the United States and all other countries better prepared to mount an adequate defense in the event of an epidemic or intentional widespread exposure.

Bioinformatics

Title: SBIR Phase II: Permanent Attachment of Antimicrobial Peptides to Central Venous Catheters.

Award Number: 0822959
Program Manager: Cynthia A. Znati

Start Date: August 15, 2008
Expires: July 31, 2008
Total Amount: $499,923

Investigator: Christopher Loose, crloose@gmail.com
Company: Semprus Bioscience Corporation
107 Gore St #4
Cambridge, MA 02141
Phone: (857) 363-0218

Abstract:

This Small Business Innovation Research (SBIR) Phase II project continues SteriCoat's development of a permanent antimicrobial coating for use on central venous catheters. Current leaching antimicrobial technology does not possess the duration of efficacy required to protect these devices over the lifetime of implantation, especially for peripherally inserted central lines (PICCs). Research during this Phase II project will focus on the integration of proprietary polymer technology with tethered antimicrobial peptide (AmP) technology developed in Phase I to maximize the efficacy and bioavailability of the immobilized AmPs in vivo. Work will also be performed to ensure the manufacturability of SteriCoat's coating technology, including prototype production. After transitioning this formulation to the intra- and extraluminal surfaces of a polyurethane tube, efficacy and biocompatibility will be demonstrated both in vitro and in vivo. By the end of this Phase II project, SteriCoat will have an antimicrobial CVC model with efficacy proven in vivo using the models designed by industry thought leaders and will be ready for scale-up and manufacturing. This SBIR Phase II project addresses the hospital infections afflicting 1.7 million patients and killing 99,000 in the US annually, the majority of which are associated with medical devices. Existing slow-release antimicrobial coatings are insufficient in addressing device infection. They have a limited lifespan and concerns over drug resistance and toxicity because the drug gets distributed in the bloodstream. SteriCoat is developing a permanent coating using antimicrobial peptides (AmPs) to prevent bacterial colonization of central venous catheters (CVCs), a $350M market. The goal of this project is to deliver a polyurethane-based antimicrobial CVC model which incorporates a surface functionalization with AmPs and to test the ability of this approach in resisting bacterial colonization. By the end of this phase II project, SteriCoat will have verified in vivo efficacy of prototype catheters and be positioned to begin GLP studies for FDA product approval. In addition, achievement of the technical objectives of this Phase II will open up avenues for additional investigation in the field of bioactive ligand presentation as the developed technology could lend to the efficacy of many biomaterial applications in addition to antimicrobials.

Title: STTR Phase II: Improving Privacy and Security in Biometrics

Award Number: 0750485
Program Manager: Ian M. Bennett

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $479,685

Investigator: Walter Scheirer, Scheirer@securics.com
Company: Securics Incorporated
1867 Austin Bluffs Parkway
Colorado Springs, CO 80918
Phone: (719) 387-8660

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project aims to make fundamental advances in Biotopes -- cryptographically secured privacy-enhanced fingerprint and face-based technologies. The project will develop prototypes to support beta testing in commercial applications and pursue large-scale government testing. The development effort introduces the concept and will develop/demonstrate bi-directional biometric verification, whereby both the sensor and DB receive match confirmation. This is critical for remote/web-based biometric usage and improves security and privacy with match-on-card solutions. It will develop a new Biotope which uses, but never stores, multi-spectral data not obtainable from existing databases or from latent prints, providing a sustainable non-spoofable secured identity tokens that match in encoded form and change on every transaction. It will explore improving accuracy with 'negative' minutiae and PCA-based feature enhancements. To improve reuse of existing minutia-based algorithms and hardware, the effort seeks to develop a minutiae-to-minutiae mapping approach with the same security/privacy protection of existing Biotopes. For face-based biometrics, the project develops new multi-view approaches for face-based verification from non-cooperative subjects in complex unstructured environments. Additionally, the project addresses privacy protection, with a non-searchable technology that still supports a privacy-protecting image-storage for fraud prosecution, and will extend other research work in the area of continuous verification by improving the online verification for distance education and other applications. The broader impact starts with its unique focus on simultaneously improving privacy and security rather than trading one for the other. At a time when citizens feel their privacy is traded for the mere promise of security, this effort is an investment in privacy. The project will transition fundamental research into testing with commercial partners. It directly addresses reasons that other researchers have said cause the perpetual gap between predicted and realized commercial growth in biometrics. It will enhance biometrics, providing 'revocability' and transactional uniqueness to support biometric-based commerce without fear of phishing, hacking or insider access. The project will impact the distance education market for example, by focusing on improving effectiveness of state training for those in need while protecting their privacy and dignity. The projected outcomes also open the potential for passports/IDcard that allow individuals to prove their identity without allowing others to use that data to search for them. It will support smart-card based solutions that allow for biometric-verified yet 'anonymous' transactions. It addresses the often overlooked biometric dilemma, that wide-spread deployments of biometrics today may ultimately increase identify theft and also limit biometrics security value tomorrow.

Title: SBIR Phase II: Shape Memory Polymer Based Orthopedic Fixation Devices

Award Number: 0750247
Program Manager: Cheryl F. Albus

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $499,826

Investigator: Jack Griffis, jack.griffis@medshapesolutions.com
Company: MedShape Solutions, Inc.
1575 Northside Drive
Atlanta, GA 30318
Phone: (404) 583-6889

Abstract:

The Small Business Innovation Research (SBIR) Phase II project includes the design, development and commercialization of shape memory polymer orthopedic soft-tissue fixation devices. Current soft tissue fixation devices are primarily metal or plastic screws used to attach tissue grafts to bone in repair of torn anterior cruciate ligaments (ACL). These threaded devices commonly damage the tendon during insertion; reducing the effectiveness of the surgery. Shape memory polymers are a superior solution in that they can provide a simpler, stronger, and less damaging fixation method for these tendon grafts. Essentially, a shape memory polymer device can be; (1) delivered into the body in a compacted and less invasive state, (2) self-deploy at body temperature and (3) do so without sharp edges that might damage the tissue. The proposed work has immediate commercial potential and direct societal benefit in the field of sports medicine with a significant market on the order of $210 million in ACL repair devices annually. Furthermore, the biomaterial developed for ACL reconstruction should have long-term impact on the 1.6MM orthopedic procedures performed each year to repair tendons and ligaments in knees, shoulders, and ankles and by reducing the invasiveness of surgery and improving the outcomes.

Biomaterials

Title: SBIR Phase II: Microwaveable Bioplastic Packaging

Award Number: 0822999
Program Manager: Gregory T. Baxter

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Laura Hollingsworth, lauraohollingsworth@hotmail.com
Company: PolyNew Incorporated
1021 18th Street
Golden, CO 80402
Phone: (303) 277-9033

Abstract:

This Small Business Innovation Research (SBIR) Phase II research develops innovative nanotechnology to allow the use of bioplastics for food packaging. Polylactic acid (PLA) is an environmentally beneficial bioplastic made from renewable resources; however, the properties of PLA are limited. This makes it unsuited for use in microwaveable food packaging. In Phase I, university expertise resulting from earlier NSF funding was used to formulate a bioplastic with suitable properties, including cost. In Phase II, a viable manufacturing route towards food packing trays will be demonstrated at the pilot plant level working in close collaboration with a large industrial manufacturing partner. The broader impacts of this Phase II SBIR research will be manifold. The new bioplastics are quantitatively more environmentally benign that petroplastics. Bioplastics are made form renewable resources and therefore simultaneously help decrease dependence on foreign oil while providing environmental benefits. Using a domestic biomass resource provides a competitive advantage against low labor cost manufacturers like China helping to stem job losses in the plastics industries. Presently, polystyrene is largely used for tray applications and foamed with 3-5 weight percent hydrocarbons. PLA can be foamed with carbon dioxide so the new technology has the additional benefit of displacing at least 1 million pounds per year of the pollutant volatile organic carbons (VOCs).

Title: SBIR Phase II: Shape memory polymer AAA Endograft

Award Number: 0823015
Program Manager: Cynthia A. Znati

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $450,989

Investigator: Craig Lanning, clanning@endoshape.com
Company: EndoShape Inc
1408 Kingwood Pl
Boulder, CO 80304
Phone: (303) 652-7338

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to continue the development of novel endografts for percutaneous treatment of abdominal aortic aneurysms (AAA) using unique and proprietary shape memory polymer (SMP) technology. Abdominal aortic aneurysms are both common and lethal in the older population, affecting between 7 and 13 % of older persons (> 60 years), accounting for between 13,000 and 18,000 deaths per year in the US alone, and increasing in diagnostic prevalence as both diagnostic techniques improve and the population ages. Endovascular treatment using covered stainless steel or Nitinol stent-grafts is now the preferred option for AAA treatment. However, current devices are far from perfect, and complications from endovascular repair such as endoleaks, continued growth of the aneurysm, device migration, arterial dissections, and other problems persist at very high (> 25-35%) rates. Most if not all these problems can be traced to the inherent limitations of the materials used in current devices. We propose to continue the highly promising Phase I work with particular focus on four areas: finalize polymer formulation; develop methods to manufacture patient-specific endograft designs; finalize biocompatibility evaluation; and evaluate endografts in acute and chronic animal studies. Anticipated deliverables at the end of the Phase II project are a finalized polymer formulation particularly suitable for endografts, complete ISO 109993 biocompatibility evaluation, methods to manufacture patient-specific endografts, and comprehensive data on the acute and chronic vascular response of the shape memory polymer endografts. The broader impacts of this work lie in the development of the next generation of medical devices using advanced materials with characteristics that can be customized to the patient. The successful development of useful devices from such technologies should pave the way for a plethora of commercial opportunities including tissue-engineering applications whereby the "seeds' of new tissues or organs can be incorporated into shape memory polymer devices and delivered using minimally invasive methods into the target site to eventually grow healthy tissue. The ability to fuse shape memory polymer technology with advanced three-dimensional imaging and automated manufacturing methods, such as rapid prototyping and stereo-lithography, promises to open up the exciting prospect of creating patient-specific devices within the operating suite; devices that once manufactured can be compacted in situ into a catheter and delivered immediately into the patient. Lastly, successful completion of the overall project should have immediate impact on a disease that is the 13th leading cause of death in the US, and consequently on human health.

Title: SBIR Phase II: Fire-Retardant Phase Change Materials from Fats and Oils

Award Number: 0750470
Program Manager: Gregory T. Baxter

Start Date: April 15, 2008
Expires: March 31, 2010
Total Amount: $500,000

Investigator: Mark Sutterlin, rusty@renewablealternatives.com
Company: Renewable Alternatives, LLC
4009 Day Flower Ct.
Columbia, MO 65203
Phone: (573) 884-0562

Abstract:

This Small Business Innovation Research (SBIR) Phase II research focuses on a new type of phase change material(PCM)that can meet performance goals of being fire-retardant, non-toxic, and renewable. This project will advance the state of understanding of fat/oil chemistries. It will also advance our understanding of non-ideal mixture behavior. Applications that will benefit include such things as clothing, building construction and HVAC systems. Fat and oil based PCMs currently produced by the company both out-perform paraffin-based PCMs and cost less. While customers have overwhelmingly accepted these renewable PCMs, they overwhelmingly expressed their desire that fire-retardant phase change materials be developed. The broader impacts of this research includes the incorporation of PCMs into applications that would have impacts for both general public and the military/emergency response personnel. Phase change materials find a range of applications, including clothing, construction materials, and food containers. The introduction of lower-cost fire-retardant phase change materials will have broader impacts through improved utilization in consumer products. Applications not previously pursued will be open to use of these materials because of reduced risk of fire. When used in buildings, the phase change materials can reduce energy costs year-round. An improved understanding of the associated fat and oil chemistry will likely find other applications in the fat and oil industries.

Biomedical Devices and Instrumentation

Title: STTR Phase II: Magnetohydrodynamic-based Circular Liquid Chromatography

Award Number: 0822723
Program Manager: Gregory T. Baxter

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $499,923

Investigator: Christine Evans, ceevans@sfc-fluidics.com
Company: SFC Fluidics, LLC
535 W Research Blvd, Suite 135,
Fayetteville, AR 72701
Phone: (479) 571-2592

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project develops a circular chemical separation system on a small (~1 inch x 1 inch) chip. This chip and the associated instrument will separate complex mixtures for biological, chemical, medical, and industrial applications. Based on magnetohydrodynamic (MHD)-driven liquid flow, liquid chromatographic (LC) separations will be accomplished in a circular, closed-loop format. Typically, LC separations require a sample containing multiple analytes to flow in a single direction along a fixed-length, linear column with detection performed after the analytes elute from the column. In the circular LC system, miniaturization is possible because samples are instead circulated around a closed-loop chromatographic column thus, the effective column length is not limited to small chip dimensions. Very few methods can provide the mobile-phase pumping in a closed-loop that is required for practical application of circular LC. The MHD-based circular LC system envisioned will be small, portable, and designed for laboratory as well as field use. The sealed LC chip will contain the stationary phase, mobile phase, and all in situ MHD pumps needed to conduct the separation of complex samples. This prototype LC instrument will be designed and fabricated with a built-in fluorescence detector for monitoring analyte separation directly on the chromatographic column. The broader impacts of this research are highlighted by the ability of the proposed circular separation system to miniaturize a valuable analytical tool, liquid chromatography (LC). Samples of interest include human blood serum, saliva, and urine, with component analytes of interest that are equally diverse (e.g. proteins, pharmaceuticals, and small molecular biomarkers). Many analytes in these complex mixtures have similar properties and cannot be separated and analyzed using a very short chromatographic column, which has limited the miniaturization of this important analytical tool. This limitation is overcome using circular LC, where the effective column length is not limited by the small chip sizes that are essential for portable LC instrumentation. SFC Fluidics' core technology makes possible the miniaturized, closed-loop pumping required for implementation. This method has broad implications for the portable LC systems for field deployment or point-of-care applications. The market opportunity is expected to be significant, particularly when considering that applicability extends beyond the traditional instrumentation market into the worldwide point-of-care diagnostics market.

Title: SBIR Phase II: Optical Spectroscopy for Colon Cancer Screening without Colonoscopy

Award Number: 0823064
Program Manager: Cynthia A. Znati

Start Date: July 15, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Andrew Cittadine, andrew.cittadine@americanbiooptics.com
Company: American BioOptics, LLC
1801 Maple Ave
Evanston, IL 60201
Phone: (847) 467-0628

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a commercial grade optical probe and system for FDA clinical trials and subsequent commercialization of a population-wide colon cancer screening test. An interdisciplinary research team of engineers, biologists, and clinicians has developed low-coherence enhanced backscattering (LEBS), an optical technique which enables sensing tissue microarchitectural correlates of the genetic/epigenetic changes in otherwise histopathologically normal mucosa. The preliminary animal and human studies demonstrated the potential of LEBS to detect subtle alterations in histologically normal-appearing tissue that occur with the presence of precancer in a different part of an organ, a consequence of the well-established concept of field carcinogenesis. This opens a possibility to detect colonic adenomas by means of LEBS analysis of rectal tissue, which is readily accessible using a rectal probe and without the need for colonoscopy or bowel preparation. Indeed, ex vivo human studies and a small-scale trial of the in vivo LEBS probe from Phase I research demonstrate that rectal LEBS is remarkably accurate for predicting neoplasia anywhere in the colon. In continued close collaboration with the research team, American BioOptics endeavors in Phase II to refine the prototype LEBS probe into a medical-grade probe for use in a patient without bowel preparation and to develop a low-cost LEBS optical system for multi-center FDA trials and subsequent commercialization. LEBS has the potential to become the first truly population-wide test for colon cancer screening performed during an annual exam by a primary care physician, without colonoscopy or bowel preparation to determine the need for colonoscopy. The proposed test would be simple, inexpensive, minimally intrusive and highly accurate without the need for bowel cleansing. Colon cancer is the second leading cause of cancer deaths in the U.S. largely because of especially poor screening participation relative to other major cancers. Only a small fraction of eligible population (90 million Americans over age 50) undergoes screening colonoscopy due to a variety of reasons including expense, patient reluctance, complications, and insufficient number of endoscopists. Development of a minimally invasive test to identify patients who do and do not harbor colonic adenomas is of crucial importance to enable, for the first time, population-wide screening for this disease. Currently, no such initial screening test is available. Based on the results of the LEBS test, the physician could recommend either no colonoscopy (the majority of cases) or need for colonoscopy (which the patient will be more compliant with). Thus, with a readily available LEBS screening test developed in Phase II and subsequent FDA approval, more patients with colonic neoplasia will undergo colonoscopy. The LEBS test would not only prevent many more colon cancer deaths by screening a larger part of the population, but it would also reduce costs/complications of screening in the majority of the population who are not destined to develop neoplasia.

Title: SBIR Phase II: Automated Analysis of Body Fluid Chemistry Using MHD-Based Microfluidics

Award Number: 0750328
Program Manager: Gregory T. Baxter

Start Date: February 15, 2008
Expires: January 31, 2010
Total Amount: $500,000

Investigator: Christine Evans, ceevans@sfc-fluidics.com
Company: SFC Fluidics, LLC
535 W Research Blvd, Suite 135,
Fayetteville, AR 72701
Phone: (479) 571-2592

Abstract:

This Small Business Innovation Research (SBIR) Phase II Proposal develops a suite of labs-on-a-chip that can be used to establish the metabolic health of an individual in real-time from a finger-prick sample of blood. Each disposable chip will contain all reagents necessary to run the assay and all waste will be stored on the chip. These sealed, self-contained assay chips will be based on magnetohydrodynamic microfluidics and microelectrochemical detection and will allow for the simultaneous quantization of multiple biomarkers. The biomarkers chosen for this project have been linked to an individual?s metabolic health in a broad range of high importance areas, including aging, cardiovascular health, neurochemical health, and prepregnancy health. The ability to quantify the biomarkers simultaneously will allow for assessment of an individual?s metabolic status and determination of an intervention strategy within the time scale of a single visit to the doctor. Any necessary follow-up visit will provide immediate feedback on success or failure of the intervention strategy. This point-of-care testing platform will allow both doctor and patient to take a more proactive stance in the management of an individual?s metabolic status. The broader impacts of this research meet a need for improved preconception care. This technology can be expanded to include additional biomarkers that will allow for convenient, inexpensive screening of a number of health issues, including pernicious anemia, renal disease, neurochemical health and cardiovascular health that could broaden its impact on improving the Nation's healtcare.

Title: SBIR Phase II: High-Throughput In-Situ Crystallography Screening System

Award Number: 0750353
Program Manager: Gregory T. Baxter

Start Date: February 15, 2008
Expires: January 31, 2010
Total Amount: $499,393

Investigator: Steve Wang, youngkreisler@gmail.com
Company: Xradia
4075A Sprig Drive
Concord, CA 94520
Phone: (925) 288-1818

Abstract:

The Small Business Innovation Research (SBIR) Phase II project aims to develop a high throughput crystallography screening system aimed at accelerating and automating crystal growth for structural studies. X-ray crystallography is the primary method for determining the molecular structure of biological macromolecules, including proteins and nucleic acids. Yet, although crystals are an ideal material for analyzing the structure of solids, growing crystals of sufficient quality for diffraction studies has heretofore been a tedious and labor-intensive undertaking. Thus, the development of a platform that allows automation, miniaturization and parallelization for obtaining crystals of optimal quality would be a significant step forward in crystallography and would accelerate structural studies. An improvement in this area would therefore be of interest not only to academic scientists engaged in structural studies, but also to pharmaceutical researchers who are interested in the structural relationship of drugs and their targets.

Bioprocessing and Industrial Bioproducts

Title: SBIR Phase II: Room Temperature Medical Waste Treatment

Award Number: 0750056
Program Manager: Gregory T. Baxter

Start Date: February 15, 2008
Expires: January 31, 2010
Total Amount: $505,999

Investigator: Czeslaw Golkowski, cg18@cornell.edu
Company: Super Pulse
227 Durfee Hill Rd
Ithaca, NY 14850
Phone: (607) 255-6474

Abstract:

This Small Business Innovation Research (SBIR) Phase II research develops a novel, reliable, affordable, technology for effective decontamination/sterilization of medical waste. The technology is based on an air/gas sterilant produced in a non-thermal plasma source powered by a standard microwave oven magnetron. The simplicity and the affordability of the technique to produce an effective gas sterilant capable of sterilizing a wide range of materials and surfaces at low-temperature and with low energy requirements provides technology suitable for a low cost decontamination/sterilization device for medical and dental offices/clinics. This technology is free of chemical residue, low maintenance, and simple in operation. The broader impact of this research is to improve the safety of doctors' offices and hosptials through on-site sterilization of biohazardous and infectious wastes. The technology provides a significant power saving and decreases the number of medical waste incinerators that contribute harmful emissions to the environment.

