

This SBIR Awardee Profile 2002 serves as an introduction to the Seventh Annual Tibbetts Awards winners – small firms, projects, organizations, and individuals who are being recognized at the Tibbetts Awards ceremonies that will take place in Washington, D.C. on October 2, 2002.



Awarded annually by the U.S. Small Business Administration, the Tibbetts Awards honor significant achievements in technological innovation derived from research or R&D conducted through the Federal Small Business Innovation Research (SBIR) program and also individual facilitators of the SBIR program success.

The Awards' namesake ROLAND TIBBETTS designed a program in 1977 at the National Science Foundation (NSF) that became the foundation of today's SBIR program. Prior to joining NSF, Mr. Tibbetts was vice president of two technology firms and a founder and director of one of the first Small Business Investment Companies – a program initiated and administered by the SBA.

Awardee profiles describe notable business, technological, and economic achievements and other accomplishments of the winners in their many different areas of technological endeavor and stages of development. The profiles also demonstrate the wide range of benefits – locally, regionally, and nationally – attributable in part to the research conducted through the SBIR program.



Advanced Optical Systems, Inc.

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Advanced Optical Systems, Inc. (AOS) is a veteran-owned, private company located in Huntsville, Alabama. At AOS, the focus is pushing state-of-the-art optical technology beyond existing boundaries to solve commercial and military problems. Since 1988, when it was founded by Dr. Richard Hartman, AOS has been awarded 14 Phase I contracts. Of these, ten have been completed and have led to seven Phase II contracts and one Phase III contract. The SBIR program has provided the technical foundation for seven non-SBIR projects.

The SBIR program has allowed AOS the ability to grow from a home-based business of one to a thriving staff of 28. AOS has brought together experts in physical optics, optical engineering, lasers, lens design, optomechanics, opto-electronics, and software, enhancing the company's ability to build complete systems in-house.

Dr. Hartman's expertise in missile system engineering comes from a career at the U.S. Army Missile Command, where he was the Director of Research. Dr. Hartman invented and managed the fabrication of the country's premiere indoor laser radar range (U.S. Army Missile Optics Range) and the development of the US's smallest optical image processor (featured on the cover of SPECTRUM magazine). He developed an optical processor system for missile guidance and started the Army's program in optical processing.

Using this optical correlation expertise as a base, Dr. Hartman answered a NAVY Phase I SBIR requirement in 1994 with ULTORTM, an optical based correlator using Fourier transform techniques to perform automatic target recognition and tracking. The feasibility of success was proven in Phases I & II and AOS moved into Phase III development of the correlator prototype. The expertise of the AOS staff was enhanced via these SBIRs as system components for correlators (optics, opto-electronics, opto-mechanics, software), typically found under multiple roofs, were brought together. The program and the product have benefited as AOS now has much greater control in tying individual components into a solid working system. As a result of the SBIR contract, AOS has obtained \$1.3M in follow-on sales and over \$10M in DoD investment.

There are multiple benefactors from SBIR funding acquired by AOS. AOS is able to bring needed optical resources in-house, allowing better interfacing and control of complex optical systems. The Navy will benefit in obtaining an optical correlation system that meets their specific requirements for automatic target recognition and tracking. Commercial markets will eventually benefit when the optical correlator can obtain and then define targets for multiple commercial applications. Quality control, medical imaging, and security are just some of the areas that have been defined. In the end, SBIR funds have allowed AOS the ability to bring market requirements together.



*Anvik Laser Projection Imaging System (HexScan 2100 SPE)
installation ceremony at Rockwell Collins, October 2001*

During the past eight years, Peter Black has compiled an excellent record of proposing and technically managing several successful contracts under the Army and DARPA SBIR programs. Three notable contracts are with Anvik Corp., Irvine Sensors Corp., and AkroMetrix.

SBIR funding for Anvik Corp. has allowed the development, fabrication, and installation of one of the most advanced Printed Circuit Board (PCB) exposure tools available. Installation of the system at a major military supplier gave Anvik significant credibility and enabled the company to successfully expand to other microelectronics markets. Anvik would not have developed a close partnership with a major PCB manufacturer and a military supplier without SBIR support. Thirty jobs were created and equipment sales have increased in Europe and the Far East. Anvik's system is of great importance to the struggling national PCB manufacturing industry and for domestic sources of state-of-the-art electronics for the military.

Irvine Sensors Corp. developed a molded integration technique that allows fabrication of both electronic and optoelectronic components into thin layers of stacks, with high-speed optical communication between the layers. Irvine Sensors is now well positioned in the optoelectronic integrator market and has entered the high-end communication market. Irvine Sensors spun off a company (iNetWorks) to provide high performance data routers using optoelectronics. Four new engineering positions were created. Technology which will

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develop strategic alliances with Honeywell, Peregrine Semiconductors, and Micron Corp. This technology will have national impact by aiding the telecommunication industry in building a bigger data "pipe" to carry vast amounts of digital information throughout the information highway infrastructure. Follow-on DoD contracts in this technology area total nearly \$9M.

AkroMetrix's large area warpage measurement system has been implemented by several major US electronics manufacturers for warpage characterization of PCB substrates. Materials, labor, and field service costs have improved due to reduction in defects and rework related to board warpage. Companies using this technology include IBM, Cisco, Solectron, and Raytheon. Three positions at AkroMetrix and four jobs at user companies were created. Development has led to a 30% increase in revenues. Demonstration of the system has been critical to closing all sales. International competitiveness has led to sales in Italy, Germany, The Netherlands, South Korea, Japan, and Canada. Export value to date is in excess of \$1M USD. A follow-on effort has upgraded software for a high-speed production level version. The paper, wallboard, plastics, rolled steel, and lumber industries have inquired about new applications.

Mr. Black's diligence, attention to detail, and excellent management skills have contributed to the success of a myriad of contracts under the Army and DARPA SBIR programs.

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Paul A. Skvorc II is the Chief Scientist at DataFlow/Alaska, Inc., an Anchorage company. His professional career spans more than 30 years, and has included jobs ranging from Sonar Section Leader on a nuclear submarine to Head of Sonar and Technical Services for the State of Alaska, Department of Fish and Game.

The Technology Research & Development Center of Alaska recognizes DataFlow/Alaska as a significant contributor to the management of one of Alaska's, and our Nation's, valuable natural resources – fish. SBIR funding has provided DataFlow/Alaska an opportunity to develop technology applications with important social impact.

DataFlow/Alaska submitted its first ever SBIR proposal to the National Science Foundation in response to an Information-Based Technologies topic. The company received a Phase I award in 2001 and began work on the project. The Alaska Fisheries Science Center in Seattle (a unit of National Marine Fisheries Service) is providing assistance to the project. Other agencies are participating and additional funds are supporting the project.

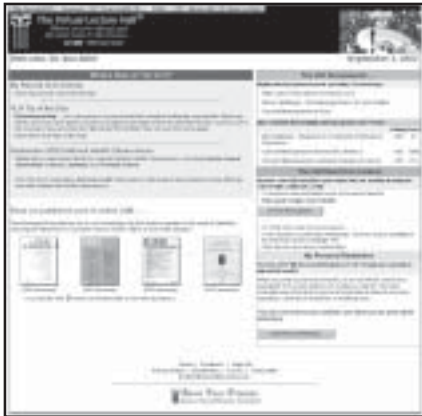
Under the direction of Principal Investigator Paul Skvorc, DataFlow/Alaska is developing a prototype to automate the analysis, archival, and transfer of fish otoliths and scales. Code-named the OASIS project, the process provides an automated and more precise estimation of fish age, longevity, and stock identification assessment.

The company also has begun the design and development of a prototype that automates the identification of individual fish, and a second SBIR Phase I application has been submitted to NSF for this project, code-named TNT. The capability will replace currently used tagging methods. In both projects, Mr. Skvorc leads a team comprising current imaging expertise with analyst/programmer talent, including database development.

The developing methods and products/services will benefit fisheries scientists worldwide. Just as importantly, the enhanced analysis capabilities will support better fish management policy-making decisions, leading to a reduction in overfishing risks and unnecessary economic damage.

DataFlow/Alaska expects to launch the company's export activity as well as make meaningful contributions to our Nation's efforts to better fish monitoring and management practices.

Incorporated in 1994, DataFlow/Alaska, Inc. operates the largest and fastest growing Alaskan-owned information technology services organization in the 49th State. The company regards its IT services business as a natural incubator for its research and development activities.

**Medical Directions, Inc.**

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Specializing in asynchronous, Internet-based distance learning for health professionals, Medical Directions, Inc. (MDI) was founded in 1995 and has become a leader in this growing field of specialized online distance learning. In 1995 MDI developed its first interactive online physician education program. Subsequently, it launched what has become one of the premier Internet continuing medical education (CME) sites for physicians, The Virtual Lecture Hall (www.vlh.com), in 1998. Since then MDI has provided 50,000 hours of category 1 continuing medical education to physicians worldwide.

Between 1998-2001, SBIR funding enabled MDI to prepare and successfully market a path breaking series of online CME programs in cancer prevention. With SBIR funding MDI has become a stable Internet enterprise and, increasingly, a recognized industry leader. The Virtual Lecture Hall is used by a growing number of medical educators to distribute their work. MDI also enjoys an increasing reputation for innovation in medical education, which is supported by its SBIR-funded research findings.

The benefits of the online cancer prevention programs in improving physician knowledge, beliefs, and skills were demonstrated in three publications in peer-reviewed medical literature. The SBIR grant has also enabled MDI to form national and

international collaborations. MDI collaborates with an Internet organization in the UK to provide the online skin cancer education program, developed under the grant, to British physicians (first described in *The British Medical Journal*). MDI also collaborates with a growing number of US health care delivery organizations to offer its online CME programs to physicians as part of their quality improvement efforts. A large California managed care organization recently purchased the skin cancer program on behalf of its primary care physicians. Because of its growing stature in the field of online medical education, MDI also works with a number of other SBIR-funded organizations, such as Clinical Tools, HealthCare Education Associates, and Talaria, Inc.

New ways are needed to fund and distribute CME to physicians and other health professionals. MDI has developed and tested novel, interactive, problem-solving approaches to CME that have been shown to be more effective than expensive and lengthy live presentations. In addition, MDI has developed a viable approach to developing and distributing CME that is supported by physician memberships rather than advertising or commercial funding. This success has led to an increasing appreciation of the viability of high-quality online CME in the US, Latin America, and Europe.

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Leslie Lane is the Vice President-Finance for the Arkansas Science & Technology Authority. The Authority is a state entity charged with promoting the benefits of science and technology to the citizens of Arkansas.

Mr. Lane has been extremely successful within the State of Arkansas through a wide range of SBIR related programs that he initiated and developed. Starting in 1998, Mr. Lane began his work through the Arkansas Science and Technology Authority program known as Phase Zero. Phase Zero allows small Arkansas companies to receive grants of up to \$3,500 to write SBIR proposals.

Mr. Lane's leadership led to immediate success. In 1999, Arkansas jumped from near the bottom in SBIR awards by state ranking to 36th.

He has helped develop new policies and guidelines at the Arkansas Science and Technology Authority, which now allow the state agency to provide matching grants for SBIR awards. One of these ASTA programs allowed Mr. Lane to work with two small Arkansas companies and develop "Fast-Track" funding leading to two new DoD Phase II awards.



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David A. Benaron, M.D., of Spectros Corporation located in Portola Valley, California, is a recognized pioneer in the field of fluorescent optical imaging. He has diligently served as a reviewer on many NIH study sections. In June 2002 he served as a reviewer on the SBIR application review panel for an important NCI initiative entitled "Development of Novel Technologies for In Vivo Imaging." His support of the peer-review process has been invaluable to the NIH/NCI.