Environmental Biotechnology

Title: SBIR Phase II: Photochemical Treatment of Dioxin-Furan Compound Emissions from Industrial Processes

Award Number: 0822985
Program Manager: Gregory T. Baxter

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $490,912

Investigator: John Richards, john.richards@aircontroltechniques.com
Company: Air Control Techniques, P.C.
301 East Durham Road
Cary, NC 27513
Phone: (919) 460-7811

Abstract:

This Small Business Innovation Research (SBIR) Phase II research will advance the use of photochemistry for the control of toxic air pollutants emitted from industrial sources such as furnaces, boilers, and kilns. The types of ultraviolet lamp sources now used successfully for wastewater treatment, water purification, and air stream disinfection will be adapted for use in the more challenging environment of industrial process effluent gas streams. This research program concerns a photochemical system designed to destroy highly toxic compounds called dioxin-furans, which are unintended byproducts of some industrial processes. During an extended test program at an industrial facility, the researchers will evaluate: (1) long-term ultraviolet lamp energy efficiency in hot, dust-laden gas streams, (2) dioxin-furan destruction efficiencies during routine variations in source conditions, (3) reaction product characteristics, and (4) reductions in pollutants in addition to the targeted dioxin-furans. The broader impacts of this research will include an improved understanding of the chemical reactions of dioxin-furan compounds at the gas temperatures and pollutant concentrations typical of industrial gas streams. The results will help assess the applicability of photochemical systems to provide high efficiency air pollution control while reducing emissions of greenhouse gases produced by existing control techniques. Photochemical systems that destroy toxic air pollutants will provide an attractive alternative to systems that retain the toxic compounds on adsorbents disposed in landfills. The development of ultraviolet light technology will result in reduced air emissions of persistent toxic pollutants that bio-accumulates in the food chain and cause adverse human health effects.

Title: SBIR Phase II: A Portable Dissolved Oxygen Delivery System for Rapid Treatment of Organic Spills

Award Number: 0750402
Program Manager: Gregory T. Baxter

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $494,416

Investigator: Clay Thompson, clay.thompson@blueingreen.biz
Company: Blueingreen
535 W. Research Ctr. Blvd.
Fayetteville, AR 72701
Phone: (479) 571-2592

Abstract:

This Small Business Innovation Research (SBIR) Phase II project completes the design, construction, and testing of the largest readily portable Supersaturated Dissolved Oxygen (SDOXTM) injection system developed in smaller scale in Phase I. During the first year of the project, the SDOX will be used to study the effect of dissolved oxygen addition on water quality and fish health in the tailrace of a hydroelectric dam. In the second year of this project, the SDOX will be used in the prevention of spills and remediation of waterbodies impacted by organics and phosphorous. The effects of the SDOX on removing DO as the limiting component in aquatic ecosystems will be studied during all four seasons of the year. The broader impacts of this research are the ability use of a portable SDOX 400 on aquatic ecosystem restoration that has previously been impractical or impossible. This technology benefits an improved environment for aquatic species, minimized environmental impact from hydroelectric dams, and more economic and efficient wastewater treatment. The technology could positively impact drinking water, recreation, irrigation and other aqueous ecological services important to the public and the environment.

Genomics

Title: SBIR Phase II: Automated culture and differentiation of human Embryonic Stem Cells

Award Number: 0823027
Program Manager: Gregory T. Baxter

Start Date: October 1, 2008
Expires: September 30, 2010
Total Amount: $500,000

Investigator: Veit Bergendahl, vbergendahl@stemcell-products.com
Company: Stem Cell Products Inc.
525 Science Dr.
Madison, WI 53711
Phone: (608) 310-5105

Abstract:

This Small Business Innovation Research (SBIR) Phase II research is focused on methods to utilize blood precursor cells derived from human embryonic stem (HES) cells. The project uses a new defined differentiation system which allows automation and scale-up production of this important cells. There is a significant demand for these cells from research and drug discovery. Increased availability and batch-to-batch reproducibility of HES cell-derived blood cells, resulting from the defined genetic background of the starting material and this standardized, automated culture system, make this technology invaluable model systems for basic research and drug development. Based on the automated pilot system for handling and scale-up production of HES cells developed in phase I of this SBIR project we will transfer our current culturing protocols into robust automated production procedures to provide a reproducible quality of CD34 positive cells The broader impacts of this research will be improving the process of drug discovery and development and in the long term by providing revolutionary new applications for medical treatment to improve public health. Nearly 98% of a multi-million dollar stem cell market is currently consumed by blood and immune system treatments. We anticipate that the proposed research will lead to the faster integration of HES cell biology into biomedical research. It will help to provide a variety of other blood cell types in quantities required for basic research, drug development, high throughput screening, biochemical characterization and potential medical treatment of blood related disease.

Marine Biotechnology

Title: SBIR Phase II: Innovative Control of Ectoparasites: Key to Expansion of Open Ocean Fish Farming

Award Number: 0822862
Program Manager: Gregory T. Baxter

Start Date: August 15, 2008
Expires: July 31, 2010
Total Amount: $499,910

Investigator: Jennica Lowell, jennica@kona-blue.com
Company: Kona Blue Water Farms, LLC
P.I. Box 4239
Kailua Kona, HI 96745
Phone: (808) 331-1188

Abstract:

This Small Business Innovation Research (SBIR) Phase II research targets innovative means for controlling ectoparasite pests in open ocean aquaculture. Offshore fish farming offers tremendous growth opportunities. Adaptive fish health management offshore remains a challenge for environmentally sound expansion of this potentially lucrative industry. PEDICURe (Passive Ectoparasite Device In Counter-current Underwater Reservoir) prototypes showed great efficacy in treating ectoparasite pests in marine fish in tank trials. Phase II research will refine therapeutic treatments, PEDICURe designs and protocols for use. Commercial-scale prototypes will be deployed and tested in offshore cages. PEDICURes could be sold or licensed to fish farms worldwide. PEDICURes could also provide compelling competitive advantages to drive expanded production in Hawaii, U.S. waters, or globally. The broader impacts of this research are in increasing the environmentally sound means for optimizing fish health in open ocean aquaculture, and thereby aiding the growth in this innovative, exciting and potentially lucrative industry. Offshore farms can produce high-value marine fish without significant impacts on water quality, benthic habitats or other ocean user groups. Cost savings to a $1 billion U.S. offshore farming industry could be $115 million p.a. There are potential applications worldwide.

Title: STTR Phase II: Commercialization of an Innovative Green Technology for Controlling Zebra Mussels

Award Number: 0750549
Program Manager: Gregory T. Baxter

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $500,000

Investigator: Pamela Marrone, pmarrone@marroneorganics.com
Company: Marrone Organic Innovations, Inc.
2121 Second Street
Davis, CA 95618
Phone: (530) 750-2800

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II research project is focusing on the development and commercialization of a new, environmentally safe biopesticide for the control of zebra and quagga mussels. These freshwater, invasive bivalves foul water pipes and cause severe economic and ecological harm throughout North America and Europe. Marrone Organic Innovations, a leader in biopesticide commercialization, is partnering with biological control experts at the New York State Museum who have discovered a bacterium, Pseudomonas fluorescens, that produces a natural compound that is selectively lethal to these pest mussels. The microbial biopesticide developed in this project will be an environmentally safe alternative to the polluting, non-selective chemicals that infested facilities, due a lack of alternatives, are currently forced to rely on to control mussel infestations. The broader impacts of this research include both economic and ecological benefits to society. Mussel infestations cause hundreds of millions of dollars in additional expenses every year, and the chemical methods currently used to control them are known to be harmful to other aquatic organisms. The proposed research will advance a project of national significance and reach across numerous scientific disciplines, including biochemistry, microbiology, and invertebrate zoology, serving as a model in the effort to reduce the use of polluting pesticides. Training and learning will be fostered by involving postdoctoral, graduate, and undergraduate students. Because of its extraordinary safety, this bacterial biopesticide will serve as an example of a green technology that will benefit the environment as well as industrial and recreational users of freshwater.

Pharmaceutical Drug Delivery

Title: SBIR Phase II: Multivariate Analysis of Heterologous Protein Expression

Award Number: 0750206
Program Manager: Gregory T. Baxter

Start Date: March 15, 2008
Expires: February 28, 2010
Total Amount: $500,000

Investigator: Mark Welch, mwelch39@comcast.net
Company: DNA Twopointo Inc
1430 O'Brien Drive
Menlo Park, CA 94025
Phone: (650) 853-8347

Abstract:

This Small Business Innovation Research (SBIR) Phase II research develops methods to improve the manufacture of recombinant protein products produced in foreign hosts. Cost-effective production of proteins generally utilizes organisms that are well-suited for protein engineering and large-scale production. Establishing a suitable production system for a protein is often a time-consuming, trial-and-error-based process and can be a significant barrier for the commercialization of a protein. In cases where production systems are found, they are often far from optimized due to the time and cost required as well as our current limited understanding of the critical parameters. In Phase I several gene design variables were assessed for their importance to protein expression in the bacterium Escherichia coli, a commonly used production organism. Data suggested novel means for gene optimization that were unexpected from conventional wisdom. In Phase II relevant gene design variables suggested by Phase I will be explored toward development of a refined model of the relationship of gene design to protein expression in E. coli as well as in other useful production organisms. The broader impacts of this research are improved manufacturing techniques for recombinant protein based products. Protein products constitute a currently >$40 billion and rapidly growing world-wide market including industrial enzymes, diagnostic enzymes and protein pharmaceuticals. The tools developed from this project will drastically improve the speed, reduce the cost, and remove the uncertainties of modern protein manufacturing, which significantly limit this market. Improved production will also accelerate the study of proteins with therapeutic or otherwise marketable potential, expanding the field of candidate proteins for commercialization.

Title: SBIR Phase II: Lantibiotic Synthesis Using Differentially Protected Orthogonal Lanthionines

Award Number: 0749884
Program Manager: Gregory T. Baxter

Start Date: February 15, 2008
Expires: January 31, 2010
Total Amount: $500,000

Investigator: Jeffrey Hillman, jhillman@oragenics.com
Company: Oragenics Corporation
13700 Progress Blvd.
Alachua, FL 32615
Phone: (386) 418-4018

Abstract:

The Small Business Innovation Research (SBIR) Phase II project aims to develop differentially protected orthogonal lanthionine technology (DPLOT) to synthesize novel antibiotics. Lanthionines are found in nature and have been isolated from a variety of sources. Although amino acids, lanthionines are not components of proteins. They are however, constituents of a group of naturally occurring peptide antibiotics called lantibiotics, which includes nisin (a food preservative), subtilin, epidermin (an anti staphylococcus and streptococcus agent), and ancovenin (an enzyme inhibitor). Due to their mechanism of action, resistance to lantibiotics is uncommon and as such they can be of value for treating antibiotic resistant bacterial infections. The technology under development would allow the synthesis of novel lantibiotics that may be effective against the growing number of antibiotic resistant bacteria and would expand the therapeutic arsenal available for treating such infections. It would therefore have a profound impact on public health and the control of infectious diseases caused by bacteria.

Detectors/Sensors/Instruments

Title: STTR Phase II: Diamond Nanoprobes for Atomic Force Microscopy - Imaging, Metrology, Material Property Measurement, Process Control, and Manipulation with Ultrahigh Performanc

Award Number: 0823002
Program Manager: William Haines

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $484,464

Investigator: John Carlisle, carlisle@thindiamond.com
Company: Advanced Diamond Technologies
429 B Weber Road
Romeoville, IL 60446
Phone: (815) 293-0900

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project will develop commercially viable atomic force microscope (AFM) probes fabricated from ultrananocrystalline diamond. The project will refine the processes developed in Phase I and bring contact and non-contact all-diamond probes to market. Probes using conducting diamond that are chemically and electronically tunable and have superb tribological properties will also be developed. This work will facilitate new industrial applications for AFM, including high-throughput imaging, metrology, and characterization of large quantities of materials, local electrical characterization for process control in micro/nanoelectronics, nanomechanical characterization of MEMS/NEMS devices, and ultraprecise hard mask correction for the micro/nanolithography industry.

Title: STTR Phase II: High Resolution Spectrometer-on-a-Chip Based on Nano-Optic Plasmonic Device

Award Number: 0823023
Program Manager: Juan E. Figueroa

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Byounghee Lee, blee@nanolambda.net
Company: NanoLambda, Inc.
510 William Pitt Way
Pittsburgh, PA 15238
Phone: (412) 828-6266

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project is to develop an ultra-compact, high-resolution and low-cost spectrometer-on-a-chip, based on plasmonic nanowire arrays. In response to the growing demands for miniaturized non-invasive spectroscopic sensor, there have been many efforts to miniaturize optical spectrometers using various conventional technologies. However they are not yet conducive to both dramatic miniaturization and also high spectral performance at low production cost. Unlike the bulky and expensive conventional diffractive optical devices, the proposed nano-optic device utilizes the wavelength-dependent plasmonic phenomena occurring on metal nanowire surfaces and the gaps between the metal nanowires. This single layered nano-optic filter array is expected to enable a high resolution spectrometer-on-a-chip, overcoming the limits of diffractive optics. This proposal is to design, and fabricate the nano-optic filter array structure using standard wafer processes, to integrate it with a custom designed CMOS detector array to form a spectrometer-on-a-chip. The anticipated outcome of this project are spectrometer-on-a-chip samples for customer test and evaluation, and demonstration of high spectral resolution (10nm) over 380nm ~780nm wavelength range in a compact size, less than 5 mm x 5 mm x 2 mm, at significantly lower cost. If successful the proposed ultra-compact high-resolution low-cost spectrometer-on-a-chip can be used in various applications such as high-resolution color sensing, multiple gas detection, and mobile/wearable health monitoring. Consumer electronics manufacturers, portable medical device vendors, and wireless sensor node suppliers can be all potential customers. As a key component to these markets, it is anticipated that the total addressable market for the proposed spectrometer-on-a-chip will be over $1 billion in around 2012. Considering the manufacturability of the proposed technology and the readiness of the markets, it is feasible to launch the first commercial product in 2010. The proposed activities will contribute to enhancing color quality and color consistency across consumer color devices, and has potential to contribute to advancing personalized point-of-care, environmental monitoring, and homeland security by enabling non-invasive, high-throughput, low-cost sensing. The proposed activities will provide further solid understanding of the phenomena occurring when a light interacts with nanostructured metal, and enhance the mass production capabilities of nano-structures. Successful completion of this project will also open up new application opportunities in the convergence areas of information, bio and nanotechnologies.

Title: SBIR Phase II: A High-Throughput Scanning Probe Microscope Using Micromachined Ultracompliant Probe Arrays with Embedded Sensors for Simultaneous Topography and Thermal Imag

Award Number: 0822810
Program Manager: Cheryl F. Albus

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $499,694

Investigator: Angelo Gaitas, angelo@picocal.com
Company: Picocal, Inc.
333 Parkland Plaza
Ann Arbor, MI 48104
Phone: (734) 972-9348

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to produce a commercial prototype of a state-of-the-art high throughput scanning probe microscope (HT-SPM), which can be used for measuring topography and thermal parameters in nanotechnology, bio, and semiconductor applications. The scanning probe microscope has been a very successful tool, but emphasis has not been put on rapid data acquisition. The HT-SPM is an enabling technology that consists of a transformative and patented method for extracting topography which allows for higher throughput. The project leverages experience in atomic force microscope (AFM) probe micro-fabrication and industry. An immediate outcome of this SBIR project will be a fully functional and market ready HT-SPM. The broader impact/commercial potential of measurements in nanometer scale devices and structures have both scientific and industrial importance. Although the Atomic Force Microscope (AFM) is one of the most important tools for nanotechnology, there has not been any fundamental innovation in the way it operates for more than a decade. This project provides faster measurement as a result of a fundamentally different way of imaging. Faster characterization permits manufacturers to expedite problem isolation, leading to higher productivity and higher return-on-investment (ROI). The HT-SPM also benefits R&D, failure analysis and off-line engineering. The HT-SPM offers critical capabilities that will allow users too quickly and clearly measure topography/friction/temperature at the nanoscale and view critical characteristics. The HT-SPM fills a critical need in integrated circuits, nanotechnology, life sciences and other markets that rely on sub-micron microscopy, as it will provide users with a superior and inexpensive measurement system to aid in studying new properties.

Title: SBIR Phase II: Sub-100nm Infrared Spectroscopy Based on Atomic Force Microscopy

Award Number: 0750512
Program Manager: William Haines

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $493,057

Investigator: Kevin Kjoller, kevin@anasysinstruments.com
Company: Anasys Instruments Corp.
3944 State Street, Suite 345
Santa Barbara, CA 93105
Phone: (805) 455-5482

Abstract:

This Small Business Innovation Research (SBIR) Phase II project seeks to develop the prototype of a characterization system which can perform IR spectroscopy and imaging at sub-100nm spatial resolution and thus break the 5 micron resolution barrier that has limited IR spectroscopy for the last 50 years. This 50x breakthrough in spatial resolution is enabled by the proprietary technique of Photo-Thermal Induced Resonance (PTIR) whose feasibility has already been demonstrated in the Phase I work. IR spectroscopy is a critical analytical technique which itself comprises a $1 Billion/yr industry. However, its spatial resolution limitation has seriously limited researchers who need information on nanoscale chemical composition. The potential impact of nanoscale IR ranges from new materials discovery to interfacial property improvements in high value applications.

Title: SBIR Phase II: Picotesla Magnetic Sensor Using MgO-Based Magnetic Tunnel Junction Technology

Award Number: 0750584
Program Manager: Muralidharan S. Nair

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $498,295

Investigator: Benaiah Schrag, schrag@micromagnetics.com
Company: Micro Magnetics Inc
421 Currant Road
Fall River, MA 2720
Phone: (508) 672-4489

Abstract:

This Small Business Innovation Research(SBIR) Phase II research project will develop a compact, easy-to-use two-axis magnetic sensing module with picotesla sensitivity, based on the use of Magnesium Oxide (MgO)-based Magnetic Tunnel Junction (MTJ) sensor devices and associated electronics. The sensor module will have superior field sensitivity with excellent linearity and orthogonality, thanks to a specialized control circuitry which allows the sensors to operate under optimal magnetic conditions. The sensor module will operate under ambient conditions, with no extra infrastructure required, and will therefore be easily integrated into a number of emerging applications. The field sensitivity of the sensor module will be more than a factor of ten larger than any commercially-available thin film sensor, giving it a dominant technical edge for high -performance applications. This sensor module will be realized through the synergy of three key innovations: enhanced device performance derived from magnesium oxide tunnel barrier technology, active sensor compensation via on-board current-carrying striplines, and anisotropy engineering using specialized annealing processes. This research will create a new product family with greatly enhanced capabilities for use in many critical segments of the world sensor market, including remote sensing applications in the defense and homeland security segments, as a key component of non-destructive evaluation systems, and in emerging medical applications. It will expand the utility and availability of a number of powerful new medical technologies. This research will improve the understanding of the emerging spintronic technology of magnetic tunnel junctions, a class of devices which forms the central component of several important commercial products in the high-tech semiconductor and data storage industries.

Title: STTR Phase II: Coherent THz Sources and Amplifiers Using Carbon Nanotubes

Award Number: 0750559
Program Manager: Juan E. Figueroa

Start Date: February 15, 2008
Expires: July 31, 2010
Total Amount: $508,705

Investigator: Christian Drouet d'Aubigny, cdaubign@teravision-inc.com
Company: TeraVision Inc.
5516 E. South Wilshire Dr.
Tucson, AZ 85711
Phone: (520) 465-1909

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II research project will design and develop practical traveling-wave tube (TWT) amplifiers and oscillators at THz frequencies. During Phase II the research team will 1) optimize the design for low noise operation, 2) add a tuned feedback loop to the 0.345 THz TWT so the unit can function as a stand-alone oscillator, 3) based upon the experience gained at 0.345 THz, develop a detailed design for a TWT for higher frequency operation (e.g. 0.65, 0.82, and 1.5 THz where atmospheric absorption by water is at its minimum at THz frequencies), and 4) package a THz TWT for a wide variety of commercial uses. The proposed developments will increase the coherent output power available at frequencies above ~200GHz by orders of magnitude, while dramatically reducing the cost per milliwatt. The work will also provide a path for the realization of the first THz low-noise amplifiers. If successful the results from the proposed research will lead to the availability of signal sources and amplifiers capable of yielding orders of magnitude more coherent power in the THz regime than is currently available. The devices coming out of the effort will lead to THz components and devices that can be used in applications ranging from communications and remote sensing to medical imaging. . Potential end-users include NASA, aerospace companies, telecommunication companies, the security industry, companies engaged in the development of medical imaging systems, and the military.

Title: SBIR Phase II: Vapor Generator for the Calibration of Explosive Trace Detectors

Award Number: 0749979
Program Manager: Cheryl F. Albus

Start Date: February 1, 2008
Expires: January 31, 2010
Total Amount: $499,961

Investigator: Donald Hayes, dhayes@microfab.com
Company: MicroFab Technologies Inc
1104 Summit Ave Ste 110
Plano, TX 75074
Phone: (972) 578-8076

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to use digitally controlled vapor generators for calibration and test of explosive. Two systems will be created: a research oriented system, targeting manufacturers, for development of new explosive vapor trace detectors and production quality control and a portable system, intended for end users, for field testing and calibration. The use of digitally controlled ink-jet dispensing to precisely eject minute amounts of dilute explosive solutions and convert them into vapor has been demonstrated. We have also identified unique requirements of distinct vapor trace detector models and the actual needs of the marketplace. This project will: design and fabricate the two systems; generate the software control program; formulate explosive solutions customized for commercial explosive vapor trace detectors; develop test protocols for each system; evaluate the systems with commercial vapor trace detectors; and run reliability and repeatability testing. The research performed will also include: material compatibility studies; distribution of various explosive vapors by flow simulations and measurements; shelf life studies of the cartridges; and development of methods to calibrate the cartridges for explosive solutions. The broader impact/commercial potential from this technology will be a method to evaluate the development of the next generation detectors. This project will lead to products (vapor generator systems and associated consumables). These products will provide the means to compare the various explosive trace detectors and to identify the most accurate ones. Ultimately, the ability to further miniaturize the vapor generators will lead to units that are embedded into next generation detectors for real-time verification and calibration. The overall societal benefit of successfully developing vapor generator products will be improved protection of the public, both real and perceived, from terrorist threats while minimizing the cost and negative perception related to false alarms. Technological advances from this project will facilitate basic research on detection mechanisms for explosives, drugs and chemical threats. Researchers in government labs and academia will be able to use the vapor generator to evaluate and quantify improvements of promising detection methods. The technology also has spin-off opportunities in olfaction based medical diagnostics.

MEMS

Title: SBIR Phase II: Automotive Nanocomposites

Award Number: 0822808
Program Manager: Cheryl F. Albus

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Joel Dulebohn, jidulebohn@comcast.net
Company: Claytec Inc.
5901 Sleepy Hollow
East Lansing, MI 48823
Phone: (517) 862-3928

Abstract:

This Small Business Innovation Research (SBIR) Phase II proposal aims to commercialize a new mesoporous silicate nanoparticles for the reinforcement of thermoplastic polymers used in the manufacture of U.S. cars and light trucks. Whereas nanoparticles, in general, provide some polymer reinforcement benefits, they typically lack the ability to provide strength as well as stiffness. Also, they normally require extensive organic surface modification for dispersion in the polymer matrix. Organic modifiers limit nanoparticles thermal stability and compromise their suitability for nanocomposite manufacturing through cost-effective melt processing methods. The purely inorganic mesoporous silicates this project plans, circumvent all of the limitations caused by organic modifies by providing a unique combination of surface polarity, mesopore size, surface area, and pore volume which optimizes interfacial interactions between the particles and the polymer matrix for effective dispersion and reinforcement. In addition to providing stiffness at particle loadings, the mesoporous silicates provide strength, which allows the amount of polymer needed to produce an automotive part to be reduced in proportion to the added strength. The polymer savings alone allow users of the technology to reduce the weight of the vehicle, achieve stiffness, and improve fuel economy at no added cost. The broader impact/commercial potential of automotive nanocomposites can directly impact the US energy economy, as well as environmental quality. The combination of reduced vehicle weight and increased fuel economy translates into a reduction in petroleum consumption and green house gas emissions. The process for producing mesoporous silicate nanoparticles is neither energy-intensive nor environmentally harmful. Based on aqueous sol-gel chemistry, this project's nanoparticles are manufactured in yields at a temperature of with no harmful waste released to the environment.

Title: SBIR Phase II: MEMS for Secure RFID Applications

Award Number: 0823009
Program Manager: Muralidharan S. Nair

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Joshua Cross, jdc47@cornell.edu
Company: Cerberex Technologies, Inc.
507 East Buffalo Street, #2
Ithaca, NY 14850
Phone: (607) 227-9539

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project will demonstrate a working alpha prototype of a MEMS-based approach to security for RFID and other electronic security applications. MEMS resonators have very narrow bandwidths and high frequencies which vary from resonator to resonator. This natural frequency variation can be used to uniquely identify a resonator, and makes cloning a specific signal extremely difficult, in essence creating a voiceprint. This approach to RFID security overcomes the drawbacks of encryption which include more complex and expensive tags and the need to manage encryption keys. MEMS resonators for RFID tags are unique, secure, cost effective, CMOS compatible, and fast to read, with low power requirements and low overhead. This research project will demonstrate in a real environment with material temperature swings, working vacuum encapsulated MEMS chips with attached antennas, a low-cost prototype reader with maximum 10cm read range, and reader and system software to extract MEMS response signals to compare with stored signals for chip identification. This project will have broad impact on the security of identification of both people and goods. For example, the RFID tags used in the implementation of US passports were recently cloned which calls into question the security of those documents. Since MEMS resonators cannot be cloned, they can provide significant security assurance to economically validate a given passport. MEMS resonators can also be used to economically authenticate pharmaceuticals since counterfeit drugs are increasingly prevalent (the World Health Organization projects a $75 billion counterfeit market in 2010) and have caused deaths.

Title: SBIR Phase II: Control System Development for Microelectromechanical Systems (MEMS) Segmented Deformable Mirrors

Award Number: 0750521
Program Manager: Gregory T. Baxter

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $474,995

Investigator: Carl Kempf, carl.kempf@irisao.com
Company: Iris AO, Inc.
2680 BANCROFT WAY
Berkeley, CA 94704
Phone: (510) 849-2375

Abstract:

The Small Business Innovation Research (SBIR) Phase II project aims to develop an integrated control system for adaptive optics (AO) systems based on microelectromechanical systems (MEMS) deformable mirrors (DM). Under ideal circumstances, the resolution of an optical system is limited by the diffraction of light waves. Due to imperfections in optical components however, the limits are never achieved. AO is a technology that enhances the performance of optical systems such as telescopes and microscopes by reducing distortion. It can lead to significantly sharper images which can approach the theoretical diffraction limit. The increase in image sharpness also allows additional gains in contrast, thus allowing detection of faint objects. Although AO has been significantly used for improving the performance of telescopes, an AO system based on MEMS deformable mirrors for use in biomedical applications has not. It would significantly improve image quality and would likely find multiple applications. As such, it would lead to the adoption of AO in a variety of biological imaging settings and would be of benefit to scientists engaged in such research.

Nanostructured Materials

Title: STTR Phase II: Low-Cost Nanoparticles for Enhanced Heat Transfer

Award Number: 0823112
Program Manager: William Haines

Start Date: August 15, 2008
Expires: July 31, 2010
Total Amount: $480,409

Investigator: Yanming Liu, y.liu@amadinc.com
Company: Advanced Materials & Devices Inc
4451 Lynnfield Way
Reno, NV 89519
Phone: (775) 826-8868

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project is to develop and commercialize copper nanofluids for heat transfer enhancement applications. The low cost nanoparticle production methods developed will produce quality nanoparticles for this application. Success of this STTR project will benefit a wide range of applications for heat transfer enhancement including: electronics, HVAC, transportation, textile and paper manufacturing, and energy production systems. The project will also provide educational impact by offering opportunities for student recruitment, research and training, and curricula design at the University of Nevada, Reno.

Title: SBIR Phase II: Chemical Aerosol-flow Synthesis of Nanometals

Award Number: 0823029
Program Manager: William Haines

Start Date: August 15, 2008
Expires: July 31, 2010
Total Amount: $499,986

Investigator: Yuri Didenko, info@utdots.com
Company: UT Dots, Inc.
115 Paddock Dr.
Savoy, IL 61874
Phone: (217) 390-3286

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop new scale up methods for the synthesis of surface stabilized metal nanoparticles from aerosol. The advantage of chemical aerosol-flow synthesis is in its simplicity in procedure and experimental setup, low cost and scalability. The method allows for the synthesis of high quality nanoparticles in continuous flow regimen. Phase I results proved feasibility of the method for the synthesis of high quality silver nanoparticles with high yield. This Phase II project will focus on increasing manufacturing capabilities to decrease the cost of nanoparticles significantly. Low cost, printed electrical conductors are expected to be a rapidly growing market for flexible electronics and solar cells. Reducing processing temperatures and material costs are key enablers to these growing applications. The low cost production of nanometals will contribute to these trends.

Title: SBIR Phase II: High-Efficiency Nanocomposite Photovoltaics and Solar Cells

Award Number: 0822652
Program Manager: Juan E. Figueroa

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $492,740

Investigator: Valery Rupasov, anteosinc@aol.com
Company: Anteos, Inc.
105 Hartford Turnpike
Shrewsbury, MA 1545
Phone: (508) 754-3548

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is focused on development of an innovative technology for fabrication of high-efficiency thin film nanocomposite photovoltaic materials and solar cells taking advantage of the recently discovered effect of carrier multiplication in semiconductor nanocrystals. The proposed concept employs smart design of the solar cells providing fast and effective spatial separation of electrons and holes photo-generated in the nanocrystals. The proposed reach nanotechnology platform solves the challenging problem of electrical communications with nanoscale objects, such as nanocrystals, nanorods, nanowires, nanotubes, etc. It can be employed for development of many other nanocomposite optoelectronic devices having numerous commercial and military applications. If successful the development of new generation of high-efficiency photovoltaic materials and solar cells based on the demonstrated technology will have broad impact on the entire solar energy industry resulting in considerable energy savings and environmental protection. The technology has great commercialization potential and niche market. The proposed all-inorganic, high-efficiency, thin film, flexible nanostructured photovoltaic materials and solar cells, which can operate in extreme environment conditions and offer significant mass and volume savings, are ideally suitable for numerous applications, including power generating residential rooftops, power supplies for utility grid, emergency signals and telephones, water pumps, activate switches, battery chargers, residential and commercial lighting, etc.

Title: SBIR Phase II: Development of Cadmium-Free, Water-Soluble and Multicolor Quantum Dots by Chemical Doping

Award Number: 0823040
Program Manager: William Haines

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Lin Song Li, lsli@oceannanotech.com
Company: Ocean NanoTech, LLC
700 Research Center Blvd
Fayetteville, AR 72701
Phone: (479) 871-0707

Abstract:

This NSF Small Business Innovation Research (SBIR) Phase II project is to synthesize cadmium-free, water-soluble, and multicolor quantum dots (QDs) by chemical doping. The project will focus on the synthesis of high quality doped ZnSe QDs using a newly developed phosphine-free approach. From these cadmium free doped derivatives with high quality blue, green, and red emissione will be produced. Then the doped core/shell QDs will be processed to make them water-soluble and biocompatible through proprietary methods for biomedical applications. Successful development of the proposed techniques will result in a new generation of biolabels and make significant advances in biomedical applications of such cadmium-free doped QDs. The "green" nature of the production methods, mineral precursors, natural surfactants, non-toxic and nonvolatile solvents and cadmium free QDs, will assist to maintain a sustainable environment, in addition to delivering high performance end products to the public.

Title: SBIR Phase II: Dual Substrate MEMS switch

Award Number: 0750536
Program Manager: Juan E. Figueroa

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $511,945

Investigator: Jaquelin Spong, jackie@imtmems.com
Company: Innovative Micro Technology
75 Robin Hill Rd
Santa Barbara, CA 93117
Phone: (805) 681-2800

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop manufacturing capabilities for MEMS electrical switches with a novel dual substrate design approach. The approach consists of dividing the switch components between two substrates, with the moving portion on an upper substrate, and the stationary contacts on a lower substrate. The moving portion will be formed from a stress-free layer of single crystal silicon, and so has no tendency to warp or distort. Using two substrates allows the contacts to be fully exposed throughout processing, and cleaned just before the substrates are bonded together to form the switch, thereby minimizing the contact resistance of the switch. Because the contacts are exposed, they can be effectively cleaned just prior to sealing in the hermetic seal between the two wafers, thereby reducing the contact resistance of the junctions. This Phase II effort will take the improved design into volume manufacturing to produce higher power, higher frequency, lower contact resistance and/or smaller footprint switches than competing ones while being produced at lower costs. If successful, the approach described here will be used to produce MEMS cantilevered switches for a broad range of applications, from DC power handling applications to RF and radar applications. Because of their high current-carrying, high frequency characteristics with small size and low cost, the MEMS switches may serve as viable replacements for FET switches or micro relays in a wide range of devices. The approach may also be applicable to other sorts of MEMS devices, such as sensors and actuators, which may have a movable component suspended over a substrate which interacts with a fixed component on the substrate. This approach may therefore fundamentally alter how these devices are manufactured, and open up a wide range of applications not presently served by MEMS devices.

Title: SBIR Phase II: Advanced Materials for Hybrid Electrochemical Capacitors

Award Number: 0750183
Program Manager: Cheryl F. Albus

Start Date: February 15, 2008
Expires: January 31, 2010
Total Amount: $467,171

Investigator: Christopher Rhodes, chris.rhodes@lynntech.com
Company: Lynntech, Inc
7610 Eastemark Dr
College Station, TX 77840
Phone: (979) 693-0017

Abstract:

The Small Business Innovation Research (SBIR) Phase II project involves the development of a nanostructured electrode material for high energy and power density hybrid electrochemical capacitors also called ultracapacitors or supercapacitors. Symmetric electrochemical capacitors that consist of two identical electrodes currently utilize flammable, non-aqueous electrolytes to improve the energy density. Hybrid or assymetric configurations that utilize different electrodes result in significantly higher energy densities and can operate in aqueous rather than non-aqueous electrolytes. The objectives of the Phase II project are to optimize the material's synthesis, further characterize the material, perform electrochemical testing to evaluate the energy density, power density and cycle life of the material, optimize the electrode fabrication process and electrolyte composition, and develop a low-cost, large-scale manufacturing process to produce the material. The anticipated result of the project is the development of a new, commercially viable electrode material that enables hybrid electrochemical capacitors with improved energy density, lower cost, and improved safety over current technologies. The development of low cost, high performance electrochemical capacitors has a substantial impact on the development of electric and hybrid vehicles, consumer and industrial electronics, and telecommunications devices. The broad impact of this technology is to enable the manufacturing of next generation electrochemical capacitors that will have higher energy densities, lower cost, and improved safety compared with current electrochemical capacitors. Hybrid electrochemical capacitors that have high energy densities as well as power densities result in improved performance power systems for numerous medium, high, and pulse-power applications. The ability of the hybrid ultracapacitor to operate in benign aqueous electrolytes reduces the cost of the device and has significant environmental and safety impacts, since current non-aqueous electrolytes are flammable and can emit toxic gases.

Title: SBIR Phase II: Spatially-Resolved Swept-Laser Spectroscopic System for Gold Nanoparticle Sensing

Award Number: 0724231
Program Manager: Juan E. Figueroa

Start Date: November 15, 2007
Expires: October 31, 2009
Total Amount: $499,939

Investigator: Kevin Hsu, khsu@micronoptics.com
Company: Micron Optics Inc
1852 Century Pline
Atlanta, GA 30345
Phone: (404) 325-0005

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is to develop a spatially-resolved bio-sensing technology based on spectroscopic swept-source optical coherence tomography (S-SSOCT) and gold nanoparticles as bio-sensors at 1060nm spectral region. The proposed system will advance contrast-enhanced molecular imaging of diseased tissue. The project will explore several contrasting agents for imaging applications, among these are; the traditional florescence and absorption dyes, to the latest semiconductor quantum dots and metallic nanoparticles. The recently engineered gold nanoparticles possess superior light scattering and absorbing characteristics as well as long-term stability, and when bound to antibodies, can enable high-contrast molecular and cellular imaging of various diseases. The advancement of biotechnology and nanotechnology will benefit greatly from the ability to perform spatially-resolved and sensitive imaging of diseases in molecular and cellular levels through contrast enhancing agents. One expected outcome of this project is to make it possible to track the effectiveness of pharmaceuticals, treat disease, monitor responses to therapies, as well as to provide novel pairing of therapeutic and diagnostic processes. A particular goal of this project is to advance cancer diagnostic technology by developing a high-speed, high-resolution bio-medical imaging modality using gold nanoparticle as bio-conjugated sensors. This market is driven by synergy between various imaging methods (optical, nuclear, and magnetic) and new types of imaging agents.

Photonics

Title: STTR Phase II: High Resolution, High Brightness Display for Virtual Reality

Award Number: 0822965
Program Manager: Ian M. Bennett

Start Date: September 1, 2008
Expires: August 31, 2010
Total Amount: $492,628

Investigator: Michael Bass, bass2703@comcast.net
Company: bdDisplays, LLC
905 Sykes Court
Orlando, FL 32828
Phone: (407) 718-2843

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II research project focuses on new GaAs-based, low voltage technology for high definition head mounted displays (HMDs), suitable for advanced applications in immersive virtual reality and 3-D imaging. Applications for this technology include battery powered augmented reality HMDs, full color, high resolution HMDs with 3-D imaging potential, and low cost, low voltage indicators and backlights for battery powered electronics. Displays derived from this GaAs technology have superior color gamut, high brightness, resolution and efficiency compared to other approaches. The results obtained from the STTR Phase I project indicate that low cost HMD-based optical systems can be designed using these high resolution microdisplay chips at supply voltages as low as 1.5 volts. Compared to display systems based on GaN LED and OLED technology which require voltages of up to 4 volts, this technology presents a path for continued advancement to 3-D imaging systems that could reach the resolution of the human eye. This technology should impact low cost HMDs displaying low-information content data such as maps, text or line graphics that require long battery life for markets that include first responders, factory and inventory workers, and consumer appliances. The technology can be advanced to much higher resolution microdisplays and improved optics for the high-information content marketplace such as immersive virtual reality for education, medical imaging and surgery, games and videos. Commercial emphasis will be placed on the low voltage operation for battery compatibility, a key advantage for augmented reality HMDs; and one which may lead to fundamental changes in battery powered electronics having indicator lights and/or displays.

Title: SBIR Phase II: Electronic Orientation and Navigation System for People with Visual Impairments

Award Number: 0822972
Program Manager: Muralidharan S. Nair

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Michael Manning, michael@manningrf.com
Company: ManningRF, LLC
2718 Winningham Rd.
chapel hill, nc 27516
Phone: (919) 967-5438

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project will design, build and test a new type of orientation and navigation (O&N) system for people with visual impairments. While GPS-based solutions show promise in outdoor environments, there are currently no widespread O&N devices that are designed for use in indoor environments. This makes it difficult for people with visual impairments to navigate through indoor public spaces. The purpose of this research will be to complete development of a new type of radio frequency identification (RFID) system, in which intelligent, variable-range active RFID beacons are programmed with information about their locations and placed through indoor environments like schools, shopping malls and museums. This information will be accessible to people with visual impairments via a small RFID receiver worn on the user?s belt. Information will be conveyed to the user via a text-to-speech interface. Results from field testing have demonstrated that the device helps people with visual impairments to navigate through an unfamiliar environment. Phase II research will complete development of the communications protocols and interface techniques that give the system its unique capabilities for delivering speech-based information to people with visual impairments. There are 10.4 million people with visual impairments in the U.S., and this research will lead to an inexpensive commercial product that will greatly enhance their ability to navigate in unfamiliar surroundings. The market for this technology includes those who will purchase the RFID receivers and the RFID beacons. This includes people with visual impairments, as well as the owners and tenants of public spaces, such as office buildings, schools, malls, museums and government facilities. Also, because of the simplicity of the interface, the system will be useful to Orientation and Mobility educators working with young children to develop spatial concepts.

Title: STTR Phase II: Hybrid Integrated Optoelectronic Systems

Award Number: 0750506
Program Manager: Juan E. Figueroa

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $500,000

Investigator: Lisa Dhar, lisadhar@inphase-tech.com
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Longmont, CO 80501
Phone: (217) 369-7409

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project will combine advanced two-chemistry photopolymer science and 3D maskless lithography to demonstrate a solution to a ubiquitous barrier to the broader impacts of optical and optoelectronic technologies. This research will strive for a universal integration platform capable of seamlessly hybridizing electronic, micro-mechanical, opto-electronic and optic devices on a single chip to implement complex 3D systems in an environmentally robust package. Over 90% of the development cost of optoelectronic components for telecom is estimated to be packaging and the limited market penetration of MEMs products is universally blamed on packaging difficulties clearly showing the need for the proposed platform. In this program the team will optimize the photo polymerizable monomer system and adapt a multi-beam direct-write lithography platform in order to demonstrate and optimize a new class of 3D routed waveguides. Anticipated results are a new class of polymer material and an associated maskless lithography technique to support research, education and commercial production of a wide range of miniature mobile devices that are currently confined to laboratory benches. If successful the proposed multi-disciplinary materials and lithography research program has the potential to revolutionize public access to complex microdevices that are currently restricted to laboratories or expensive military systems. By providing a platform for inexpensive, robust miniaturization of systems that seamlessly incorporate optics, MEMs and electronics, a wide range of communication, medical and sensing systems become technically and economically feasible.

Title: SBIR Phase II: Wavelength-Selective Lasers for Photonic Integrated Circuits

Award Number: 0724237
Program Manager: Juan E. Figueroa

Start Date: October 1, 2007
Expires: September 30, 2009
Total Amount: $499,998

Investigator: Alan Sugg, arsugg@vegawave.com
Company: Vega Wave Systems
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West Chicago, IL 60185
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Abstract:

This Small Business Innovation Research (SBIR) Phase II research project will address the commercial need for novel, wavelength-selective laser diodes for 10 Gigabit Ethernet applications. The distributed feedback lasers currently used in 10 Gigabit Ethernet transceivers are fabricated using an expensive, low-yield, epitaxial re-growth process. The drawbacks of this method are the high cost of the capital equipment and of the manufacturing process. In addition, the lower yields encountered with the multiple regrowths required to fabricate complex photonic circuits make cost-effective integrated photonic components difficult to achieve. A novel laser diode design and high-yield manufacturing method that will enable the fabrication of low-cost wavelength-selective and tunable laser diodes for optical communications has been developed. This research will refine the design and fabricate both discrete and integrated devices for 10 Gigabit Ethernet applications.