Spectros Corporation develops and markets advanced detection and imaging systems that use light to locate trace amounts of cancer or direct interventional therapies in the body in real-time. Spectros accomplishes inside the body what the pathologist does outside of the body – look closely at the optical appearance of tissues for immediate and accurate identification.

To enhance the abilities of medical equipment, Spectros technology can be added to cameras to detect and image tumors, can be deployed in needles to quickly help a physician determine their precise locations in the body, or can be used in probes to monitor the oxygen sufficiency in tissues.

The Spectros imaging and monitoring approaches are under evaluation by world-class clinical leaders at major university centers in California, Washington, New York, and Europe.

Dr. Benaron has been an inspiration to his colleagues and co-workers as he diligently continued his work in a truly outstanding and commendable manner while faced with the illness and untimely death of his wife, Lori.

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Vibration Suppression, Precision Motion, & Noise Control

CSA has acquired an international reputation for excellence in structural dynamics and vibration control. The depth, experience, and capabilities consistently exhibited by CSA make them the premier small company in this area and certainly make them a national asset for developing vibration mitigation technologies critical to the success of military and scientific exploration missions. CSA's consistent excellence was recently recognized through award of the National Small Business Administration Prime Contractor of the Year for 2002. CSA has also been recognized as an SBIR success company, and has been featured in numerous Air Force SBIR brochures and videos. The company has won recognition awards from TRW, Lockheed, NASA, and AF/SMC.

CSA is a debt free, employee-owned company that consistently maintains a healthy work backlog. CSA has aggressively moved forward into new areas and successfully conducted product development for commercial applications. CSA is active in the SBIR program and has brought multiple products to market with the help of this funding. The company is especially well known for its outstanding technology transitions to operational spacecraft, launch systems, and major weapons systems.

A major recent success has been the development of the SoftRide whole-spacecraft vibration isolation systems. Initially started under SBIR funding, this effort has now transitioned to a \$15M Phase III

contract and commercial contracts. These SoftRide systems protect the spacecraft from the harsh vibration environment that damages spacecraft during launch. To date, SoftRide has successfully protected 7 satellites and flight data shows that the damaging vibrations transmitted to the satellites have been reduced by as much as 75% or more. This technology has already saved the government millions of dollars (on one program alone SoftRide allowed the avoidance of a \$6M+ spacecraft redesign and a 6-9 month schedule slip). Because of their success, the SoftRide systems are now being considered for broad application to the launch vehicle fleet.

A similar success has been the laser isolation/suspension system for the Airborne Laser (ABL) Program. Under an SBIR Phase II, an Airborne Suspension/Vibration Isolation System (AS/VIS) was designed, built, and tested, and successfully demonstrated the advanced technology required to meet the stringent ABL requirements. This Phase II transitioned to a \$5M+ contract to build a ground demonstrator and the flight Optical Bench Isolation System (OBIS). The OBIS flight system simultaneously meets the unprecedented requirements for rejecting the large unwanted vibrations affecting the system coupled with the competing requirements for extremely precise registration of multiple optical benches spaced more than 50 feet apart in the ABL aircraft.



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IntelliTools, Inc. is a leading publisher of educational computer products for the diverse classroom. For ten years, the IntelliKeys keyboard has set the standard in computer input devices for students with physical, visual, and cognitive disabilities. More recently, SBIR support has helped IntelliTools publish award-winning reading software for a broader range of elementary school students.

IntelliTools Reading: Balanced Literacy pioneers the use of universal design and assistive technology to deliver a balanced, full-year supplemental reading program for students with disabilities. Developed with funding through the National Institute for Child Health and Human Development at the National Institutes of Health, the software is consistent with the Reading First initiative and No Child Left Behind Act.

SBIR support for research has allowed IntelliTools to become a leader in the special education reading marketplace. Professional and personal reviews from industry reviewers, educators, parents, and users, along with 16 months of sales figures, validate that IntelliTools Reading: Balanced Literacy is effective and popular. The product stands apart from the competition with customizable and comprehensive support for students with disabilities and a balanced approach to reading, writing, and word study.

IntelliTools traditionally has served specialized markets of students with disabilities and those who

require differentiated instruction. Using proprietary software and hardware, the company strives to create new learning opportunities for these students. Product development costs for these special markets can be prohibitive when compared to potential revenue gains. SBIR support makes it possible to do this work.

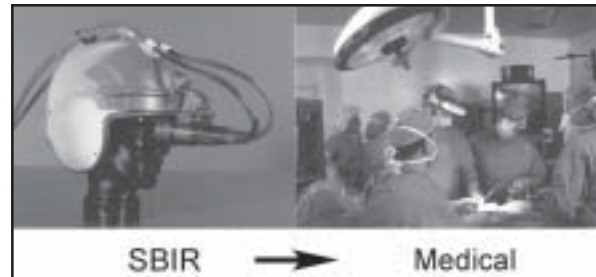
SBIR support for Balanced Literacy has additionally propelled IntelliTools to becoming a provider of products for the mainstream educational markets, including the fully inclusive classroom. Reading experts and coordinators are studying the effectiveness of Balanced Literacy for a broad student population and are finding it effective with many struggling readers. IntelliTools is currently developing a network version of Balanced Literacy that has enormous sales potential throughout elementary education.

Based on the mainstream effectiveness of Balanced Literacy, Houghton Mifflin Co., a leading US educational publisher, joined with IntelliTools to create Get Set for Reading. This software is an interactive, bilingual (English/Spanish) software program for students (grades 1-6). Houghton Mifflin is one of the nation's leading educational publishers, so this collaboration has enormous potential for IntelliTools – both financially and in market recognition.