The major scientific and technical benefit of this work is an improved method for fabricating lasers and other optoelectronic devices. The work should also result in arrays of novel, wavelength selectable lasers suitable for use in high-speed data communications applications. The main societal impact will be the increased availability of low-cost, high-speed data communications, which is a significant contributor to economic development. Making lower cost lasers will enable a significant reduction in the cost of transceivers, which will increase the rate at which high speed Ethernet penetrates the data network.

Robotics

Title: SBIR Phase II: Extended Performance Red VCSELs

Award Number: 0823022
Program Manager: Juan E. Figueroa

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $485,794

Investigator: Mary Brenner, mhibbsbrenner@photonicdevelopment.com
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15350 25th Ave N, Suite 110
Plymouth, MN 55447
Phone: (763) 746-8045

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will demonstrate significantly improved output power, temperature range of operation, and reliability of red VCSELs. Commercialization of red VCSEL technology has been plagued by the limited temperature range and output power of the devices and unknown reliability characteristics. The Phase I project demonstrated the 1) feasibility of improving output power and temperature range through a number of techniques, 2) that the fundamental limit of the temperature range is at least as high as 125°C, and 3) dramatically improved reliability. The Phase II approach proposed here breaks away from traditional models for fabricating VCSELs and consists of a variety of growth and fabrication methods allowing us to provide a high thermal conductivity path from the active region to the package. The goals and expected technical results are to demonstrate > 0.5mW single mode, and >1mW multi-mode useful output power at 670nm at 85°C, and the same power output power objectives for 655nm at 65°C on a reproducible basis. This project will also demonstrate greater than 10,000 hours device lifetime at 85°C continuous operation. Project activities consist of design, wafer growth and fabrication, performance testing, and reliability testing. To date, the only commercially available VCSELs have been at 780nm to 850nm, due to the substantial materials challenges at other wavelengths. This proposed effort is applicable to a variety of VCSEL wavelengths (similar thermal issues exist at 1310nm to 1550nm), as well as other optoelectronic devices. Commercially, a significant enhancement in red VCSEL performance can enable the migration of plastic fiber based home and auto networks to higher data rates, faster and higher quality laser printing, longer distance and more precise motion control sensing, new types of portable or wearable medical sensing, and improved robustness and cost of radiography equipment. The success of this project not only creates a significant business opportunity for a red VCSEL supplier, but also enhances the competitiveness of customers by making available a valuable new technology. The reduction in power consumption and improvement in medical technology costs address particularly important societal issues.

Title: SBIR Phase II: High-Speed Atomic Layer Disposition System for Compound Semiconductor Thin Films

Award Number: 0750076
Program Manager: Cheryl F. Albus

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $499,908

Investigator: Prasad Gadgil, pgadgil@atomic-precision.com
Company: Atomic Precision Systems Inc.
301 Rosemont Drive
Santa Clara, CA 95051
Phone: (408) 244-5845

Abstract:

The Small Business Innovation Research (SBIR) Phase II project will develop a novel high-speed Atomic Layer Deposition technology comprising an ALD reactor and associated thin film processes for GaN thin films required for fabrication of high-brightness Light Emitting Diode (HBLED). The proposed effort is based on successful demonstration of operation of the ALD reactor in phase-I SBIR project at 5x speed of commercially available ALD reactors. The unique ALD reactor concept can process atomically thin films and also micron thick films in one chamber. Furthermore, point-of-use, safer and low-cost generation of chemical precursors combined with low temperature processing promises low defect density thin films of a variety of compound semiconductors including GaN. Low defect density, low cost GaN thin and thick films are building blocks of an HBLED. An HBLED bulb that consumes 15 Watts, lasts 10+ years and costs a few dollars can effectively replace a fluorescent tube consuming 30 Watts and an incandescent bulb consuming 100 Watts. The proposed ALD technology promises to reduce process cost, and improve the HBLED quality critical to realize ultra-large scale production of affordable HBLEDs for worldwide lighting applications leading to 50% potential electricity savings and tremendous associated environmental benefits.

Semiconductor & Other Materials

Title: STTR Phase II: 3D Lithography of Thick Photopolymers for Imaging and Photonic Crystal Waveguides

Award Number: 0822695
Program Manager: Juan E. Figueroa

Start Date: August 15, 2008
Expires: July 31, 2010
Total Amount: $499,990

Investigator: Jacob Kuykendall, jlkuykendall@zenwa.net
Company: Zenwa Inc
25 Hampshire Street
Sudbury, MA 1776
Phone: (508) 875-3000

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project will culminate in a new form of 3D lithography capable of fabricating imaging arrays and photonic-crystal waveguides that are cheaper, higher performance, lighter, more flexible and have capabilities not currently possible with current “stack and draw” manufacturing. For example, by directly fabricating these parts at the micron scale, perturbations such as global scaling (to implement magnifying arrays), global rotation (to implement image inverters) or local scaling (to implement modal tapers or integrated lenslets) can be created in a single process step. Unlike current methods which must draw out a minimum of km from a preform, here single parts can be cm in length. The imaging arrays have significant commercial potential as replacements for current endoscopes, fiber face plates and image inverters. They also enable new markets including inexpensive eye monitoring for clinical and public safety applications, wearable gaze-tracking for human-computer interface for paralysis victims, and ultra lightweight heads-up displays for military and consumer entertainment. The team will develop both the lithography and materials to create these all-polymer imaging cables. The transport and manipulation of optical images is ubiquitous but nearly uniformly implemented with delicate, rigid lens trains. Discrete imaging devices such as fiber bundles are sufficient for modern digital displays and cameras and are naturally robust, but currently limited by cost and capability. By enabling flexible, lightweight transport of discrete images, the results will impact Education, Medical and Biological Research and Macular Degeneration. The Phase I including supplementary funding has partially funded 7graduate, 1 post-doc and two undergraduate students. An exchange of graduate students with Dublin Ireland extended this impact. The lithography system has been used in multiple undergraduate class projects and for multiple cross-disciplinary graduate research programs. Disposable endoscopes with high resolution, small diameter and large field of view exceed current capabilities at much lower costs. Zenwa has signed a collaborative agreement with the Smith-Kettlewell Eye Research Institute to develop a lightweight customized image delivery system to restore sight to the severely vision impaired.

Title: SBIR Phase II: VLSI Clocking Using BDS Technology

Award Number: 0822830
Program Manager: Muralidharan S. Nair

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $499,989

Investigator: Mihai Banu, mihaibanu@ieee.org
Company: MHI Consulting LLC
22 Sulfrian Road
New Providence, NJ 7974
Phone: (908) 464-6893

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project intends to demonstrate a unique circuit method for GHz clock distribution inside CMOS chips, which provides state-of-the-art performance and is modular, scalable, and reusable. The theoretical foundation of this technology is the Bi-Directional Signaling (BDS) principle implemented over on-chip transmission lines. The project covers the design, fabrication, and evaluation of a comprehensive test chip aimed at validating key aspects of this new method such as the practical accuracy of a long distribution system, the realization of inexpensive high-quality integrated transmission lines, and the design of low power high precision active circuits for local clock generation. If laboratory tests confirm the expected performance and features, this method will be the basis of a valuable new VLSI Very Large Scale Integration (VLSI) technology. The demonstration of scalable and reusable circuit Intellectual Property (IP) for clock distribution will cause a major simplification in the VLSI design methodology with substantial benefits to the manufacturers of integrated circuits. The semiconductor industry will be able to produce faster processing, lower power, and lower cost VLSI components for systems such as computers and communication devices.

Title: SBIR Phase II: Novel Deposition of Silicon Carbide Boules

Award Number: 0750064
Program Manager: William Haines

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $522,000

Investigator: Joshua Robbins, josh.robbins@sicsystems.com
Company: SiC Systems, Inc.
400 Corporate Circle, Unit B
Golden, CO 80401
Phone: (303) 216-2656

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a novel processing technique to form silicon carbide (SiC) boules for wafer production. The technique uses high-purity gas precursors and has the potential to economically produce large diameter SiC boules with low contamination levels and reduced defect levels. In this project, SiC boule growth using gas-phase precursors will be developed for commercialization of 150 mm SiC wafers. SiC is a wide bandgap compound semiconductor with high thermal conductivity, high breakdown electric field strength, thermal stability and chemical inertness. SiC-based electronics are of great interest because they can significantly outperform conventional semiconductors under high-temperature, high-power, high-radiation, and corrosive conditions. Potential products based on SiC include engine control eletronics, turbine engine sensors, power switching devices, microwave electronics, and many others.

Title: STTR Phase II: Germyl Silanes - Enabling Precursors for Chemical Vapor Deposition of Advanced CMOS Substrates, CMOS-Integrated MEMS, and Nano-Scale Quantum-Dot Silicon Phot

Award Number: 0750479
Program Manager: William Haines

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $481,557

Investigator: Matthew Stephens, mstephens@voltaix.com
Company: Voltaix, Inc
197 Meister Avenue
North Branch, NJ 8876
Phone: (908) 231-9060

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project will demonstrate pilot scale manufacture of germyl silane precursors and their use to create prototype semiconductor devices and thin films under low temperature and selective growth processing conditions. The project addresses a critical need for precursors and processes that deposit such films under low temperature conditions with throughput rates that are significantly higher than those offered by existing processes. The potential market for devices made with these technologies is predicted to exceed several billion dollars per year and exhibit double-digit growth rates over the next five years. Ge-rich SiGe films will enable higher clock speeds in microprocessors, lower power consumption in cell phones, silicon-based photonics, and more efficient solar cells.

Title: SBIR Phase II: Ultra High Thermal Conductivity Aluminum/Graphite Composites from Low Cost Natural Graphite

Award Number: 0750180
Program Manager: Cheryl F. Albus

Start Date: February 1, 2008
Expires: January 31, 2010
Total Amount: $499,994

Investigator: James Cornie, jcornie@mmccinc.com
Company: Metal Matrix Cast Composites, LLC
101 Clematis Avenue
Waltham, MA 2453
Phone: (781) 893-4449

Abstract:

The Small Business Innovation Research (SBIR) Phase II project will develop and present for commercialization natural graphite (NG) reinforced Al (AlGr). In this project, inexpensive natural graphite flake (NGF) will be manufactured into a preform and pressure infiltrated with Al-Si alloys to form composites with thermal conductivities (TC) from 600 W/mK to 750 W/mK and corresponding thermal expansion (CTE) from 7 to 4 ppm/K. CTE is specified by controlling volume fraction of NGF. TC is 1.5 to 1.9 times oxygen free high conductivity (OFHC) Cu at 25% of the mass and comparable volumetric cost to Cu with customized CTE enabling thermally efficient direct die attach. High TC results from reaction of Si from the alloy with NGF surfaces to form low thermal impedance SiC interface. These properties result from innovative preform architecture. In addition, quasi-isotropic TC values (~700 W/mK) are achievable through further preform design. For every 10C decrease in operating temperature, the life of an electronic device is doubled. Conversely, more efficient cooling schemes enable devices to be manufactured with higher performance at higher power densities and in smaller spaces. The materials developed in this project would enable such performance enhancements, and at lower cooling costs. The proposed technology would reduce the dependence on copper for electronic thermal management applications and would find serious application in space and military radar and communication systems as well as laser diode heatsinks, heat spreaders for notebook computers and other consumer electronics.

Title: SBIR Phase II: Diffractive Electrode Structure for on Chip Embedded Passive Components.

Award Number: 0724467
Program Manager: William Haines

Start Date: October 1, 2007
Expires: September 30, 2009
Total Amount: $499,027

Investigator: Ronald Kubacki, kubacki@ionic.com
Company: Ionic Systems Inc
2161 Otoole Ave Ste H
San Jose, CA 95131
Phone: (408)435-2680

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a method for tuning the capacitance of on-chip capacitors. The Phase I effort demonstrated an optical diffractive electrical electrode structure that permits the penetration of deep ultra-violet (DUV) radiation into an underlying dielectric. This was used to precisely tune dielectric constant and capacitance. The DUV radiation incites a photochemical reaction altering the dielectric constant of the spacer material in the capacitor.

This project, if successful, will enable compact, precision capacitors embedded on chip to replace external discrete capacitors in electrical circuits. Moving passive components on chip in the same fabrication process is a reduction of manufacturing effort. By precisely trimming electrical values with resistor trimming equipment a significant simplification of the manufacturing process may be achieved. The successful results of Phase II will result in the demonstration of a molecularly engineered nanocomposite for use in millimeter and micro wave monolithic integrated circuits that can be photo-optically tuned for precise value to embed precision capacitors on chip. Incorporation of this technology can result in reduced size and cost for a wide variety of high frequency applications.

Wafer & Sensor Production/Lithography

Title: SBIR Phase II: Single Crystal Silicon Flexible Display Backplane

Award Number: 0822770
Program Manager: Juan E. Figueroa

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $475,557

Investigator: Etienne Menard, etienne.menard@semprius.com
Company: Semprius, INC.
2530 Meridian Pkwy. 2nd Floor
Durham, NC 27713
Phone: (919) 806-4923

Abstract:

This Small Business Innovation Research (SBIR) Phase II project focuses on fabrication of flexible display backplanes using transfer printed electronics. The display industry has been successful at fabricating amorphous silicon (a-Si) thin film transistor (TFT) backplanes on rigid glass. However, a-Si TFT manufacturing does not easily translate to flexible substrates due to handling issues and the high temperature process of a-Si deposition. In transfer printing, a novel elastomeric stamp is used to pick-up specially designed circuits from the parent wafer and transfers the circuits to the desired target substrate. The parent wafer is fabricated using a standard silicon IC foundry and the single crystal silicon transistors have much better performance than the a-Si counterparts. The SBIR Phase I project demonstrated chip transfer printing process yields of 99.9% and chip placement accuracies better than +/- 5 ìm. Phase II objectives include design, fabrication and characterization of flexible backplane prototypes and further optimization of transfer printing by increasing throughput and demonstrating rework methods. The anticipated result is a manufacturing approach to flexible electronics that is cost competitive, low temperature and well suited to handle flexible substrates. The competitive advantage of the proposed approach is the fact that all the demanding fabrication process steps necessary to fabricate high performance electronic systems are performed on the ?mother? substrate and not on the final plastic substrate. If successful the inherent mechanical or chemical instabilities of the receiving plastic substrate do not limit the choice of semiconductor manufacturing processes for fabricating devices. The ability to manufacture flexible display backplanes to the demanding standards of the display industry will open up a broad market of opportunity in flexible electronics far beyond displays, including configurable X-ray sensors, RFID tags, and wearable electronics and biosensors. In displays, backplanes using the proposed technology will be utilized by all major display manufacturers and many specialty manufacturers.

Title: SBIR Phase II: High Performance Cooling Devices through Wafer Scale Manufacturing

Award Number: 0750189
Program Manager: William Haines

Start Date: February 1, 2008
Expires: January 31, 2010
Total Amount: $505,487

Investigator: Andrew Miner, miner@romny-scientific.com
Company: Romny Scientific
828 San Pablo Avenue
Albany, CA 94706
Phone: (510) 931-7511

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will create high performance coolers using waferscale semiconductor manufacturing by building on the material processing foundations demonstrated in Phase I. Phase I work has demonstrated that high quality materials can be formed in a method that can be extended to high volume production. This Phase II effort will implement this manufacturing technique at a wafer scale, integrating Phase I materials into initial devices for customer evaluation and sale. The broader impacts of widespread deployment of efficient thermoelectric coolers include reduction in energy consumption and more efficient use of available energy by widespread use of high performance thermoelectric power generation from waste heat; and broad improvements in general quality of life by high performance compact coolers that allow continued advancement of products in the microelectronics and optoelectronics industries.

Wireless Networks

Title: SBIR Phase II: Clock-on-Demand: High Performance, Ultra Low Power

Award Number: 0822542
Program Manager: Muralidharan S. Nair

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Farokh Eskafi, farokh@tagarray.com
Company: TagArray Incorporated
5150 El Camino Real
Los Altos, CA 94022
Phone: (650) 966-1640

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project is to develop a prototype and proof of concept for the tag and reader that uses an innovative low power Clock-on-Demand (CoD) and baseband/ media access controller (MAC) calibration algorithm to be used with ultra wideband communication systems. The new CoD and algorithm are motivated by application of ultra wideband to the RFID (Radio Frequency Identification) market. In this prototype, the CoD and the baseband/MAC layer algorithm are implemented in standard CMOS for tag and the UWB receiver and narrowband receiver with discrete components for reader. The low power requirement is achieved by the CoD and by dividing the time into epochs and epochs into slots. The CoD only runs until the tag transmits its impulse in the relevant slot, and the reader decodes the ID representations of all tags by the slot number. Therefore, if an epoch is divided into 210 slots, an impulse by tag represents 10 bits of the information. The robustness is achieved by having an UWB impulse transmitter in the tag and by repeating the impulse in different epochs. RFID is an exponentially growing market. However, the technology that supports its expansion is not able to provide robust communication and signaling between a tag and a reader. Furthermore, today?s technology only supports a low tag density (10s of tags/sec), while the applications that will fuel the exponential expansion of the RFID market, like point-of-sale, inventory management, shelf management, etc., require 100s and 1000s of tags/sec.

Title: STTR Phase II: Low-Cost Portable Telerehabilitation System for Intelligent Stretching and Remote Assessment of Hypertonic Arm Joints

Award Number: 0750515
Program Manager: Muralidharan S. Nair

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $485,564

Investigator: Yupeng Ren, yupeng.r@gmail.com
Company: Rehabtek LLC
2510 Wilmette Ave.
Wilmette, IL 60091
Phone: (847) 853-8380

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II research project seeks to develop technologies needed for rehabilitation of post-stroke patients with neurological impairment. For those patients, physical therapy followed by timely examination is the cornerstone of the rehabilitation. However, not all patients receive sufficient therapy due to limited access to expert healthcare services. There is a need for a tele-rehabilitation system that can stretch the spastic/contractured joints under accurate control at a remote location and provide remote access to expert healthcare services. This Phase II research will focus on improving the technology and making it suitable for the market by improving the design of the tele-rehabilitation system for multi-purpose applications to treat/evaluate multiple joints in the arm. It will make the portable device stand-alone with built-in capabilities of passive stretching, voluntary movement exercise, and tele-assessment of joint range of motion, stiffness, spasticity, and catch displayed in an intuitive way. Finally, a clinical test of the tele-rehabilitation system on stroke survivors will be conducted. This portable and low-cost stretching device is suitable for home use, making frequent and convenient treatment accessible to a large number of patients. It can potentially have broad impact on rehabilitation of stroke and other neurological impairments. The intelligent stretching concept was developed to insure safe and effective treatment and it will also be useful in other applications dealing with human-machine interface.

Computer Algorithms and Image Processing

Title: SBIR Phase II: Cilk++

Award Number: 0822896
Program Manager: Ian M. Bennett

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $500,000

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12 Waltham Street
Lexington, MA 2421
Phone: (781) 325-0818

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project aims to develop software technology to enable C++ programmers to easily program multicore chips produced by the leading processor hardware vendors. Physical limits are driving chipmakers to produce chips containing multiple processor cores, but existing methods for programming multicore chips are error-prone and difficult to use. The potential outcomes of this research project will enable C++ programmers to easily parallelize applications to run on multicore processors without restructuring their legacy applications. Cilk++ is a simple set of language extensions to C++, which, together with a powerful runtime platform, allows multicore processors to be programmed easily. Market research shows that global variables pose a major barrier to parallelizing legacy code. This research project seeks to understand the linguistics, implementation, and applicability of hypervariables, a new construct designed to solve data-race problems created by parallel accesses to global variables. The results of the project include software implementations of hyper-variables in the context of Cilk++, including modifications to the Cilk++ language, compiler, tools and runtime platform. Additionally, the project will produce engineering design documents, user documentation, and training and educational materials, and will evaluate this technology in customer applications. In 2008, the leading processor manufacturers will ship over 100 million processors, with forecasts for over 75 percent of such processors be multicore. On the software side, the C++ programming language has become the standard langauge for developing applications that run on uniprocessor-based platforms. Although C++ programmers number well over 3 million, most lack the specialized training to use create correct, high-performing parallel programs. This research project will allow ordinary developers to multicore-enable legacy code and bring new multicore applications to market, thereby fulfilling the potential of multicore technology to help users of computers and personal appliances be more productive and to take advantage of the increased performance of computers in as diverse areas as health care, shopping, scientific advancement, entertainment, financial planning, and more. This research will advance the understanding of how multicore computers can be programmed effectively. The lessons of Cilk++, and the innovation of hypervariables in particular, will generalize to other programming languages, such as Java, C#, and Fortran. The educational and training materials will educate software engineers in parallel programming and expose them generally to the subtle issues of concurrency.

Title: SBIR Phase II: Algorithms and Visualization Techniques for the Detection of Geographic Aberrations in Crime (GIS)

Award Number: 0750507
Program Manager: Ian M. Bennett

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $467,805

Investigator: M. Cecelia Buchanan, info@avencia.com
Company: Avencia Incorporated
340 N 12th St, Suite 402B
Philadelphia, PA 19107
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Abstract:

This Small Business Innovative Research (SBIR) Phase II project will further develop HunchLab -- software tools that leverage spatial statistics to enable police personnel to test their theories of criminality against data collected in the day-to-day activities of policing. The preceding Phase I project proved the feasibility of developing HunchLab as a set of innovative software tools that scour the historic data of a police department, search for geographic aberrations expected by the theories or 'hunches' put forth by crime analysts, and apply spatial statistics to confirm or deny the supposition. Preventing crime is a more sophisticated task than simply mapping incidents or arrests and deploying resources accordingly. The ability to detect and analyze changes in the geographic patterns of crime and disorder is an innovation in policing which holds the potential to enhance the organizational capacity of police departments across the country. This Phase II project will refine the application and build additional functionality, including alternate workflows for different user types, expanding the alert infrastructure, and building text mining capabilities. The obvious sector that this product will impact is law enforcement at all levels of government. Additionally the successful outcome will impact federal law enforcement agencies and regional crime analysis consortia. There are roughly 250 municipalities with over 100,000 people in them, and these each have police departments that would find this system of use. The tools will be helping thousands of police officers do their jobs better every day. This efficiency will result in better policing, meaning that criminals will be caught more effectively. Criminals cause damage far in excess of the property and medical costs directly attributable to their activity. Perhaps more importantly, the research will form the basis for other products that operate in realms other than law enforcement. The algorithms and technologies developed in the Phase I prototype are transferable to other datasets that demonstrate similar point pattern processes - events with explicit spatial and temporal attributes. Our Phase I process demonstrated a substantial utility in domains other than law enforcement including fraud detection, real estate, sales and public health. The Phase II work plan includes testing with other data sets to refine that software should address these other markets.

Title: SBIR Phase II: FireScape: A Platform for On-Demand, Browser-Based Incident Command

Award Number: 0750514
Program Manager: Ian M. Bennett

Start Date: March 15, 2008
Expires: February 28, 2010
Total Amount: $491,180

Investigator: Robert Crabtree, crabtree@hyperspectives.net
Company: HyPerspectives, Inc.
2048 Analysis Drive
Bozeman, MT 59718
Phone: (406) 556-9880

Abstract:

This Small Business Innovation Research (SBIR) Phase II aims to prove the feasibility of creating a web-based mapping and visualization application for end-users in wildland fire management communities as an extension to the results of the Phase I work. By partnering with strategic vendors, the project will expand our current application to offer not only advanced remote-sensing data products and customized reports, but on-site, real-time weather data, GPS tracking, and full data transfer and communications networks (including audio and video). The project aims to ultimately provide end-users access to a complete team of expert analysts and engineers to gather, merge, and analyze fire-related data products through satellite communications networking. Our experts will then consolidate and simplify all the available data into custom, real-time data reports with geospatial context and delivery it to end-users to expedite high-level decision making, which can save valuable assets and lives. The platform will be amenable to the networking, visualization and analysis of a great number of issues in not only the natural resources realm, but also homeland security, disaster relief, global monitoring, and hazard mitigation. The ability to quickly and efficiently collect, analyze, and share geospatial data (in particular, time-sensitive environmental data) across the World Wide Web is the cornerstone value proposition for this product. These combined abilities provide a critical and as-yet-unavailable tool for the fire management community. The project has both economic and humanistic benefits in that confinement strategies decided-on and applied during the early stages of fires can significantly reduce the cost of fire suppression by several millions of dollars. This increased information will also allow decisions to be made that keep firefighters as safe as possible. Additionally the project will offer advanced data products in formats designed specifically to address the aspects that influence these decisions. The combination of the hub solution and web browser interface as a flexible architecture, is based on open standards and therefore is agile, dynamically configurable, and interoperable holding significant value for applications such as natural disasters, pandemics, or homeland security. The overlay and visualization of that data will provide analyses of critical importance for decision and policy makers, as well as regular citizens, all seeking the best geospatial information possible and in a form they can use.

Title: SBIR Phase II: User Oriented Character Animation Framework for Producing Believable Motions

Award Number: 0724452
Program Manager: Errol B. Arkilic

Start Date: November 15, 2007
Expires: October 31, 2009
Total Amount: $493,457

Investigator: Adam Divelbiss, awdivelbiss@optonline.net
Company: Creative Logic Entertainment
7 Barnes Drive
Wappingers Falls, NY 12590
Phone: (914) 649-2235

Abstract:

This Small Business Innovation Research (SBIR) Phase II Project proposes a new approach to the problem of creating and editing premium quality computer-generated character animation that will dramatically reduce the heavy labor penalty associated with animation techniques and software tools currently available. The specific technical innovation consists of a generic animation framework that produces high-quality motion through a reduced set of input parameters (compared to keyframe techniques) while providing a high degree of "directability" for the user. Additionally the proposed innovation affords the ability to capture, store and reproduce stylistic motions with a high level of fidelity and repeatability. Style is encoded in both physically- and behaviorally-based time-variable parameters supporting smooth transitions between styles. The theoretical foundation is similar to spacetime approaches yet has major differences that improve usability, flexibility, and productivity. Successful completion of this project will lead to a product that increases the productivity of experienced animators by simplifying the animation process, and enables novice or non-animators to quickly and easily create animated content. The successful completion of this Small Business Innovative Research phase II project, in conjunction with an appropriately developed user interface, will positively impact the global content creation industry by increasing the ease-of-use for creation of animation compared to the difficult and labor intensive animation processes currently employed. Successful commercialization will expose a much broader consumer market to the art of computer animation. The broader exposure of the solution will allow un-trained and underrepresented groups the ability to express themselves through the art of 3D computer generated character animation that is currently the realm of highly skilled users only. In addition, the increased ease of creating compelling animations will afford the dissemination of animation based information over a broader audience. Finally, the solution will allow animation to be used for applications where it was not previously feasible due to ease-of-use and budgetary constraints opening up new commercial opportunities.

Database Management

Title: SBIR Phase II: SaaS-Based Procurement and CRM Systems for Local Food Markets

Award Number: 0822889
Program Manager: Errol B. Arkilic

Start Date: August 15, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Heather Hilleren, heather@greenleafmarket.com
Company: Hevva LLC
PO Box 5155
Madison, WI 53705
Phone: (608) 395-4990

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a new methodology for data interchange in the agricultural industry. GreenLeaf Market is developing application program interfaces to enable the automated transfer of data to enterprise resource planning systems through a representational state transfer interface interchangeable with a webservice. This platform automatically identifies and aggregates agricultural market information while enabling this information to be integrated into the purchaser's business systems. If successfully commercialized, the application stands to significantly reduce post-harvest spoilage costs, now in the tens of billions of dollars for the United States. It will increase productivity for purchasers, assist the producer in identifying emerging markets, reduce the distance agricultural products must travel, boost the local economy, improve the food security of the US, and lower the overall cost of food by reducing the gap between supply and demand.

Title: STTR Phase II: Integrating Online Analytical Processing (OLAP) and Ontologies to Discover Inconsistencies in Expectations for Supply and Demand

Award Number: 0750543
Program Manager: Errol B. Arkilic

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $512,000

Investigator: Peter Moore, peter@clados.com
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San Mateo, CA 94401
Phone: (650) 231-0494

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project aims to produce a software application that dramatically improves a manager's ability to allocate resources to productive uses. With advances in Online Analytical Processing (OLAP) and ontology technology, the tool has the potential to enable the discovery of future supply and demand imbalances for teams of business analysts. The objective is to produce at least one Investable Inconsistency per day by the end of the research period. The Phase I project produced unanticipated innovations that may have broad utility in both the OLAP field and the ontology field, and with these innovations, the software platform shows promise for transforming the essential practice of analysis in the field of market research in support of investment decisions. The Phase II project, if successful will result in technology that extends this promise to a broad audience, educating users in best practices for investment analysis and enabling them to materially improve their allocation of resources.

Title: STTR Phase II: Disciple Technologies for Development, Utilization, and Maintenance of Regulatory Knowledge Bases

Award Number: 0750461
Program Manager: Ian M. Bennett

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $500,000

Investigator: Tomasz Dybala, tom.dybala@exprentis.com
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4031 University Drive, Suite 200
Fairfax, VA 22030
Phone: (703) 272-7702

Abstract:

This Small Business Innovation Research (STTR) Phase II project as a continuation of the Phase I effort, will develop alpha versions of the Regulatory Knowledge Base (RKB) products. The Regulatory Knowledge Bases will be tailored to classes of compliance problems within the financial services space, such as broker or trading compliance, or anti-money laundering. Addtiionally, they will include a complex regulatory ontology specific to the financial services industry and rule bases that reflect the latest regulations and best practices that govern analysis of alerts and compliance cases. The Regulatory Knowledge Base products will be sold in various formats and standards so they can be directly deployed on various commercial off-the-shelf reasoning engines. Regulatory demands, as well as the increasing costs associated with financial crime, are placing increasing cost pressures on financial institutions. The burden of compliance is driving up operational costs. Financial services firms are seeking to improve the effectiveness, efficiency and return on investment of their compliance and risk management systems. The current knowledge management technologies and software tools cannot offer efficient customized procedures to deal with specific compliance cases. Therefore, there is a need for flexible knowledge-based systems, like Disciple-FS, and for Regulatory Knowledge Base products, that can offer help in solving specific cases while ensuring compliance with all the rules and regulations. These systems should also be capable of acquiring reasoning skills of their users to adapt their capabilities to deal with new cases. The prototype built during Phase I proved that the Disciple Technologies have the required functions and abilities to support development, utilization, and maintenance of regulatory knowledge bases. The prototype also helped to identify research and development goals for Phase II that we present in this proposal.

Data Storage

Title: STTR Phase II: Next Generation Digital Data Recovery System

Award Number: 0822980
Program Manager: Ian M. Bennett

Start Date: September 1, 2008
Expires: August 31, 2010
Total Amount: $489,525

Investigator: Anandabrata Pal, PashaPal@aol.com
Company: Digital Assembly LLC
Best
Brooklyn, NY 11201
Phone: (917) 482-0211

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II research project proposes to research and bring to market the next generation digital data recovery techniques. The problem of restoring lost data from a damaged digital device arises routinely in digital forensics and data recovery. In many advanced cases of digital storage failure currently available file recovery techniques based on disk storage information fail. During the Phase I of this project a software framework was developed for file carving. Using this framework a software library and a user interface to carve fragmented files from a disk image, called Adroit was implemented. Adroit currently supports carving of JPEG fles, structured documents (such as HTML, source code, plain-text fles, etc.), and Microsoft office documents. In tests conducted, Adroit recovers more files than tools currently available in the market. Furthermore, the validation and user interface component built into Adroit excels at allowing the user to guide the technology to recover more data with much less effort. The problem of recovery of information from bits and pieces of digital data, in the absence of storage meta-information to tie the pieces together, is equivalent to the problem of having hundreds/thousands of jigsaw puzzles mixed into together. The challenge of identifying if a piece of data belongs to a specific file or file type is daunting. The preliminary research conducted in Phase I has demonstrated the viability of developing domain specific techniques to identify the type of data fragments and the use of file type specific algorithms to reconstruct files. The broad impact of this technology and its commercialization are: 1) it will change the nature of the data recovery market and make possible unprecedented recovery of data in a variety of situations; 2) it will save countless users the agony of losing valuable data. Be it important data that is needed for a company's survival or an emotionally valuable photograph of a proud parent or child; 3) it will provide law enforcement officials with an increased ability to gather evidence and prosecute their cases more effectively; 4) it will provide counter-terrorism experts the ability to glean crucial evidence that they may have otherwise missed.

Title: SBIR Phase II: Scalable Location Data Management

Award Number: 0822777
Program Manager: Errol B. Arkilic

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Karthikeyan Ramasamy, karthik@cs.wisc.edu
Company: Locomatix, LLC
48 Washington St., #8
Santa Clara, CA 95050
Phone: (408) 249-8845

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to design, implement, and test scalable methods for providing location-based services, with a special emphasis on mobile cell phone applications. Examples of such applications include continuous monitoring of static and dynamic geo-fences, building dynamic mobile social networks, and mobile e-commerce. The Phase II effort will develop methods to push the efficiency of the location-based computation techniques, and develop methods for more sophisticated features such as privacy management and mobile power management, which will be crucial for the wider adoption of location-based applications. Location data is currently generated by continually moving physical objects equipped with location-based sensors, such as GPS and Wi-Fi based tags. Data management methods for these datasets require dealing with high update rates, large volumes of historical location data, and location-based triggers that raise an alert when the location of a moving object meets certain criteria (for example, if an object is beyond a well-defined boundary). Existing methods for supporting applications that have these requirements are not scalable. The broader merits of this project include the development of a technology that has a potentially large commercial value and addresses an emerging market need. For example, for the cell phone market, these location-based services are projected to grow from $464M in 2007 to over $11B by 2011. If successful, the potential impact in both consumer and enterprise markets for location-based services could be substantial.

Title: STTR Phase II: Splintered Topologically Close-Packed (TCP) Offload Engine for Grid Computing and Bandwith-Delay Product (BWDP)

Award Number: 0822744
Program Manager: Ian M. Bennett

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $488,128

Investigator: James Awrach, jma@seafire.com
Company: SeaFire Micros, Inc.
39 Dodge St #319
Beverly, MA 1915
Phone: (978) 317-1831

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II research project addresses the challenges of networks with extreme bandwidth delay products. Bulk data transfer over such networks used by national research laboratories and aerospace companies need to be provided with the endpoint resources required to ensure high performance in a cost effective manner. The outcomes of this project attempts to provide compatibility with present and future versions of GridFTP. The project addresses these challenges through the use of a novel offload engine. During the Phase I project, the feasibility of deriving and simulating the offload engine architecture, firmware, and creation of intellectual property (IP) for low-cost, high-performance field programmable gate array (FPGA) subsystems was completed. Successful results from this research will significantly advance the state of the art for off-load engines used in grid computing. Immediate applications include accommodating the e-Science community's need for scalable 10-100 Gbps off-load engines, while supporting present and future versions of GridFTP. Other applications include the use of our ultra high-speed offload engines for grid and cluster computing, utilizing our open source firmware. The FPGA code resulting from this project has the potential to be used as intellectual property that could then be marketed to off-load engine manufacturers. These IP cores would accrue cost-effective savings for existing engine firms and would accelerate products to the market.

Engineering Analysis & Modeling

Title: STTR Phase II: Condensing Ejector for Second-Step Compression in Reversed Rankine Cycle

Award Number: 0822525
Program Manager: Cheryl F. Albus

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $499,873

Investigator: Mark Bergander, mjb1000@aol.com
Company: Magnetic Development, Inc.
68 Winterhill Rd.
Madison, CT 6443
Phone: (203) 421-3562

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project seeks to continue the research and analysis of condensing ejectors for second stage compression in a refrigeration cycle. A condensing ejector is a two-phase jet device that produces outlet pressure higher than either of inlet pressures. The project combines theoretical and experimental models in order to design the condensing ejector for use in more efficient refrigeration systems. The results thus far show that the new design is capable of improving the efficiency of vapor compression refrigeration cycle by approximately one-third with R22 refrigerant. The goal is to draw closer to this ideal value with environmentally friendly refrigerants like R410A. The application of critical two-phase flow devices will lead to development of more efficient thermodynamic cycles for refrigeration and A/C and in the future possibly for propulsion and power generation. The broader impact/commercial potential from this project will bring considerable economic and societal benefits by reducing our nation's dependence on foreign oil, improving safety of nuclear reactors and natural gas pipelines, and better understanding of phenomena of two-phase flow. Applications of the condensing ejector theory in heat pumps might promote use of renewable geothermal energy sources in the remote communities with limited energy choices. This project leads to enabling technologies by providing the technology platform for a new approach to evaluating two-phase flows. The capability to handle rapid phase change simulations has generated interest from the automotive industry to simulate flash boiling in automotive fuel injection. This project also provides the basis for establishing fundamentally new engineering and designing methods for equipment operating on two-phase flow.

Title: SBIR Phase II: Virtual Prototyping Tool for Complex Flows of Polymers and Suspensions

Award Number: 0750465
Program Manager: Cheryl F. Albus

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $497,699

Investigator: Ilya Staroselsky, ilya@exa.com
Company: Exa Corporation
3 Burlington Woods Drive
Burlington, MA 1803
Phone: (781) 676-8587

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop an engineering design level simulation tool for non-Newtonian fluid systems used in advanced materials engineering/process design. The project will implement innovative physics modeling of rheological properties and will leverage the full computational strength of the company's PowerFLOW simulator, including automatic grid generation for arbitrarily complex geometry and perfect parallel scalability on cluster computers using hundreds of million computational cells. This project will convert the hydrokinetic software resulting from Phase I project into a stable and robust technology platform that can be fully commercialized. The broader impact/commercial potential from the technology will be virtual design tools to overcome physical and/or engineering limits in flow simulations of chemicals, food products, pharmaceuticals, and nutritional processing, disk drive manufacturing, environmentally benign processes, semiconductor equipment, anti-icing aircraft sprays, etc. The tool for non-Newtonian flow prediction will open new commercial markets for the PowerFLOW technology. Key advantages include grid generation and set up times, thus enabling shortened product/process development cycles, optimization to improve yield and energy efficiency, and environmental improvements.

Title: SBIR Phase II: Engine Combustion Simulator

Award Number: 0750406
Program Manager: Cheryl F. Albus

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $488,721

Investigator: Glen Ko, ghk@resgroupinc.com
Company: RES Group, Inc.
11 Cambridge Center
Cambridge, MA 2142
Phone: (617) 834-2416

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop the Engine Combustion Simulator (ECS), an innovative software product that will enable researchers to develop and apply accurate chemical reactions for the design, control and optimization of the automotive engine and exhaust gas after-treatment devices. The ECS will reduce the costly and time-consuming experimental testing, as well as enable the researcher to probe concepts that are difficult or infeasible to test experimentally. These developments will accelerate the development of more fuel efficient and environmentally cleaner automobiles. At the core of the ECS is a suite of advanced database technologies and computational algorithms that enable the user to easily build accurate reaction mechanisms, and quickly perform simulation studies using these mechanisms. The broader impact/commercial potential from this technology will result in cleaner and more fuel-efficient vehicles. Even a small gain in fuel efficiency can translate to billions of savings in fuels as well as reduced dependence on foreign oil. Less fuel consumption directly scales to reduction in emissions thus lowering of greenhouse gases while improving the human health. The ECS will be made available at no-charge for use in education and research in academia and some of the key components will be made available as an open-source to the research community to foster collaboration between researchers.

Enterprise Systems

Title: SBIR Phase II: Software Platform for Quality-by-Design Implementation

Award Number: 0750063
Program Manager: Ian M. Bennett

Start Date: March 15, 2008
Expires: February 28, 2010
Total Amount: $511,771

Investigator: Paul vanEikeren, paul.van.eikeren@bluereference.com
Company: Blue Reference
2554 NW First St.
Bend, OR 97701
Phone: (541) 317-4105

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a novel Quality-by-Design (QbD) software platform directed at the needs of FDA's QbD initiative, a framework for innovative pharmaceutical development, manufacturing and quality assurance. QbD is implemented at four levels: process understanding; quality by design; monitor, predict and control; and continuous improvement. QbD implementation is hampered by the lack of a reusable and extensible QbD Software Platform for assembling QbD tools that execute, document and integrate QbD workflow. In the Phase I program, we successfully demonstrated 'proof-ofconcept' for the QbD Software Platform for application to the first QbD level workflow. This project will extend research to the other levels and enhance the QbD Software Platform in three principal ways: 1) increase capabilities for managing QbD data-set objects; 2) enlarge the pool of QbD workflow objects; and 3) add collaboration capability in conjunction with a centralized repository. We will test, evaluate and validate the QbD Software Platform through use scenarios developed in conjunction with pharmaceutical-company research collaborators. The ultimate goal of the program is to develop a commercial QbD software toolkit that enables scientists and engineers to implement QbD for increased manufacturing efficiency with regulatory flexibility. The health of our nation's citizens depends on the availability of safe, effective and affordable medicines. Pharmaceutical companies need to employ innovation, cutting-edge scientific and engineering knowledge, and the best principles of quality management to respond to the challenges of new discoveries (e.g., complex drug delivery systems and nanotechnology) and individualized therapies or genetically tailored treatments. The FDA and global pharmaceutical community are laying the foundation for a regulatory policy revolution, Quality-by-Design (QbD), that provides a framework for allowing regulatory processes to more readily-adopt state-of-the-art technological advances in drug development, production and quality assurance. QbD shifts focus from 'quality by testing' to 'quality by design', i.e. build quality into the process rather than rely on resource-intensive quality control systems to prevent defective products from leaving the factory. The Quality-by-Design (QbD) Software Platform of the present proposal enables scientists and engineers to implement state-of-the-art multi-variate analysis and machine learning to manufacturing quality. Additionally, given that manufacturing represents 25% of drug cost, equipment utilization is below 40%, and batch quality failures range from 5 to 15%, the effective implementation of QbD will enable improved efficiency providing lower drug costs and increased competitiveness for the US pharmaceutical industry.