OPTICS 1, Incorporated

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OPTICS 1 owes a lot of its technology and business successes to the SBIR program. The company's first SBIR Phase I was awarded in 1989 by the Navy when the company consisted of 3 employees. The technology (a microprocessor-controlled infrared zoom lens) was successfully converted to a Phase II program. The resulting hardware represented a technology that a large aerospace company claimed was not possible.

Subsequently, OPTICS 1 has been successful in winning 21 Phase I SBIRs and 11 Phase II SBIRs. Further, two Phase III commercialization successes have also resulted.

The first successful Phase III was the commercialization of a head-mounted display that began as a Navy simulator for night vision goggles. The commercialized product has been successful in the commercial marketplace and has been sold to various government agencies. The product has become a significant aid to surgeons in an operating room environment. Interestingly, the product was very prominently used to produce the early scenes of the blockbuster movie Titanic. For this SBIR effort, OPTICS 1 was highlighted in the "Success Stories" section of the US Navy SBIR website.

The second OPTICS 1 Phase III SBIR is now a \$25M IDIQ to design and produce multispectral imaging systems for the Navy.

OPTICS 1 had 3 employees when it won its first SBIR. The company's staff has increased to 35 and with facilities on both the West and East coasts, its

space has increased from under 500 sq. ft. to over 30,000 sq. ft. Company revenues have grown nearly 400% over the last seven years. This dramatic growth was due in a major way to the SBIR programs. Not only have jobs been created, but also the SBIR successes have enhanced the overall credibility of the company, which has encouraged a continually increasing client base over the years. OPTICS 1 is now a key supplier to several large aerospace companies in the government and defense arenas plus companies in the medical field, display systems, and other commercial and industrial fields.

A further benefit of OPTICS 1's SBIR awards has been the many collaborations that have resulted. These have ranged from collaborations with other small businesses that have supported OPTICS 1's SBIR efforts to large corporations including major aerospace companies that have supplied key components. Its work on a NAVSEA rear projection monitor for the New Attack Submarine (NSSN) helped OPTICS 1 gain technical expertise in that area, which has helped forge relationships with major US consumer companies, major US and international aerospace customers, two projection technology startups, and other companies.

Thanks in a very significant way to Roland Tibbetts, who created the SBIR program, OPTICS 1 has become one of the most respected optical companies in the United States.

The logo for btechcorp. is displayed in a bold, lowercase, sans-serif font. The letters are black and the overall style is clean and modern.

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Browne Technology Inc. (btechcorp) was nominated for a 2002 Tibbetts Award for its technical contributions to solving Department of Defense problems in uni-directional thermal and/or electrical conductivity in a bulk adhesive product. Its development of these advanced conductive adhesives for advanced USAF fighter radars will revolutionize a key segment of the commercial electronics packaging industry.

The company was founded in 1996 and is owned and operated by Mr. Jacob (Jay) L. Browne and Mr. James (Jim) M. Browne.

btechcorp has invented and patented a process for aligning fibers in high density through the thickness of uncured epoxy films and has additionally extended the fiber alignment technology to several key programs for two Department of Defense agencies. The first key technical accomplishment was the demonstration on a 1997 Missile Defense Agency Phase II technical effort – a high thermal conductivity film adhesive along the thickness (or z-axis) of the film. This seminal work has resulted in an initial commercial product that theoretically far surpasses and experimentally surpasses (using three independent test methodologies) the thermal resistance of flow solder when tested one-on-one in bonded joint comparisons.

Extending the capability of its technology to a recently awarded Phase II technical effort with the

U.S. Air Force Materiel Command (Air Force Research Laboratory and Aeronautical Systems Center), btechcorp is developing a combined thermally and electrically conductive adhesive formulation that will provide significant cost savings per year (\$24M) to the Air Force in the assembly and performance of its radar systems. This second key technical accomplishment is currently under scale-up for production qualification by the RF assemblers during the Phase II and, if successful, will enable a lower cost, fully automated production process. The successful co-conductive adhesive formulation from this Phase II effort has already attracted other spin-on applications for the DoD and commercial spin-off customers for more affordable anisotropic conductive adhesive films. Further refinement of the existing formulations provides new adhesive product possibilities for bonding pressure-sensitive circuits with liquid crystal display screens and other rigid and flexible circuitry and for future production-level combined die-bumping and underfill adhesive applications in flip-chip packages.

btechcorp is recognized for its responsiveness to solve technically challenging military RF systems problems while considering the true spirit of the SBIR program to transition small business R&D into viable, commercial products at affordable production levels.

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MicroSat Systems, Inc. (MSI) is a minority-owned small business located in Littleton, Colorado. Founded in April 2001, MSI is an example of a new firm being established based on the results of SBIRs. MSI has created new jobs and enabled new contracts in excess of \$50M. MSI is the third company that is part of a regional cluster of new firms that emerged from ITN Energy. (Global Solar Energy and Infinite Power Solutions are the other two.) These companies are developing new technologies with the continued support of the SBIR program. Additionally, MSI is pursuing international export capability in support of the Canadian Space Agency and Canadian Department of Defense while at the same time strengthening our national capabilities for homeland defense and other defense space-related applications.

MSI is chartered to design and manufacture small satellites and satellite subsystems for commercial and government customers. It is establishing a presence in the space industry through the application of new technologies that reduce cost and reduce cycle time for manufacturing, integration, and test. Key technologies are integrated through creative satellite designs, low cost/lightweight power subsystems, composite structures, advanced avionics, and advanced satellite features such as formation flying and autonomous operation.

As a result of its excellent work and performance on AFRL SBIRs, MSI was chosen as the prime contractor for the TechSat 21 program – a \$52M contract with AFRL to design, manufacture, and test three

formation-flying experimental satellites. The focus of the contract is to develop a revolutionary new paradigm in satellite technology – formations of low cost microsattellites that can replace single, large, expensive satellites. These satellites are designed to fly and be reconfigured in multiple formations and retain knowledge of each other's position through an inter-satellite link. An independent assessment by the RAND Corporation for the Air Force identified the potential for microsattellite clusters to yield three times the utility of current satellites for one-third the cost.