High Speed Networking

Title: SBIR Phase II: Implementation, Testing and Refinement of a Hybrid Distributed / Traditional System for Broadcasting Live and Pre-Recorded Content to Large Online Audiences

Award Number: 0750136
Program Manager: Errol B. Arkilic

Start Date: February 15, 2008
Expires: January 31, 2010
Total Amount: $512,000

Investigator: Mike O'Neal, mike@nft-tv.com
Company: Network Foundation Technologies
818 Nelson Avenue
Ruston, LA 71272
Phone: (318) 257-5432

Abstract:

This Small Business Innovation Research (SBIR) Phase II project has two technical goals. In Year 1 the focus is on increasing the video quality (bit rate) of NFT delivered broadcasts, while keeping bandwidth costs low. In Year 2 the focus shifts to expanding product support to Mac and other non-Windows systems. Network Foundation Technologies (NFT) has developed a patented distributed broadcast technology that overcomes many of the current bottlenecks. The key difference between the NFT approach and the traditional approach is that with NFT the computers and Internet connections of the viewers watching a broadcast help deliver that broadcast on to other viewers. Network Foundation Technologies' products and technology have the potential to significantly impact the way television-style broadcasting is conducted over the Internet, greatly increasing the number of voices that can be heard. While NFT's near term goal is "to bring television to the Internet", the long term goal is to give ordinary citizens their own "online television stations."

Title: SBIR Phase II: TRX Sentinal First Responder Tracking System

Award Number: 0750498
Program Manager: Ian M. Bennett

Start Date: February 1, 2008
Expires: January 31, 2010
Total Amount: $512,000

Investigator: Carole Teolis, carole@technosci.com
Company: Trx Systems Inc
387 Technology Drive
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Phone: (240) 790-0620

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the critical problems of tracking and monitoring firefighters or other first responders inside structures. Whereas many available systems such as GPS fail indoors or require an overwhelming number of access points to obtain accurate information, our system requires only a base station that can be quickly set up at a command post outside (or inside) a building and small devices worn by the responders. Our system sets up a mesh network to communicate data amongst responders, as well as between the responders and the command post base station(s). The mesh network extends the range of the base station by allowing data to be relayed through another team member if a responder goes out of range. Our prototype system has been demonstrated to provide accurate tracking and location of personnel performing simple motions in complex structures from a base station outside of the structure. This project will focus on improving tracking algorithms such that complex motions can be recognized and accurately tracked. The expected outcome of the project is a much improved interface between the typical command center and the first responders. The initial market impacted by this project development is firefighter location and monitoring. Firefighting is one of the most dangerous jobs in the US. An average of 95 firefighters have been lost every year over the past decade. Some of these deaths could have been prevented if only the firefighter's distressed condition and exact position were known. No commercial technology currently exists that pinpoints the location of a downed firefighter. Critical time can be wasted before a downed firefighter is even first detected. Subsequently, critical resources are often diverted in frantic searches in hazardous conditions and extremely poor visibility. The seconds saved by knowledge of firefighter alarms and their positions could mean the difference between minor and severe injuries or death.

Human/Computer Interface

Title: SBIR Phase II: Multi-Party Peer-to-Peer V3oIP

Award Number: 0750558
Program Manager: Errol B. Arkilic

Start Date: January 15, 2008
Expires: December 31, 2009
Total Amount: $495,154

Investigator: Milton Chen, milton.chen@vsee.com
Company: VSee Lab
3188 Kimlee Drive
San Jose, CA 95132
Phone: (510) 823-3564

Abstract:

This Small Business Innovation Research (SBIR) Phase II project extends the PI's Phase I to create a theoretical bandwidth and latency efficient multimedia streaming framework for communication. The ultimate goal is a software system that achieves less than 150 msec one-way end-to-end delay (the typical delay of telephone) for a 10-30 site meeting supporting wideband audio, full motion video, and application/desktop sharing over broadband networks. The industry norm to achieve multiparty video/web conferencing is the client-server architecture. Client-server architecture is expensive to deploy due to the number of servers required and the bandwidth required at the server nodes. Peer-to-peer approaches have been successfully used for large scale file sharing. However, peer-to-peer approaches have been relatively unexplored to scale the number of participants in a single meeting. This research combines real-time network sensing and the domain knowledge of video and web conferencing to create a scalable and cost effective peer-to-peer streaming algorithm. The maximum number of sites in a multiparty videoconferencing is typically 4-6. Given the limited screen resolution of a laptop/desktop, methods for showing 10-30 full motion video and a shared application are relatively unexplored. Poor user experience from inadequate user interface is a major barrier to the adoption of previous video/web conferencing tools. This research combines recent human factor discoveries to create a novel user interface that intuitively supports multiparty communication. Since AT&T invented videoconferencing in 1927, videoconferencing has been one commercial failure after another. The PI's previous research suggests that such failures are rooted in inadequate knowledge of the human factor requirements of videoconferencing. Based on previous research, they are developing a commercial software system which will make substantial impact on telework, remote education, and humanitarian operations. This project aims to create a low-cost peer-to-peer alternative to client-server architectures for large scale meetings. If successful, the architecture proposed in this effort could have significant commercial impact.

Information Management and Retrieval

Title: SBIR Phase II: Mobile Visual Search Engine

Award Number: 0822713
Program Manager: Errol B. Arkilic

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Gerald Pesavento, gerry.pesavento@iqengines.com
Company: IQ Engines, Inc.
821 Pine Lane
davis, CA 95616
Phone: (530) 219-2192

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a biologically-inspired image search and recognition technology to provide rapid object information retrieval from a mobile phone camera. The end result is that potentially any object in the real world is now "clickable": a picture of an object provides a hyperlink to the Internet. The proposed system utilizes a new method for sparse, multi-scale image representation based on the monogenic signal, a 2D generalization of the analytic signal that is robust to image transformations. By 2010, it is estimated that there will be over 1 billion mobile phones with cameras.The mobile phone is becoming an important connection between people and the digital world. The applications for mobile search technology are enormous and include national homeland security, product information retrieval (such as environmental ratings, pricing, or specifications), vision support for the blind, accessing object information for the disabled, and general purpose information retrieval including remote visual data analysis and inspection. Search technology has brought about many profound societal, educational and scientific benefits in the past decade. The proposed mobile image search technology will extend those benefits to a broader base of users and applications.

Title: SBIR Phase II: OpenBio Workbench for Sharing of Mathematical Models in Drug Discovery

Award Number: 0822975
Program Manager: Errol B. Arkilic

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $496,357

Investigator: Taeshin Park, tspark@alum.mit.edu
Company: RES Group, Inc.
11 Cambridge Center
Cambridge, MA 2142
Phone: (617) 834-2416

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop an innovative software platform called OpenBio Workbench that will enable researchers in drug discovery to easily access and share mathematical models and model results. Modeling is becoming increasing important, motivated by the FDA's drive to modernize the drug discovery process and the advent of emerging fields such as Systems Biology. A broad adoption of modeling has been limited, however, because the current practice requires programming and computational skills not typically possessed by experimental researchers in biological sciences. In the Phase II project, the tool's capabilities will be augmented by allowing users to calibrate models by including experimental data, adding innovative advanced modeling tools such as model building. The potential commercial value of this workbench is high as the pharmaceutical industry is investing significantly in mathematical modeling and Systems Biology aiming to overcome both the high costs of drug development and the stagnation in the discovery of new drugs since the 1990's. Further, aging populations in developed countries are going to cause sharp increases in health care costs, while at the same time there are serious budgetary pressures (both from government and private insurers) to keep health care costs under control. Thus, methods that speed up the research cycle and reduce development costs for new drugs and treatments are going to become increasingly important.

Title: STTR Phase II: Integrating Online Analytical Processing (OLAP) and Ontologies to Discover Inconsistencies in Expectations for Supply and Demand

Award Number: 0750543
Program Manager: Errol B. Arkilic

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $512,000

Investigator: Peter Moore, peter@clados.com
Company: Clados Management LLC
133 Saint Matthews Avenue
San Mateo, CA 94401
Phone: (650) 231-0494

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project aims to produce a software application that dramatically improves a manager's ability to allocate resources to productive uses. With advances in Online Analytical Processing (OLAP) and ontology technology, the tool has the potential to enable the discovery of future supply and demand imbalances for teams of business analysts. The objective is to produce at least one Investable Inconsistency per day by the end of the research period. The Phase I project produced unanticipated innovations that may have broad utility in both the OLAP field and the ontology field, and with these innovations, the software platform shows promise for transforming the essential practice of analysis in the field of market research in support of investment decisions. The Phase II project, if successful will result in technology that extends this promise to a broad audience, educating users in best practices for investment analysis and enabling them to materially improve their allocation of resources.

Title: SBIR Phase II: Collaborative Patent Drafting Software

Award Number: 0750550
Program Manager: Errol B. Arkilic

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $500,000

Investigator: Rocky Kahn, rocky@teampatent.com
Company: Team Patent LLC
5832 Birch Court
Oakland, CA 94618
Phone: (510) 601-7625

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a patent-drafting software tool which addresses two critical problems currently preventing inventors from closely collaborating with patent attorneys: 1. Attorneys need tools to hold their comprehension of and manipulate the relations in the document while ensuring they're used correctly and 2. Inventors need an ability to share the attorney's comprehension of the relations, review the application at any time, and author parts of the specification without requiring extensive oversight or rework by the attorney. The project will entail prototyping a set of collaborative knowledge representation methodologies, which are not currently available on any platform and which require cutting-edge, broadband-enabled infrastructure. The U.S. economy relies heavily and increasingly upon intellectual property, and patents are the primary currency of this economy. 500,000 utility patent applications will be filed in 2008 with the U.S. Patent and Trademark Office (USPTO), a quantity that has been growing annually at 7.5% for a decade. As patents become more significant in the operations and outcome of U.S. businesses, it becomes increasingly important to assure that the system can be efficiently traversed by high-technology startups, which will provide the next-generation of innovations. A U.S. patent application typically costs $10,000 and requires either specialized knowledge or the time to learn how to navigate the process. The large expense and difficulty of patents leads companies to triage protection for their innovations, leading to curtailment of promising activities due to the lack of a budget for patent protection. They must decide whether to divert precious capital and engineering resources from product development to patenting. The proposed patent-drafting software tool will encourage greater participation in the intellectual property economy by reducing costs, increasing relevance, and allowing inventors to actively participate in drafting the application.

Title: SBIR Phase II: Automated Community and Sentiment Mining for Global Media Preference Understanding

Award Number: 0750544
Program Manager: Errol B. Arkilic

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $500,000

Investigator: Tristan Jehan, tristan@echonest.com
Company: The Echo Nest Corporation
48 Grove Street
Somerville, MA 2144
Phone: (617) 628-0233

Abstract:

This Small Business Innovation Research (SBIR) Phase II project applies data mining and machine learning techniques to both natural language description and Internet link graphs to model communities in order to predict preference, taste and sentiment for different kinds of media (music, TV, online media, video games, books). Current contextual information mining approaches that scan the text on a page for advertisement or recommendation ignore valuable community connections inherent in most self-published Internet discussion. Sentiment and opinion extraction systems operating on full text create challenging language parsing problems are fraught with issues of scale and adaptability. The identification systems can automatically categorize anonymous Internet writers or website visitors into specific demographic communities based on their tastes in many kinds of media. The Phase II research project approaches opinion extraction with a bias-free learning model based on training from known online corpuses that can be adapted to different languages and learns in real time as more data becomes available for high accuracy. Current personalization and marketing approaches either look at the "clickstream" of an anonymous user, leading to equally anonymous recommendations for popular movies and music -- or by scanning a surface-level overview of the text, leading to keyword advertisements with limited contextual understanding of entertainment content and community sentiment. The project plans to fully integrate people-focused community and sentiment analysis technologies into an autonomous, learning and scale-free "media knowledge service" for digital entertainment providers and marketers that can change the way digital content is marketed and sold.

Title: SBIR Phase II: The Media Fusion Project: A Distributed Architecture for Mega-Pixel Displays

Award Number: 0750202
Program Manager: Errol B. Arkilic

Start Date: March 1, 2008
Expires: October 31, 2009
Total Amount: $499,999

Investigator: Christopher Jaynes, cjaynes@mersive.com
Company: Mersive Technologies, LLC
137 West Vine
Lexington, KY 40507
Phone: (859) 806-0398

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop and deliver a software media architecture that removes a critical barrier to the widespread use of multi-projector, high-resolution, ultra definition displays. The approach defines a set of layered abstractions from the low-level display driver to higher-level protocols including multi-user display use and security. This model is the bedrock of a new display architecture that will not constrain future display innovations, allow content developers and producers to communicate to current and future display systems, and acts to isolate the underlying complexities of new display technologies from users. Building on this new architecture, the Phase II project will implement a software-based Display Operating System. The project is motivated by the perception that we will soon live in a world where displays cease to be individual discreet devices but rather become an extension of our environment; a limitless fabric of pixels. The potential impact of this innovation is significant, by removing the usability and cost barriers normally associated with ultrahigh-resolution displays, applications once available to only a select few can become commonplace. This has the potential to change the advanced visualization, media interaction models, as well as the way in which we interact with our computational environments.

Title: SBIR Phase II: SAFE: Behavior-based Malware Detection and Prevention

Award Number: 0750299
Program Manager: Errol B. Arkilic

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $500,000

Investigator: Hao Wang, hwang@novashield.com
Company: Novashield, Inc.
1200 John Q Hammons Dr
Madison, WI 53717
Phone: (608) 833-2610

Abstract:

This Small Business Innovation Research (SBIR) Phase II project has the objective of implementing a commercially-competitive, host-based, malware detection and prevention system. During Phase I, a host-based malware detection system that demonstrated the practicality of detecting a malicious process by dynamically monitoring its system events was developed. The prototype called SAFE (Secure Activity Filtering Engine) filters system events using a stateful policy engine whose policies specify malicious behavior and the appropriate response. Because the technology does not rely upon the detection of "signatures" (i.e. patterns of bytes), it can detect previously unseen malware. During Phase II a number of significant enhancements to the policy engine including a checkpoint/rollback capability will be developed. The proposed functionality removes file system and registry changes associated with a process when a policy violation is detected. The ability to delay detection of malicious behavior until detailed system events are observed provides a just-in-time detection capability that increases the accuracy of the detection process while reducing false positives. The SAFE technology has the potential to demonstrate an effective approach to combating at least two of the dominant trends in the threat landscape. One such trend is the crafting of blended threats which use multiple infections vectors like email readers, web browsers, and messaging software to infect a host computer. Another trend is the popularity of "malware toolkits" which can be used by malware writers to quickly generate multiple variants of the same virus. The rapid proliferation of obfuscated variants is a potent threat to traditional signature-based solutions on two fronts: the rate of malware infection may overwhelm efforts to produce signatures to detect these variants and the logarithmic increase in the size of signatures databases reduces the performance of signature scanning. The SAFE technology addresses both of these trends. The stateful policy engine can correlate non simultaneous events across multiple sub systems and processes and thus detect and block blended threats. If successful, the architecture of the proposed system will have the potential to address a myriad of security threats and make a commercially-significant impact.

Teaching & Learning

Title: SBIR Phase II: Artificial Intelligence Tutoring and Assessment for Teacher Development

Award Number: 0822696
Program Manager: Ian M. Bennett

Start Date: July 15, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Benny Johnson, johnson@quantumsimulations.com
Company: Quantum Simulations Incorporated
5275 Sardis Rd
Murrysville, PA 15668
Phone: (724) 733-8603

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project focuses on bringing the power and benefits of artificial intelligence tutoring technology to the arena of teacher professional development (PD). The proposed innovation is a teacher professional development system built on the principles of artificial intelligence, and delivered via the Internet. Similar to a flight simulator, this technology will offer a realistic but benign opportunity to test and expand a teacher's preparedness through practice with realistic classroom situations. A key objective is the creation of a classroom simulator which incorporates a virtual master teacher, to help teachers deepen their content understanding, learn to respond to student questions more effectively, practice proven pedagogical techniques for improving student understanding and conduct self-monitoring and assessment before getting in front of a live class. An increasing number of schools are forced to rely on new or out-of-field teachers to fill the gap for teaching science and mathematics, often resulting in a substantial decline in quality, depth and individual attention students receive. Because of the well-documented problems of teachers teaching out of their content areas, and low-performing schools having greater percentages of lesser-qualified teachers, states have established stronger criteria for in-service teachers and newly qualifying pre-service teachers. Middle and high school science and mathematics are the areas where most out-of-area teaching is occurring. In the National Center for Education Statistics (NCES) report, 'The Condition of Education', a key finding is that high school students in high-poverty, high-minority schools were more often taught science, mathematics and English courses by out-of-field teachers than their peers in low-poverty, low-minority schools. This research is expected to impact these issues and in addition address the goals of the American Competitiveness Initiative and the requirements for highly qualified teachers identified in the 'No Child Left Behind' initiative.

Title: SBIR Phase II: OptDiverse: Innovative Technology to Enhance Workforce Diversity, Capabilities, and Performance

Award Number: 0750045
Program Manager: Ian M. Bennett

Start Date: April 15, 2008
Expires: March 31, 2010
Total Amount: $439,646

Investigator: Fred Glover, glover@opttek.com
Company: OptTek Systems, Inc.
1919 Seventh Street
Boulder, CO 80302
Phone: (303) 447-3255

Abstract:

This Small Business Innovation Research (SBIR) Phase II project seeks to refine an algorithmic approach and develop prototype software for workforce optimization with a focus on diversity planning and management. This project is expected to achieve the following four major objectives: 1) further enhance and extend the core technology created during Phase I and endow it with added capabilities that will be valuable for marketability as well as effectiveness; 2) enhance external communications - the software must communicate effectively with the user and database systems. In Phase I, rudimentary communications were established. During Phase II, the system will be greatly enhanced to allow for more effective use; 3) develop software as a service architecture - for greatest market penetration, the software will be deployed via the web. The system architecture will be redesigned to accommodate this requirement; and 4) perform alpha-testing - internal and external testing is critical to releasing a high-quality product. The Phase II research will strengthen the technical aspects of the product while significantly improving its ease of use, producing a system ready to enter the market. The commercial applications anticipated for the software system are to first enhance the performance of workforce diversity planning and then evolve to supporting the optimization of the entire workforce. The technology is expected to have a significant impact on the broader inclusion of under-represented talent in the workforce. We also expect the technology to lead to improved organizational performance by enabling better decisions in recruitment and retention of all employees. The software will permit an organization to model and simulate critical patterns between policies, programs, initiatives, as well as other factors such as practices and compensation. The impacts of this research include the potential to: 1) design a more effective approach (simulation/optimization) to diversity planning and workforce optimization, increase workforce diversity, capabilities, and performance; 2) support a significant social and economic initiative; 3) become appealing to attract investments as it significantly increases return and minimizes risk in diversity and workforce planning; 4) add to the body of knowledge in human resource management and decision sciences that may be leveraged to permit additional research and development.

Title: SBIR Phase II: Adaptive Authoring for Compound XML Documents: Collaboration Tools and eLearning Content Creation for STEM

Award Number: 0750520
Program Manager: Ian M. Bennett

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $499,920

Investigator: Samuel Dooley, sam@integretechpub.com
Company: Integre Technical Publishing Company, Inc.
4015 Carlisle NE, Suite A
Albuquerque, NM 87107
Phone: (505) 889-8189

Abstract:

This Small Business Innovation Research (SBIR) Phase II project seeks to develop rich-media adaptive authoring tools for e-learning content creation for collaborative documents for science and mathematics. The proposed objective is to remove technical barriers that impede development and deployment of e-learning content, and to advance tools that create structured content from multiple cooperating document types. The research objectives of this Phase II project will extend the Lexicon adaptive authoring framework developed in Phase I, as measured by compound document authoring issues exhibited by the QTI XML binding, which we will use as a vehicle to advance the adaptive authoring framework. The project will elaborate the Lexicon operator declarations to provide conventional authoring behavior needed for QTI markup elements, according to a progressive schedule of regular project milestones. At the end of the project, it is anticipated that the Lexicon will represent an adaptive authoring tool for rich-media collaborative documents with full language support for QTI markup, as a means for authoring and delivering e-learning content. Additional configuration language improvements and configuration authoring tools will position Lexicon to adapt to a wide range of compound XML document types for e-learning content, and extended programming interfaces will enable Lexicon to embed into a wide range of collaborative e-learning applications. Education in the U.S. is currently undergoing a transition to the digital age that will impact every aspect of teaching and learning. The current generation of collaboration tools are text-based,and do not support the notation needed to communicate mathematics. This project seeks to develop a suite of collaboration tools that have native support for mathematical notation, so that students and instructors can communicate scientific and mathematical concepts more effectively. This Phase II project aims to will extend the Lexicon adaptive authoring framework developed in Phase I, to support embedded semantic markup needed to deliver rich instructional content, and to position Lexicon to support a series of collaborative e-learning applications that are enabled by a relatively small amount of semantic markup: MathIM, an instant messaging application, prototyped during Phase I, that allows users include mathematical notation in person-to-person chat messages; MathWiki, a web-based forum application that supports communities of users who share an interest in topics that require mathematical notation; MathSpace, an online authoring environment for creating student worksheets; and MathME, or the Math Media Environment, a 'virtual notebook' in which students can record the work they are doing online.