MSI also plans to provide thin film photovoltaic arrays to large satellite manufacturers as a result of SBIR projects. Thin film photovoltaics provide a means of power collection with a specific power of greater than 200 watts/Kg, a price of less than \$200/watt, and a small stowage volume of 45 Kw/m³.

MSI's 30 employees have over 400 years of combined aerospace experience in spacecraft design, build, integration, test, and mission operations. MSI has over 45,000-sq. ft. of state-of-the-art Research & Development and manufacturing facilities that comply with ISO 9001 standards and include a 100,000-class clean room designed for spacecraft integration.

Villanova University

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Since 1997, US Nanocorp® and Villanova University have been jointly awarded nearly \$3.5M in SBIR/STTR funds to commercialize a powerful fuzzy logic method for battery and fuel cell management. Funding for this technology spans a wide range of agencies, including SBIRs from U.S. SOCOM (Ph I and II), DARPA (Ph I and II), U.S. Army TACOM (Ph I and II), BMDO (Ph I, II in application); STTR programs from NIH (Ph I and II); funding from DARPA's Advanced Vehicle Tech.; and business development funding from a 1996 Tibbetts awardee, Connecticut Innovations. This collaborative effort is an exceptional example of the synergies possible between an emerging technology company and a university – a strategic alliance that would not have been possible without the SBIR/STTR programs. These fuzzy logic programs represent a large fraction of US Nanocorp's funding and have insured viability for the company (including job creation for a 20+ staff).

US Nanocorp was founded in 1996 and has aggressively pursued commercialization opportunities in the areas of energy storage (batteries and supercapacitors) and energy conversion (fuel cells). It has recently been awarded the prestigious Deloitte & Touche Fast 50 Award, available to companies who had revenues 5 years ago of at least \$50,000 and revenues in the most recent year in excess of \$1 million. Annual revenues (primarily SBIR) for US Nanocorp range from \$34,991 in 1996 to over \$1.4 million in 2001.

US Nanocorp®

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Specifically, the US Nanocorp/Villanova University technology relates to the novel use of fuzzy logic methods to analyze complex performance diagnostic data to determine state-of-charge (SOC) in primary and rechargeable batteries and state-of-health (SOH) in both batteries and fuel cells. Application spans many fields, including UPS battery systems and portable defibrillators. First funding in the area of fuzzy logic methods for battery management was in 1997 from the US Special Operations Command. The seminal technology development occurred under this program and has resulted in 4 issued patents to date. Subsequent SBIR/STTR awards from DARPA, NIH, BMDO, and the Army led to further innovation that is now patent pending.

US Nanocorp (a joint patent assignee) successfully negotiated a worldwide exclusive License Agreement with Villanova University, effective April 2001. This intellectual property was subsequently spun off into the formation of two commercialization entities – Battery Intelligence™ Incorporated (“BII”) (formed February 2001), a subsidiary of US Nanocorp, and US Microbattery™, Inc. (“USuB”) (formed September 2000), a joint venture between US Nanocorp and Bipolar Technologies Corp. (Provo, UT). BII is presently negotiating licensing, joint development projects, and the formation of a chip manufacturing operation in Taiwan.

Kenneth A. Bannister

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Dr. Ken Bannister was the US Army SBIR Program Manager from 1995 until his retirement in 2001. The Army SBIR Program, at \$151M in 2002, is one of the largest of the Federal SBIR Programs. During his tenure, the Program nearly doubled in size, achieving a growth rate of nearly 25% in the last two years alone. During this astronomical growth, Dr. Bannister maintained virtually error-free management, while tracking and reporting large volumes of program data to the Departments of Army and Defense, the Small Business Administration, and Congress.

Dr. Bannister oversaw the implementation of and perfected the Army's unique two-tiered evaluation and selection process, where the Laboratories that write the topics evaluate proposals first and then those recommended for further consideration are forwarded to a central board of senior scientists, who make the final selections. This process ensures integrity, timeliness, and a level playing field for the small businesses and is mirrored in the development and selection of Army SBIR topics. Dr. Bannister devoted a large amount of personal work to this implementation and it has become a standard for comparison across the Federal Government. Congress and GAO have repeatedly found this system to be fair to small businesses participating in the Army SBIR process. Dr. Bannister received Vice President Gore's Reinventing Government "Hammer" Award in April 1999 for these contributions to the SBIR Program.

Owing to the vast amounts of data manipulation requirements, Dr. Bannister made the decision to implement electronic Web-based systems to support the entire Army SBIR source selection process, from requirements and topic generation through to award and tracking of contracts. Prior to this, the process was very time-consuming and labor intensive, with many opportunities for error. Under his leadership, these electronic support systems have revolutionized the Army SBIR process. They not only save time and manpower and guarantee accurate record-keeping, but also provide tremendous program flexibility.

Dr. Bannister helped create the US Army SBIR Phase II Quality Award Program, which is very popular in the small business community. The Army established the Quality Award Program to recognize Phase II efforts that exemplify the SBIR goal of bringing innovative technologies and products to the marketplace. Award winners receive a plaque in a ceremony hosted by a senior Department of the Army official.

In 1998 DoD designated the Army as the Executive Agent, and Dr. Bannister as the Program Manager, for the Chemical Biological Defense (CBD) SBIR Program. Using his vast experience gained in the Army SBIR Program, Dr. Bannister was able to smoothly establish and manage this unique Tri-Service Program with a high degree of success.

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Quantum Leap Innovations is a pioneer in the emerging field of intelligent software. Their software enhances people's ability to make decisions, develop and assemble knowledge. Featured in Business Week and described as ingenious and ahead of its time, Quantum Leap's cutting-edge technologies have assisted Global 500 companies and the Federal Government in solving their most complex and high-value business, science, and engineering challenges.

Under SBIR Phase I and II funding through the Air Force Research Laboratory, along with third party funding from the Space and Missile Command, Quantum Leap addressed the problem of satellite and range scheduling for the US Air Force. The SBIR contract required the system to deconflict 600 communication events between orbiting satellites and fixed ground based antennae and schedule necessary launch assets at both Cape Canaveral and Vandenberg Air Force Base.

Scheduling for real-world applications is a difficult and time consuming activity involving complex relationships among tasks, resources, restrictions, and other business rules. The SBIR contract enabled Quantum Leap to develop an intelligent scheduling and planning framework - the SPF. The SPF is able to solve scheduling problems in almost any domain. The software knows that every scheduling problem has certain similar features, such as jobs, resources, constraints, and goals - and understands their

interactions. For example, the software knows that jobs will require resources and will be affected by constraints on the way to achieving goals. Such knowledge vastly simplifies and expedites the development of a specific solution for a particular domain. And since the model description is defined in a high-level language, it can be created and maintained by business analysts.

The SPF was developed based on input from the Air Force Space and Missile Command, as well as previous scheduling solutions that Quantum Leap created for large manufacturing companies, including DuPont and Tyco International. The SPF utilizes Quantum Leap's award winning patented Adaptive Optimization[®] technology, which dynamically interleaves 30 techniques from mathematics, operations research, and artificial intelligence. This technology efficiently and robustly analyzes millions of alternative schedules, narrowing it down to a handful for the scheduler to scrutinize.

In addition to pursuing transition of the SPF to the Air Force and other military customers, Quantum Leap is pursuing commercial manufacturing and logistics applications of this technology. The company is developing a network of computer service providers and consulting partners with the specific market knowledge and sales capabilities to implement and commercialize the SPF within their domain of expertise.

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Richard Bixby has been involved in many different and varied activities besides the Government to earn his livelihood - from working on the financial staff of General Motors Corporation to owning and operating a restaurant for 15 years. Because of his wide variety of experiences, he brings unique vision to the Munitions Directorate's SBIR program. He understands not only the Government's point of view but also that of businesses, large and small.

Mr. Bixby is the SBIR Focal Point for AFRL's Munitions Directorate and has served in this capacity for ten years. During this timeframe he has provided administrative oversight for \$118 million of SBIR resources that represent 12-15% of the Munitions Directorate's Research and Development budget. Through his leadership, the Munitions Directorate has advanced numerous enabling technologies. These

technologies have made a major impact on the future munitions systems for the Air Force. These technologies range from material processing, explosives, and fuzing to guidance, weapon effectiveness, and seeker development. The success in developing innovative technology has made SBIR projects highly valued within the Directorate. These resources have a major impact on the Munitions Directorate's mission to develop and transition affordable weapon technology.

Mr. Bixby's work in the administration of the SBIR Program was recently recognized when he was selected the AFRL SBIR Manager of the Year. This award speaks highly of his dedication to the SBIR process and to his understanding of the importance it plays in meeting the mission of AFRL's Munitions Directorate.



With a handful of consultants, Drs. Maha Sallam and Kevin Woods started Intelligent Systems M.D., Inc. (ISMD) in October of 1997 to develop systems for computer-aided detection (CAD) in medical images. Their intended first product was a system to aid radiologists interpreting screening mammograms for the early detection of breast cancer. Due to limited capital, Woods and Sallam, two recent graduates with limited business experience, turned to the SBIR program at the National Cancer Institute (NCI).

In January 1999 ISMD was awarded a Phase I SBIR grant to complete development of the CAD algorithm and design the clinical trials required to obtain FDA approval for the mammogram CAD system. The next year ISMD was awarded a Phase II SBIR grant for development and evaluation, received instant credibility in the business community, and promptly hired employees with expertise in product development, quality assurance, and regulatory compliance. In November 2000 ISMD became Intelligent Systems Software, Inc. (ISSI) under the leadership of W. Kip Speyer. SBIR grants and Mr. Speyer's extensive business experience enabled ISSI to raise an additional \$1 million in capital. Clinical trials began in the spring of 2001 and ISSI opened its headquarters in Boca Raton, FL, hired a CFO, and began preparing for FDA inspection. By July

2001 with 12 full-time employees in two locations, ISSI submitted its Pre-Market Approval application to the FDA for regulatory approval. During August 2001 the company signed an exclusive distribution agreement with Instrumentarium Imaging, Inc. for United States market and named its product the MammoReader®. ISSI presented its first exhibit to the Radiological Society of North America (RSNA) in Chicago in November of the same year. ISSI received FDA approval in January 2002 and began selling the MammoReader® through Instrumentarium. ISSI merged with Howtek, Inc., a publicly traded company that designs and manufactures film scanners for medical applications, and changed its name to icad, Inc. in June 2002. It is the first, and currently only, publicly traded company (NASDAQ: ICAD) devoted entirely to computer-aided detection and diagnosis of medical images.

Mr. Speyer became CEO of icad and Scott Parr, former CEO of Howtek, became President and COO. ISMD founders Maha Sallam and Kevin Woods are Vice Presidents and are on the Board of Directors of icad, which now has 27 full-time employees and five full-time consultants. Woods and Sallam credit the SBIR grant program for providing them with their commercial opportunity and the growth of their company.

icad, inc.

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Vcom3D, Inc.

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Vcom3D is a software tools and technology company. Vcom3D software is revolutionizing 3D animation by taking animation out of the studio and onto the desktop. This software reduces 3D animation development cost by 90% and reduces resulting content file size by 90%, enabling effective online content delivery.

SBIR funding from the Department of Education and The National Science Foundation assisted Vcom3D in developing its SigningAvatar technology. This animated 3D software creates signing characters for educational software titles and Web accessibility known as the Sign Smith series.

First in the series is Reading Power, a CD-ROM designed for young deaf students to help develop English language reading skills. The 3D characters sign along with English text and react to student responses, providing feedback to comprehension questions.