Title: SBIR Phase II: A Standards-Based High School Symbolic Geometry System

Award Number: 0750028
Program Manager: Ian M. Bennett

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $527,500

Investigator: Philip Todd, ptodd@saltire.com
Company: Saltire Software Inc
12700 SW Hall Blvd
Portland, OR 97223
Phone: (503) 968-6251

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop an interactive symbolic geometry system that integrates algebra and geometry and focuses on high school mathematics. The absence of such a system has led to a technology gap in mathematics education between the geometry year in high school and the college level calculus sequence. The result of this project will be a software system along with learning materials which fills that gap. The National Council of Teachers of Mathematics (NCTM) standards include the visualization of three-dimensional figures and the mapping between certain three-dimensional surfaces and their two-dimensional unfolding or projection onto the plane. To address this, the project will create a three dimensional symbolic geometry system and in the process will break new ground both from an algorithmic and a user interface perspective. The creation of geometric models dependent on discrete but possibly indeterminate parameters, for example, a general n-gon, is an important pedagogic device for the study of the limits of geometrical figures. Such a facility poses new design and user interface challenges ranging from the definition of the general form of the dependence to the display of a geometrical figure with an indeterminate number of primitives. This Phase II project addresses the need for solid mathematics skills required for college-bound students and for those going directly into the workforce. Specifically, this project focuses on the learning of algebra, and its linkages with geometry. To date, no application exists that integrates algebra and geometry. The integration of technology itself within the learning of mathematics is one of the NCTM's six key principles of school mathematics. The project will incorporate geometrical constraints in addition to geometrical constructions and hence, unlike any other current educational system, directly address the workforce/professional requirements of a geometry system.

Title: SBIR Phase II: 3D Human Functional Anatomy for Middle and High School Education

Award Number: 0750352
Program Manager: Ian M. Bennett

Start Date: March 15, 2008
Expires: February 28, 2010
Total Amount: $493,537

Investigator: Robert Levine, rlevine@archiemd.com
Company: ArchieMD, Inc
1602 Alton Road #126
Miami Beach, FL 33139
Phone: (305) 981-4830

Abstract:

This Small Business Innovative Research (SBIR) Phase II Project combines 3-D computer graphics and gaming technology to provide a non-linear, immersive learning environment for science education in the human anatomy and physiology domain. Modern computer-simulations present a unique ability to present scientific information in an easy to understand manner. Technology advances in computer graphics present opportunities to present higher quality visual models in an interactive fashion that can convey the scientific process in a way which makes learning science fun and interesting for the students while capturing their enthusiasm for science. The proposed project will develop a toolkit consisting of 3-D visualizations for teaching human anatomy and physiology and interactive simulation environments for exploring the human body from a first person point of view. It is envisioned that simulations will be used in conjunction with traditional lectures while the interactive environments will provide immersive reinforcement learning. Phase II development will be validated by an independent evaluation that measures the products effects on achievement and interest in science. This project will play a role in increasing achievement and interest in science. In order for the nation to remain competitive in the life sciences, the nation must produce an adequate number of students who pursue degrees in life sciences. The proposed research is targeted at improving students' interest and achievement in science, and thus greatly impact the disturbing drop in recent years in United States' student interest in pursuing science education and careers, and the rapid increase in demand in the labor market for science-based degrees for the labor market.

Title: SBIR Phase II: Online Chapter Marketplace for Biology Learning Materials

Award Number: 0749862
Program Manager: Ian M. Bennett

Start Date: March 15, 2008
Expires: February 28, 2010
Total Amount: $499,999

Investigator: Eli Meir, meir@simbio.com
Company: SimBiotic Software
148 Grandview Ct
Ithaca, NY 14850
Phone: (212) 658-9104

Abstract:

This Small Business Innovation Research (SBIR) Phase II project focuses on the development of an electronic replacement for reading materials currently used by the majority of biology undergraduate students. This replacement will combine smaller reading sections with more active learning components such as simulated experiments. The system to be developed will be open to contribution from a wide variety of authors and subject matter experts. Textbooks are currently used in most college biology environments to present material to students. However, learning through textbooks occurs primarily through memorization. This project is developing new innovative ways to facilitate productive learning techniques, and for configuring take-home assignments of biology students to be more active, without losing the content needed for understanding biological systems. This project has the potential to transform one of the pillars of science education, the textbook, from a passive reading instrument to an active learning tool. This could contribute to the improvement of learning gains for the at least one million students per year that participate in college level biology classes each year in the U.S. On a broad scale, this project eventually could help improve learning across all the sciences.

Title: SBIR Phase II: A Visual Language for Mathematical Model-Making

Award Number: 0750432
Program Manager: Ian M. Bennett

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $532,000

Investigator: Christopher Hancock, ch@tertl.com
Company: Tertl Studos LLC
1 Hopkins St.
Montpelier, VT 5602
Phone: (802) 223-3044

Abstract:

This Small Business Innovative Research (SBIR) Phase II project continues the development of a visual interface that allows students to construct and investigate mathematical models. This research is undertaken with the goal of creating a general-purpose environment in which students, teachers, and content developers may benefit from being able to create such models for classroom use. The specific research objectives for this project address the following issues: 1) the underlying algorithmic support to achieve a concrete user interface; 2) the completion of the core functionality; 3) classroom usability and curricular integration; and 4) learning outcomes. The innovation embodied in this project responds to a national need for improved algebra education, and to increased emphasis on, and demand for, environments that provide visual, dynamic access to mathematical ideas and thinking processes.

Universal Access

Title: SBIR Phase II: (IT-B5) Feasibility to run novel voice interface on a low-power microcontroller

Award Number: 0822743
Program Manager: Ian M. Bennett

Start Date: August 15, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Seth Cameron, seth@cameronsound.com
Company: CameronSound, LLC
2004 Centennial Dr.
Great Falls, MT 59404
Phone: (801) 474-0134

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project will implement a miniature information management system that is suitable to the access requirements for visually impaired users. Current information technologies for the visually impaired are slow and difficult to operate while holding a white cane or guide dog. Visually impaired people will benefit greatly from a hands-free/eyes-free information system that is much faster to operate and easier to access. The project will develop a voice-operated personal digital assistant (PDA), called Vivian, which performs 10 times faster than Braille PDAs. The outcome of the Phase I study demonstrated the feasibility of real-time speech processing algorithms on integrated microcontrollers without hardware floating-point arithmetic. The outcome of this Phase II project is anticipated to result in a wearable device similar to a state of the art media player with 10X faster processing and 10X smaller in size. With more than 160 million visually impaired people worldwide, 10 million in the US alone, the proposed research is a critical step towards a device that will address their mobile information management needs significantly better than current alternatives. Moreover, this device should impact mobile information management for sighted people. The results of usability trials with sighted users speaking multiple languages conducted during the Phase I project, indicate that the outcomes of a powerful and fast alternative human computer interface to graphical user interfaces for sighted and visually impaired users. Additionally, this voice technology is suitable for integration into mobile appliances such as mobile phones for which over 300 million were sold in 2007.

Title: SBIR Phase II: Electronic Orientation and Navigation System for People with Visual Impairments

Award Number: 0822972
Program Manager: Muralidharan S. Nair

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Michael Manning, michael@manningrf.com
Company: ManningRF, LLC
2718 Winningham Rd.
chapel hill, nc 27516
Phone: (919) 967-5438

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project will design, build and test a new type of orientation and navigation (O&N) system for people with visual impairments. While GPS-based solutions show promise in outdoor environments, there are currently no widespread O&N devices that are designed for use in indoor environments. This makes it difficult for people with visual impairments to navigate through indoor public spaces. The purpose of this research will be to complete development of a new type of radio frequency identification (RFID) system, in which intelligent, variable-range active RFID beacons are programmed with information about their locations and placed through indoor environments like schools, shopping malls and museums. This information will be accessible to people with visual impairments via a small RFID receiver worn on the user?s belt. Information will be conveyed to the user via a text-to-speech interface. Results from field testing have demonstrated that the device helps people with visual impairments to navigate through an unfamiliar environment. Phase II research will complete development of the communications protocols and interface techniques that give the system its unique capabilities for delivering speech-based information to people with visual impairments. There are 10.4 million people with visual impairments in the U.S., and this research will lead to an inexpensive commercial product that will greatly enhance their ability to navigate in unfamiliar surroundings. The market for this technology includes those who will purchase the RFID receivers and the RFID beacons. This includes people with visual impairments, as well as the owners and tenants of public spaces, such as office buildings, schools, malls, museums and government facilities. Also, because of the simplicity of the interface, the system will be useful to Orientation and Mobility educators working with young children to develop spatial concepts.

Title: STTR Phase II: Developing a Mixed Reality Rehabilitation System

Award Number: 0750551
Program Manager: Ian M. Bennett

Start Date: April 15, 2008
Expires: March 31, 2010
Total Amount: $500,000

Investigator: Mark Wiederhold, mwiederhold@vrphobia.com
Company: The Virtual Reality Medical Center
6160 Cornerstone Ct. East,
San Diego, CA 92121
Phone: (858) 642-0267

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project investigates further development of a mixed reality (MR) haptics-based virtual reality system in preparation for commercialization. This MR system will aid the physical rehabilitation of stroke patients with upper extremity disabilities. This MR system includes hardware and software designed to induce neuroplastic changes and increase mobility through mental practice, video capture body movement, and engaging mixed reality scenarios. The goals of this project will be to file the appropriate paperwork for regulatory approval of the system in preparation of use on the market, improve the system in scenarios, add mental practice and video capture scenarios, program metrics into the system, develop sensor tracking interface and telerehabilitation capabilities, and conduct clinical trial to determine system safety and efficacy. Headed by a collaborative team of qualified investigators from The Virtual Reality Medical Center, the University of Central Florida's Institute for Simulation and Training, and Kindred Hospital (consultant), this project will increase the understanding of state-of-the-art adjuncts to traditional stroke rehabilitation therapy. To date, no MR rehabilitation tool that facilitates mental practice, includes video capturing, and aids physical therapy, has ever been commercialized. The resulting marketable product will be sold to rehabilitation facilities. This STTR Phase II project will lead to the commercialization of new software and hardware that can be used for further technological developments in mixed reality systems, including those for other applications such as prosthetic limb rehabilitation for amputees. The success of this project will also add to the scientific knowledge base on what is known about mental practice in rehabilitation. With over twelve million families in the U.S. alone that have members with a physical development, success in this project will therefore pave the development and commercialization of future rehabilitation systems to help this broad and underserved population. By increasing stroke patients' upper extremity mobility and rate of recovery, this system will also increase their activities of daily, enable at-home physical therapy, relieve some of the burden of caregivers, and decrease costs in lost productivity and hospital length of stay. The commercial spin-out company resulting from success of this project will be located near the University of Central Florida's College of Medicine where future joint projects will include recruiting and training students (including those from underserved populations) in research. The commercial spin-out company will also create new jobs, taxable revenue, and income within the Florida High Tech Corridor.

Title: STTR Phase II: Low-Cost Portable Telerehabilitation System for Intelligent Stretching and Remote Assessment of Hypertonic Arm Joints

Award Number: 0750515
Program Manager: Muralidharan S. Nair

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $485,564

Investigator: Yupeng Ren, yupeng.r@gmail.com
Company: Rehabtek LLC
2510 Wilmette Ave.
Wilmette, IL 60091
Phone: (847) 853-8380

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II research project seeks to develop technologies needed for rehabilitation of post-stroke patients with neurological impairment. For those patients, physical therapy followed by timely examination is the cornerstone of the rehabilitation. However, not all patients receive sufficient therapy due to limited access to expert healthcare services. There is a need for a tele-rehabilitation system that can stretch the spastic/contractured joints under accurate control at a remote location and provide remote access to expert healthcare services. This Phase II research will focus on improving the technology and making it suitable for the market by improving the design of the tele-rehabilitation system for multi-purpose applications to treat/evaluate multiple joints in the arm. It will make the portable device stand-alone with built-in capabilities of passive stretching, voluntary movement exercise, and tele-assessment of joint range of motion, stiffness, spasticity, and catch displayed in an intuitive way. Finally, a clinical test of the tele-rehabilitation system on stroke survivors will be conducted. This portable and low-cost stretching device is suitable for home use, making frequent and convenient treatment accessible to a large number of patients. It can potentially have broad impact on rehabilitation of stroke and other neurological impairments. The intelligent stretching concept was developed to insure safe and effective treatment and it will also be useful in other applications dealing with human-machine interface.

Environmentally Benign Technology

Title: SBIR Phase II: High Efficiency Low Cost Nitrogen Fertilizer Production from Fly Ash

Award Number: 0822738
Program Manager: Cheryl F. Albus

Start Date: August 1, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Peng Zhang, info@unitedee.com
Company: United Environment & Energy, LLC
111 Ridge Road
horseheads, ny 14845
Phone: (607) 796-0830

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop innovative high efficiency, low cost nitrogen fertilizer manufacturing technology from fly ash. Fly ash is a recycled material from coal power plants that may contain high concentrations of mercury and carbon. Traditional nitrogen fertilizer production uses natural gas as the primary feedstock and is very costly. The traditional fertilizers are water-soluble compounds, resulting in significant loss of fertilizer which in turn pollutes streams and ground water. America's coal power plants produce more than 71.1 million tons of fly ash per year, and most of it is disposed in landfills. The high mercury content in the fly ash makes the disposal more difficult and costly. The Phase II project will bring the viable fly ash nitrogen fertilizer production technology from a laboratory scale to a pilot scale, and will determine the optimal pilot plant operation conditions, produce fertilizer for farmland field testing, and demonstrate its commercial viability. The pilot plant data will be used to understand the importance of design parameters and operating conditions on plant performance, refine the manufacturing plant design, and reduce the risk associated with construction of manufacturing plants. The broader impacts (commercial significance) if this project is successful will be a high volume and highly technical application for fly ash and a value-added high efficiency low cost nitrogen fertilizer. The production of this fertilizer will not be affected by the availability of natural gas. Moreover, the projected production cost of this nitrogen fertilizer is much lower than that of the traditional nitrogen fertilizer. The use of this new nitrogen fertilizer on farms will increase crop production profitability and prevent fertilizer loss and water pollution. By avoiding the landfill disposal of the fly ash, the coal power plants will save millions of dollars. If all the fly ash produced at coal power plants in the US were used to produce nitrogen fertilizer, the amount of nitrogen fertilizer produced could meet the entire US market demand. The success of this new technology will bring a revolutionary change to the traditional nitrogen fertilizer production process and will have substantial environmental, economic, and technical benefits.

Title: SBIR Phase II: Recycling Advanced Batteries

Award Number: 0750552
Program Manager: Cynthia A. Znati

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $512,000

Investigator: Steven Sloop, ssloop@onto-technology.com
Company: OnTo Technologies
63221 Service Road Suite 6/F
Bend, OR 97701
Phone: (541) 389-7897

Abstract:

The Small Business Innovation Research (SBIR) Phase II project will develop process conditions, recycled materials, and recycling of new battery technologies. Phase I demonstrated that the innovative recycling process can produce materials for new batteries from spent batteries. The Phase II recycling research objectives will (1) Survey advanced battery technologies (2) Improve process efficiency and (3) Recondition used materials. Starting with spent batteries, the project recovers materials, examines utility, and develops methods for recondition based upon physical or chemical limiting issues. The anticipated result of this development is establishment of the most efficient process to recycle high performance battery materials. The proposed project establishes the most environmentally friendly advanced battery recycling technology as the solution to the next generation's significant environmental challenge. Today's battery recycling options inefficiently bury, burn, or melt spent batteries. This project addresses needs from battery-reliant industries for low-cost recycling with minimal environmental impact; the developed recycling process is the basis for jobs fundamental to the future portable electronics and electrified vehicle markets. The innovation is based upon knowledge from battery life-limiting mechanisms coupled with green-chemical processing techniques. The research actively involves undergraduate researchers at Willamette University in the development and commercialization of energy efficient technologies.

Title: STTR Phase II: Ultraviolet Activated Chelation (UVAC) for the Recovery of Hg from Industrial Wastewater

Award Number: 0750442
Program Manager: Cynthia A. Znati

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $502,423

Investigator: Anna Casasus, aicasasus@MazTechSolutions.com
Company: Sol-Gel Solutions, LLC
4110 SW 34th Street
Gainesville, FL 32608
Phone: (352) 378-4950

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II aims to further develop and optimize an advanced oxidation technology called Ultraviolet Activated Chelation (UVAC), which utilizes low-energy ultraviolet (UV) light for the removal of mercury (Hg) from industrial wastewaters. The Phase I project achieved Hg concentrations as low as 11 ppt (which is lower than the Hg levels commonly found in rainwater) via this process. The technology has been proven in the bench- and pilot-scales, but further work is required to consistently achieve Hg concentrations below 12 ppt and to obtain the most economical commercial design. The Phase II objectives will include the optimization of design parameters such as filtration, pH, residence time, and UV light characteristics. The effect of various water chemical characteristics on Hg removal will also be studied. It is anticipated that Phase II efforts will result in a robust and economical commercial system employing the UVAC technology for industries to comply with current and pending environmental regulations. The broader impact/commercial potential from this technology will be a process for Hg removal from water to trace levels, this technology is contributing to the protection of human health, wildlife, and the environment. Exposure to Hg, which can occur by consumption of contaminated fish, can affect cognitive thinking, memory, attention, language, and fine motor and visual spatial skills. Additionally some researchers have proposed a link between Hg and autism. A commercially viable solution for Hg removal from water to levels below 12 ppt is lacking. Development of the UVAC technology for the chlor-alkali industry may lead to the commercialization of the technology for other industries, such as coal-fired power plants and dental offices, among others. Further understanding of the UVAC process will enhance the scientific community's knowledge about Hg in the environment, particularly in relation to UV light.

Title: SBIR Phase II: An Innovative Method for Removing Resist from Wafers

Award Number: 0750623
Program Manager: Cheryl F. Albus

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $500,000

Investigator: Hang Ji, hji@uncopiers.com
Company: Uncopiers, Inc.
6923 Redbud Drive
Manhattan, KS 66503
Phone: (785)293-4917

Abstract:

The Small Business Innovation Research (SBIR) Phase II project seeks to develop an innovative, environment friendly method for removing resist from semiconductor wafers. After every lithography step, and the following processing step, e.g., etching or ion implantation, the process-hardened resist must be stripped away and the wafer cleaned. Existing photoresist removal methods (plasma ashing and wet chemical stripping) are proving too aggressive for current state-of-the-art interconnect materials-they tend to degrade and damage low-k dielectrics and corrode copper; they are also detrimental to the delicate device structures. In this project the resist stripping and wafer cleaning are accomplished in a single process step through controlled microcavitation in ultrapure water with no damage to the underlying layers and features. Resist stripping is a growing $2.64B market. The proposed resist remover and wafer cleaner successfully overcome a critical technological barrier facing the IC manufacturing industry today. Beyond the IC manufacturing industry, the microcavitation based layer removal will find applications in all areas requiring controlled thin film removal,e.g., MEMS, PCB, optics, automotive (paint removal), and aerospace. This will be an enabling technology useful in thin film processing. Microcavitation is a chemical free, environmentally friendly technology.

Polymer, Powder, & Composite Systems

Title: SBIR Phase II: Compact membrane reactors for high-purity hydrogen

Award Number: 0750325
Program Manager: Cynthia A. Znati

Start Date: January 1, 2008
Expires: December, 31, 2009
Total Amount: $490,317

Investigator: Subra Iyer, siyer@nrgtix.com
Company: Eneregtics Incorporated
P.O. Box 1745
Brea, CA 92886
Phone: (714) 993-9081

Abstract:

The Small Business Innovation Research (SBIR) Phase II project will develop mini-channel membrane reformers to produce pure hydrogen from gaseous and liquid fuels. Fuel reforming of hydrocarbon fuels to yield high purity hydrogen is, at present, the only means for overcoming the lack of an established infrastructure for hydrogen. Fuel processors must be able to start up quickly, follow demand rapidly, be tolerant to sulfur, and operate efficiently over a wide range of conversion rates. The use of mini-channel reformers, with selective membrane removal of hydrogen at the site of production within the individual reformer stages, will lead to improved efficiency, thermodynamics and kinetics of reforming reactions. If successful, the proposed membrane reformer system will decrease system complexity, reduce costs, and allow ease of control, monitoring and transient response. The proposed technology has significant business opportunities in the business sector for high-purity merchant hydrogen, and in the civilian and military sectors for hydrogen fuel cells, used in portable power and distributed generation. Valuable scientific and technological understanding will also be gained about the behavior of hydrogen-permeable membranes and their use in high-temperature, sulfur-resistant, compact fuel reformers to produce high-purity hydrogen.