Second is Illustrated Dictionary, a CD-ROM used for American Sign Language reference or education for both deaf and hearing individuals. Illustrated Dictionary includes 500 signs most commonly used in beginning ASL courses.

Future products include the Sign Smith Studio and Server and Client Players. Studio, an authoring tool that provides automated transcription of English text to Signed English, or semi-automated translation to ASL, will give users the ability to create and edit scripts which drive the characters, and control structure and meaning of the signing, including focus

of attention, indexing, role-shifting, lip-synched speech, and expression.

An SBIR from the National Institute of Standards and Technology and a Phase IIB from NSF assisted Vcom3D in adding inverse kinematics, locomotion, and server software along with lip-synched speech capability and the inclusion of multiple characters able to communicate in a 3D virtual environment in role-playing simulations. The result is the Vcommunicator series, which uses speech for general education and the government and corporate training markets. Vcom3D is currently developing an online course for the National Institute of Justice to be used by School Resource Officers in practicing their responses to school situations, such as a possibly armed student.

Vcom3D has been honored with several awards at international conferences including ACM Siggraph 2000 Web3D "Best Overall" and "Best in Education", and the Web3D Conference "Best in Show" in 2000 and 2001. Vcom3D was singled out as an SBIR program success story when Ms. Wideman, President and CEO, was invited to testify before the Research Subcommittee of the House Science Committee on July 31, 2001.

The opportunity to create the standard for all 3D content on the Web is just on the horizon. Vcom3D technologies and products will bridge the comprehension divide for all audiences in every situation imaginable with one changeable tool that works for everyone.

**Hawaii Biotech**

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Hawaii Biotech (formerly Hawaii Biotechnology Group) is the state's leading Hawaii-based, private sector biotechnology firm. The company creates, develops and markets human pharmaceutical products and services, and conducts research and development primarily on vaccines, acute cardiovascular therapies and pro-drugs targeting infectious disease and cancer. Hawaii Biotech has made significant progress in its commercialization activities since it was last recognized with a Tibbetts award in 1998.

In recent years, Hawaii Biotech has become the most successful of Hawaii companies in obtaining Phase III funding by leveraging federal SBIR program dollars and Hawaii state matching grant monies. The leveraging has resulted in millions of dollars attracted from the private sector and from other sources of federal funds. Historically, Hawaii Biotech has received 52 Phase I awards and 13 Phase II awards resulting in a combined total of over \$14 million, and over a million dollars from the State of Hawaii's SBIR matching grant program. Commercial potential in these SBIR projects has enabled Hawaii Biotech to attract an additional \$8 million in other federal research funding and nearly \$2 million in licensing royalties and product sales.

Significantly, a company milestone occurred earlier this year with the closing of Hawaii Biotech's first \$3 million Series A Preferred investment. The company is successfully gaining the confidence of venture capitalists, in part, by demonstrating the company's long-standing participation in the SBIR

program and the consistent level of federal investment it receives to conduct early-stage research in very high-risk areas. The private investments are enabling the company to accelerate the development of its clinical drug candidates.

Hawaii Biotech has successfully built a business strategy around the SBIR program. The company continues to expand its platform technologies that are supported primarily through grant revenues and supplemented by an in-licensing program, in order to produce additional proprietary clinical development candidates.

Hawaii Biotech's emphasis on commercialization was realized last year when Mr. David Watumull, a biotechnology business executive, was hired as the CEO. Through Mr. Watumull's efforts, Hawaii Biotech has become the most active private industry promoter of the SBIR program in Hawaii. Mr. Watumull is also an industry leader in advocating for an improved business support infrastructure for technology businesses in Hawaii. He spent many volunteer hours lobbying state legislature to pass a new law that provides substantial tax incentives to investors that invest in Hawaii technology. He serves as the Chairman of the Biotech Council of the Hawaii Technology Trade Association and is the state affiliate of the Biotech Industry Organization (BIO), the leading global biotechnology trade association.

Hawaii Biotech has been in operations for 20 years, and employs 36.

Clear Springs Foods, Inc.

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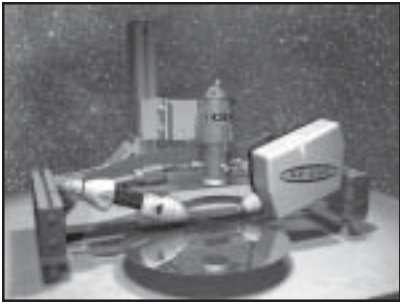


Clear Springs Foods, Inc. makes its home on the scenic Snake River Canyon of southern Idaho's Magic Valley. Here rainbow trout are farm-raised in concrete raceways fed by an abundance of crystal clear spring water. Ideal growing conditions, combined with a commitment to quality and innovation, have made Clear Springs the world's largest producer of rainbow trout, processing over 20 million pounds a year.

Clear Springs Foods is a vertically integrated company. From its state-of-the-art farm, feed manufacturing, processing plant, and research facilities to the latest specialty products production facility, Clear Springs' dedicated people are the key to its success. Clear Springs is committed to producing the highest quality products available in the world.

Clear Springs' state-of-the-art Research and Development Center produces vaccines; monitors water quality in the springs, the farms, and the Snake River; and provides an array of fish health services to the farms. Research projects are ongoing in the areas of nutrition, waste management, genetics, and fish culture. In addition, the research division provides a complement of quality assurance services to the other divisions of the company.

The SBIR Program has been very important in enhancing the efficiency and profitability of this vertically integrated aquaculture company.



Containerless Research, Inc.

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An SBIR initiated a Containerless Research, Inc. application of non-contact measurement and processing methods to develop novel instruments and materials for scientific and commercial use. Containerless Research, Inc. (CRI) has generated commercial revenues in excess of \$10.5M, leveraged support from the State of Illinois, and supported eight undergraduate students through the Northwestern University Cooperative Science and Engineering program.