Title: STTR Phase II: Durable Functional Coloring of Fiber Reinforced Thermoplastic Structural Composites for High Strength Material Applications

Award Number: 0750194
Program Manager: Cynthia A. Znati

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $500,000

Investigator: James White, jwhite@shepherdcolor.com
Company: The Shepherd Color Company
4539 Dues Drive
Cincinnati, OH 45246
Phone: (513) 454-1231

Abstract:

The Small Business Technology Transfer Research (STTR) Phase II project will demonstrate the ability to color structural composite parts made of thermoplastic polymers reinforced with long (3 mm to 25 mm in length) glass fibers. Today the options are black or natural resin color which limits their design appeal. Colorants are not used in thermoplastic composites for structural applications because they historically caused significant loss in key properties. This breakthrough of successfully using durable, high performance energy managing colorants in long glass fiber reinforced thermoplastic structural materials will open options for a wide range of products in construction, safety, sporting goods, furniture, industrial, transportation and recreational markets. Application prototypes for the transportation and industrial markets will be created in this project. By integrating durable color within structural composite parts, the speed of displacing traditional materials will increase. Thermoplastic composite materials provide clear advantages relative to metals of reduced weight in the part with equal or superior properties, corrosion resistance, and design flexibility, all resulting in significant cost savings. Painting processes can be eliminated with the incorporation of color. The structural long glass fiber reinforced thermoplastics are more durable and result in less waste over time and therefore are better for the environment.

Surface Treatments/Coatings

Title: STTR Phase II: A New Process for Boride Coatings for Manufacturing Applications

Award Number: 0822598
Program Manager: Cheryl F. Albus

Start Date: July 7, 2008
Expires: June 30, 2010
Total Amount: $499,858

Investigator: Rabi Bhattacharya, rbhattacharya@ues.com
Company: UES, Inc.
4401 Dayton Xenia Rd
Dayton, OH 45432
Phone: (937) 426-6900

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project is seeking the transfer and further development and commercialization of a new low temperature metal-organic chemical vapor deposition (LT-MOCVD) technology for boride coatings. The project will work to develop coatings for characterizations of adhesion, microstructure, morphology, composition and hardness. Selected coatings will be tested for friction and wear and corrosion resistance under laboratory test conditions on various common engineering substrate materials. The precursor preparation process will be scaled up and deposition will be done in an industrial scale deposition system. The coating process will be optimized for high hardness and good adhesion. Optimized coatings will be applied to components for testing at end users' facilities under production conditions. The broader impact/commercial potential of wear and corrosion resistant coatings are very attractive for their high hardness and good chemical stability, and have potential for many applications in the manufacturing sector in United States. The process developed in this project, of deposition of borides, will enable a wide spectrum of applications including cutting tools, die casting dies and inserts, transfer rolls for flat glass, components for chemical processes, armament industries, automotive and aerospace industries.

Structural, Engineered, and High Temperature Materials

Title: STTR Phase II: Multi-Wall Carbon Nanotubes Inclusion for Thermal Conductivity Enhancement of Microencapsulated Phase Change Material Slurry

Award Number: 0823115
Program Manager: Cheryl F. Albus

Start Date: July 15, 2008
Expires: June 30, 2010
Total Amount: $499,783

Investigator: Curt Thies, Thiesman@aol.com
Company: Thies Technology
921 American Pacific Dr.
Henderson, NV 89014
Phone: (702) 567-8206

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project seeks to investigate the commercial feasibility of new processes capable of incorporating phase change materials (PCMs) and multi-wall carbon nanotubes (MWCNT) into micro- and nano-capsules thereby producing particles with novel thermal and fluid properties. The primary objective is to take advantage of MWCNT exceptional thermal properties to enhance the thermal performance nano/microencapsulated phase change material (N/MPCM) slurry. Thermally enhanced N/MPCM slurries can provide palpable benefits in the thermal management of commercial and industrial processes and products, from microelectronics devices to large industrial facilities, by providing considerable additional heat capacity and better heat transfer performance. The combined effect of nano/microencapsulated MWCNTs and phase change materials present a unique opportunity to improve the performance of heat transfer fluids beyond current levels. A series of experiments will be carried out to quantify the degree durability, heat transfer enhancements in laminar and turbulent conditions, and in typical heat exchangers. The broader impact/commercial potential of this project will have a lasting impact on the entire heat transfer industry. Direct impacts include lower flow rates, lower pressure drop, smaller heat transfer area and improved heat transfer effectiveness. The project will also elucidate how the new fluid performs in commercially available heat exchangers. The project will also provide unique educational opportunities to undergraduate and graduate students. The success of the project will broaden scientific and technological understanding of enhanced heat transfer fluids in industry as well as in academia. Indirect impacts include enhanced living standard and improved competitiveness. Successful commercialization of the proposed concept will find applications in biomedical, aerospace, homeland security, and energy generation.

Title: SBIR Phase II: Low-Cost Hot Press Die Casting of Graphite-Metal Materials

Award Number: 0823012
Program Manager: Cheryl F. Albus

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $499,734

Investigator: James Connell, jconnell@charter.net
Company: Advanced Thermal Technologies
91 S. Street
Upton, MA 01568
Phone: (508) 529-4413

Abstract:

This Small Business Innovation Research (SBIR) Phase II project seeks to develop an unique hot press die casting technology to be used to produce graphite-metal materials. These materials will be used to produce packaging components for use in high power electronics packaging. There is a critical need for advanced materials with improved thermal properties capable of meeting the thermal management requirements of current and future high power electronic systems. The heat dissipation rate of electronic systems has increased dramatically, as a result of ongoing advances in semiconductor materials, compression of circuit physical architecture, size reduction of packaging envelops and faster switching speed. The technology developed in this project will enable the manufacture of cost effective graphite-metal packaging that offers improved thermal properties critical to thermal management solutions for next generation power electronics. The broader impact/commercial potential of this project will be the development of the hot press die casting technology for use in producing graphite-metal billet materials. The adoption and wide-spread use of the graphite-metal packaging products for electronic systems will enable commercial electronic devices based upon more efficient higher power semiconductor materials that will provide benefit to society in the form of more efficient, longer life electronics; reduced energy consumption; and improved environmental quality.

Title: STTR Phase II: Low-Cost Processing of Nanoporous, Super-Hydrophilic, Multifunctional Coatings for Glass and Plastic Surfaces

Award Number: 0823108
Program Manager: Cheryl F. Albus

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $499,999

Investigator: Uma Sampathkumaran, uma.sampathkumaran-1@innosense.us
Company: InnoSense LLC
2531 West 237Th St, Ste 127
Torrance, CA 90505
Phone: (310) 530-2011

Abstract:

This Small Business Technology Transfer Research (STTR) seeks to develop three significant permanent, self-cleaning, anti-fog coatings for plastic and glass surfaces. Fogging of the windows of a car is a hazard most drivers have experienced at one time or another. Fogging results in poor visibility, and unsafe driving or flying conditions. Durable, anti-fog coatings that provide a permanent solution to the problem have potential to satisfy critical needs, especially for the growing number of aging baby boomers. The broader impact/commercial potential of the coatings has been tested independently; these coatings will be fine-tuned for applications in aircraft cockpit windows, motorcycle helmet visors, and in related personal protective gear. These multifunctional hard coatings can be used as abrasion resistant, anti-fog and anti-reflection coatings on both glass and plastic surfaces. The coatings are made from inexpensive raw materials and simple processing techniques like dip or spray coating suited to forming conformal coatings.

Title: SBIR Phase II: Innovative Two-Phase High-Heat-Flux Heat Exchanger

Award Number: 0750416
Program Manager: Cheryl F. Albus

Start Date: March 1, 2008
Expires: February 28, 2010
Total Amount: $469,109

Investigator: Gregory Cole, gsc@mainstream-engr.com
Company: Mainstream Engineering Corporation
200 Yellow Place
Rockledge, FL 32955
Phone: (321) 631-3550

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to demonstrate an innovative multi-phase-fluid heat exchanger capable of revolutionizing heat transfer for high-heat-flux cooling applications. Initial experiments confirmed that metastable two-phase fluids can produce heat transfer coefficients 40% greater than single-phase fluids at the same flow rate and they have the potential to dissipate heat flux values. The broader impact/commercial potential from the technology will be result in a standardized family of two-phase cold plates that can be used by designers of electronics devices for a wide variety of applications. The new family of two-phase cold plates will be sold in sizes and configurations similar to existing air-cooled devices, but will have significantly increased heat flux dissipation rates and reduced thermal resistances. This project will also provide supporting design information and an Interactive Design Tool for use by the electrical packaging designer. The designer will then be free to package the remainder of the thermal management system based on basic vapor-compression design principals or purchase a system. Additionally, for applications where standard thermal components will not work, this project will provide custom solutions.

Title: SBIR Phase II: Innovative Isotropic Ultra-High Thermal Conductivity Diamond Composite Materials

Award Number: 0750177
Program Manager: Cheryl F. Albus

Start Date: January 1, 2008
Expires: December 31, 2008
Total Amount: $531,726

Investigator: David Curliss, david.curliss@p2si.com
Company: Performance Polymer Solutions Inc.
91 Westpark Road
Centerville, OH 45459
Phone: (937) 298-3713

Abstract:

The Small Business Innovation Research (SBIR) Phase II project will further develop and demonstrate an innovative class of composite ultra-high thermal conductivity materials for solid state electronics thermal management applications. There exists a growing need for high thermal conductivity materials that exhibit greatly increased isotropic thermal conductivity and lower density compared to existing thermal conductivity materials and composites. Materials with these characteristics do not presently exist, but are enabling for many other future applications. Under the Phase II effort, the P2SI Team will develop these materials and characterize the fundamental structure-property-processing relationships to enable manufacturing scale-up and commercialization. The P2SI concept is for an "Engineered Material" where the processing behavior and the resulting macroscopic performance (thermal conductivity) is a unique function of the composite architecture. Building the proposed ultra-high isotropic thermal conductivity materials from a multi-scale constituent level represents a leap in technology that was first developed from the fundamental level and validated in the Phase I program. The impacts of this research are twofold: providing a foundation for a new technology in materials science research; and utilizing these fundamental findings to develop and engineer enabling materials to meet growing needs in industry for thermal management applications.

Manufacturing Processes

Title: STTR Phase II: Modulation-Assisted Deep Hole Drilling of Micro/Meso-Scale Biomedical Components

Award Number: 0822879
Program Manager: Cheryl F. Albus

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $499,660

Investigator: James Mann, jbmann@m4sciences.com
Company: M4 Sciences Corporation
1800 Woodland Avenue
West Lafayette, IN 47906
Phone: (765) 479-6215

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project aims to develop a Modulation-Assisted Machining (MAM) system with novel capabilities for micro/meso-scale deep-hole drilling of biomedical components. The system is structured around a new device; an accessory developed for computer numerically controlled (CNC) machine tools. This new device superimposes a low-frequency sinusoidal modulation onto machining processes enabling controlled chip formation and easy disposal, enhanced lubrication of tool-chip contact, reduces energy consumption, and, potentially, a reduction in tool wear. When implemented in the appropriate system framework, unprecedented increases in productivity and efficiency of deep-hole drilling processes are envisaged. The broader impact/commercial potential of this project will be commercialize MAM technology in manufacturing of biomedical components and related applications in automotive and aerospace fluid systems manufacturing. Complemented by a strong education and training program. By driving the development of a class of clean machining processes with reduced effluent streams and energy consumption, and improved efficiency, this project will impact sustainable manufacturing for the discrete products sector, with broad societal benefits.

Manufacturing Process Control

Title: STTR Phase II: A Multi-Axis Planning System (MAPS) for Direct Fabrication Processes

Award Number: 0822739
Program Manager: Ian M. Bennett

Start Date: August 15, 2008
Expires: July 31, 2010
Total Amount: $500,000

Investigator: Jianzhong Ruan, jzruan@gmail.com
Company: Product Innovation and Engineering, L.L.C.
11513 Pine Forest Dr.
Rolla, MO 65401
Phone: (573) 308-7175

Abstract:

This Small Business Technology Transfer Research (STTR) (STTR) Phase II research project focuses on the development of an innovative Multi-Axis Planning System (MAPS), for layered manufacturing processes. By enabling current direct metal deposition systems to fully control and utilize multi-axis capability to make complex parts, MAPS will enable fully-automated process planning for multi-axis layered manufacturing processes to directly control metal deposition machines used in automated fabrication. The building of complicated shapes without support structures is a major challenge for current direct metal deposition processes. This proposed Phase II research will continue to research and develop the 'centroidal axis' algorithm in multi-axis slicing, with an emphasis on completeness and robustness for complicated shapes such as geometry with multiple loops and internal structures. This algorithm will allow manufacturing systems to handle parts with multiple loop features. Additional features to be developed under this Phase II project include a deposition visibility map for efficient computation on the collision-free slicing/deposition sequence in a multi-axis scenario, and a '3-D layer' toolpath generation which will provide an alternative turning algorithm for the deposition process. The proposed project will impact the manufacturing industry by incorporating fully-automated multi-axis control capability into the rapid manufacturing industry to produce fully functional metal parts with complicated shapes. This capability will lead to dramatic reductions in lead time and manufacturing costs for high-value, low-volume components with high performance material. Assuming the outcomes are successful, the project will several segments such as aerospace, military, motor sports, automotive, industrial machinery, medicine, dentistry, and consumer products.

Title: SBIR Phase II: Infrared Confocal Measurement System

Award Number: 0750368
Program Manager: Cheryl F. Albus

Start Date: April 1, 2008
Expires: March 31, 2010
Total Amount: $499,401

Investigator: David Marx, dmarx@tamartechnology.com
Company: Tamar Technology
996 Lawrence Drive
Newbury Park, CA 91320
Phone: (805) 480-3358

Abstract:

The Small Business Innovation Research (SBIR) Phase II project will design and construct prototype measurement systems based on near infrared (NIR) chromatic confocal sensor technology. Silicon is transparent in the NIR, and thus the sensor measures the distance to the front and back surfaces of the wafer simultaneously. The sensor will measure deep trenches and vias from the back side so that their aspect ratios are of no consequence. The proposed innovations lie in the sensor design and integration. The proposed measurement systems will address the following semiconductor industry needs: 1) in situ wafer thickness measurement during wafer thinning operations; 2) wafer thickness and shape measurements of ultra-thin wafers; and 3) the measurement of deep, high aspect ratio, etched trenches and vias in silicon. Direct, in situ, measurements during wafer thinning are not currently possible. Neither is the nondestructive measurement of trench depth of many types of deep etched trenches and vias. The measurement of the thickness of ultra-thin wafers (<150 micron) requires greater accuracy for less cost than is currently available. Present technology does not have the resolution for measuring thickness in this thinner range, nor does it have sufficient spatial density on the wafer to accurately describe its shape.

Novel Catalytic Systems

Title: STTR Phase II: Metal Oxide Nanofibers for Filter and Catalyst Support Structures

Award Number: 0822914
Program Manager: Cheryl F. Albus

Start Date: July 1, 2008
Expires: June 30, 2010
Total Amount: $500,000

Investigator: Gary Carlson, carlson@mempro.com
Company: MemPro Ceramics Corporation
PO Box 3806
Copper Mountain, CO 80443
Phone: (303) 224-9999

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project seeks to take advantage of unique performance properties of ceramic nanofiber supported catalysts for applications in automotive, power generation, and chemical process industries. The efficiency of ceramic nanofiber composite materials to capture nano-sized particulates (inorganic and soot) is of particular interest to the automotive industry. Also, an opportunity to field test a composite catalyzed nanofiber material in a power generation facility to remove low-levels of NOx has been developed through commercialization activities within the power generation industry. This is a significant opportunity that will require the fabrication of a ceramic nanofiber/polymeric composite media and a field test apparatus. Successful completion of this opportunity will provide the background necessary to develop a first-generation ceramic nanofiber product. The broader impact/commercial potential of this project will provide the initial detailed examination of catalyst deactivation mechanisms using nanofiber support structures as well as providing a critical investigation of nano-sized particulate capture by nanofiber composite materials. This baseline information is beneficial to define and support future investigations of ceramic nanofiber materials. It is anticipated that catalyzed ceramic nanofiber/microfiber media will maximize the efficient use of catalytic materials (precious metals), enhance destruction of greenhouse gases (NOx and CO) from combustion processes, and capture harmful particulates from various gas process streams. These characteristics will help the power generation industry (fossil fuel burning), the motor vehicle, and the chemical industry meet current and future emission reduction standards while simultaneously benefiting the environment. Also as globalization leads to added pressures on U.S. companies to produce products and materials at a lower cost to remain competitive, reduction in the overall cost of energy production and transportation costs will improve U.S. competitiveness.

Title: SBIR Phase II: Catalytic Filter for Diesel Exhaust Purification

Award Number: 0750259
Program Manager: Cynthia A. Znati

Start Date: January 1, 2008
Expires: December 31, 2009
Total Amount: $500,000

Investigator: Mark Fokema, fokema@aspensystems.com
Company: Aspen Products Group, Inc
184 Cedar Hill St
Marlborough, MA 1752
Phone:

Abstract:

This Small Business Innovation Research (SBIR) Phase II aims to develop a catalytically active filtration device for the continuous removal of particulate matter from diesel engine exhaust. Particulate emissions from diesel engines are viewed as a significant health hazard. New diesel fuel and exhaust emission regulations to be phased in through 2010 require that diesel engine exhaust be extensively cleaned; current purification products are considered too large, too expensive and impose too great a fuel economy penalty on the diesel engine. A particulate filtration system that continuously oxidizes particulate matter using oxygen contained in the engine exhaust and does not require regeneration will be prepared, characterized and refined. The technology that will be developed has the capability to remove ultra-fine particulates with dimensions as small as 20 nm. The broader impact/commercial potential from the technology will enhance the scientific understanding of the synthesis and stability of novel ceramic nanostructures as well as the interaction of soot with dispersed catalytic species. The successful application of this technology will lower the cost of purifying diesel engine exhaust, enabling wider application of highly fuel efficient diesel engines, which will in turn reduce the overall fuel consumption and pollutant emissions.

Photo/Electrochemical Applications

Title: STTR Phase II: Photochemically Switched Chiral Materials for Chiral Nematic Displays

Award Number: 0750379
Program Manager: Cheryl F. Albus

Start Date: February 15, 2008
Expires: January 31, 2010
Total Amount: $500,000

Investigator: J. William Doane, bdoane@kentdisplays.com
Company: Kent Displays Inc
343 Portage Blvd
Kent, OH 44240
Phone: (330) 673-8784

Abstract:

This Small Business Technology Transfer Research (STTR) Phase II project will develop an extremely low cost photodisplay for stored value cards such as gift cards, payroll and income support cards where, for the first time, the value of the card and other information can be displayed to the user updateable with each use. The enabling display technology based on photo switchable chiral materials provides displays that are thin, flexible, rugged, and above all, of such low cost that they add little to the cost of a card. Such photodisplays can provide a high resolution image without the need and cost of drive and control electronics necessary for electronic displays. The photodisplays are optically updated by a display writer in which images such as, numerical, bar codes, and other digital data can be repeatedly updated. The broader impact/commercial potential from this technology will advance the basic and applied science of photochemical chiral compounds for use in liquid crystalline materials by designing, synthesizing and studying new compounds to exploit their unique optical and electro optical effects. Thin, flexible photodisplays developed from these materials are similar to a photographic film, but with the advantage that the image can be erased, rewritten, hidden from view and made to reappear. The photodisplay films have the properties of an electronic display in which the image can be changed but without the driving electronics that forces electronic displays out of many markets. A further advantage of the photodisplay is that it can be mass produced by continuous roll-to-roll manufacturing equipment of the type already developed for the label industry. The photodisplay therefore opens new display markets in many applications such as stored value cards, point of purchase signs, identity and security tags, signage and many other uses where updatable displays were not possible before because of cost, bulkiness and inflexibility of existing electronic displays.

Separations Technology

Title: SBIR Phase II: New Synthetic Approaches to Higher Performance, Lower Cost CO2/CH4 Gas Separation Membranes

Award Number:	0750637
Program Manager:	Cheryl F. Albus
Start Date:	January 15, 2008
Expires:	December 31, 2009
Total Amount:	$523,994

Investigator: Earl Wagener, ewagener@bellsouth.net
Company: Tetramer Technologies, L.L.C.
657 S Mechanic Street
Pendleton, SC 29670
Phone: (864) 653-4339

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a new gas separation polymer membrane technology created in Phase I to significantly improve the ability to separate carbon dioxide from methane. Successful utilization of this new technology to separation of these commercially important gases will provide better performance at lower cost than current methods for separating carbon dioxide and methane. The approach to this problem involves construction of new-to-the-world polymer architecture. The monomer units, which are the building blocks to the polymer membranes desired, will be individually designed to pass carbon dioxide molecules through the membrane faster than methane molecules. The broader impact/commercial potential from the technology developed in the project will be a commercially robust membrane able to resist degradation under operation in real field conditions, which will lead to the production of prototype gas separation modules for field testing and will further expand applications to other gas separations such as oxygen and nitrogen.