CRI was formed in 1993 and is located in the Northwestern University/Evanston Research Park. It contributes to the local economy through employment, education, taxes, and support of local service providers. CRI scientists and engineers are leaders in the fields of high temperature materials and glass research using new capabilities developed under SBIR contracts.

The SBIR-funded research has led to sales of instruments and research services in excess of \$400,000 and more than \$760,000 in non-SBIR research contracts, including work for Japanese glass companies. The technical innovation involves using specialized containerless techniques to measure materials data for process modeling and optimization of manufacturing processes. This work supports the major industries of metal processing, casting, glass manufacturing, and semiconductor processing. Basic research on materials properties leads to new materials, improved performance, energy savings,

and safety. New capabilities developed with the SBIR leveraged access to instrumentation and materials processing markets, in which CRI revenues to date exceed \$5.5M.

The SBIR research resulted in new business opportunities in materials data measurement and research. These opportunities have been realized as \$1.2M in R&D contracts, instrument sales, and commercially supported research. The SBIR supported a subcontract with Auburn University and an Auburn student who received an MS degree for his work on software tools and modeling of heat and mass transfer processes in high temperature liquids. Within Illinois, CRI has developed collaborations with University of Illinois Urbana-Champaign, Northwestern University, and Argonne National Lab. Additional collaborations have been developed with five universities in other states.

The work leveraged Federal support of R&D in Illinois and has led to a profitable business. CRI has exported instruments to Japan and Europe and has sold to customers throughout the US. CRI has supported the State of Illinois and the Midwest region by helping to develop high technology industry in an area traditionally supported by an agriculture-based economy. Income brought to the State of Illinois by CRI has led to diverse collaborations, student and professional employment, and technological innovations.

Analytical Engineering, Inc.

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Analytical Engineering, Inc. (AEI) is an Indiana corporation that offers a broad spectrum of services and products, ranging from diesel engine technology to underwater communications. From its first Phase II SBIR, AEI successfully commercialized a product for developing a means to “hear” through a SCUBA mouthpiece into a 2-way diver communication system.

AEI was founded in 1994, and had exactly one employee at the time. Through slow but steady growth, it moved from a 3,000 square foot facility, which housed all office, machining, and fabrication areas, to a 10,000 square foot facility in 1999. By this time, AEI had grown to ten employees. By 2000, eight months later, AEI broke ground for a 40,000 square foot addition, located on 21 acres, to house its expanding workforce (by then 16 employees) and laboratories, vehicle engineering bays, ten dynamometer test cells, a CNC machine shop, fabrication areas, and over 9,000 square feet of engineering offices.

AEI has grown from a narrow range of services initially to a very broad range, from engine durability and performance development to vehicular exhaust aftertreatment research and development. Additional services include engine dynamometer testing, cold start testing, exhaust emissions measurement, on-vehicle emissions testing, duty cycle measurement, air flow laboratory work, engine oil analysis, and

diesel technology. Patent applications range from underwater sonar communications to microprocessor-based engine accessory development.

Growth has been significantly aided by \$1.575 million in SBIR grants from the Navy, the Army (US Army Tank and Automotive Command/TACOM), and EPA. AEI has had four Phase I and two Phase II awards. Wholly owned by Angela May, a professional engineer, the company has received no outside investment and no venture capital. SBIR has represented a critical source of funding during AEI’s growth period as it helps even out the cash flow, and the company intends to continue using it to further diversify its product mix.

Revenue and sales projections reflect in excess of \$21 million either realized or projected over the next two to three years. This reflects a mix of direct government contracts that are not SBIR dollars, and sales and/or collaborations to/with large corporations, some of which are government prime contractors. Customers/collaborators include TACOM, the EPA, ITT Technologies, Cummins Engine, Caterpillar, Mack, Detroit Diesel, International, Arvin Meritor, Martin Marietta, and other collaborators which, for reasons of confidentiality, cannot be divulged. It is safe to say that few, if any, of these collaborations would have been possible without the contacts and credibility generated through AEI’s association with the SBIR program.



Space Hardware Optimization Technology, Inc.

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Unlike Silicon Valley, rural southern Indiana is not known as a bastion of high-tech enterprises. And certainly developers of spaceflight hardware are far rarer in the area than in Houston. But thanks in part to SHOT's success with the SBIR program, the region may yet earn a new reputation.

For the past 14 years, SHOT has developed life sciences research equipment for the space shuttle and the International Space Station. Some of the most important biotech research payloads that have flown, or will soon fly in space, have been and will be completed under SBIR contracts earned by SHOT.

The Space Station Biological Research Project (SSBRP) consists of six habitats for conducting experiments critical to the development of countermeasures to the adverse effects of long spaceflights. SHOT is the only company responsible for developing more than one of them.

Last December, the first SSBRP payload to launch was the Avian Development Facility. It was designed and built by SHOT under SBIR contracts with NASA's Ames Research Center in Silicon Valley. It was the first Phase III SBIR agreement awarded by Ames. The second SSBRP payload for which SHOT is the principal architect is the Advanced Animal Habitat. Multiple units are being developed for long-term use in space - again, through SBIR contracts.

Also under SBIR contracts, SHOT developed a cassette-based biotech research facility that launched on space shuttle missions STS-77 and STS-95.

During STS-95, it was operated in space by John Glenn. It is scheduled to launch again in spring 2003.

Based principally on the success of this device, SHOT was awarded a "Space Act Agreement" which permits it to conduct biotech and pharmaceutical research on the shuttle for its own customers. SHOT is one of only four commercial companies with such an agreement.

Besides its NASA work, SHOT also sells devices for Earth-based biotech and pharmaceutical research that use technologies derived from its space equipment. SHOT also recently earned its first SBIR contract with the Department of Defense for a device related to homeland defense, and its first STTR grant from the National Institutes of Health for a microelectromechanical systems project.

This high-tech activity in the community creates jobs not only at SHOT, but also at local subcontractors. It also helps stem the "brain drain" - the exodus of the area's brightest students who graduate from nearby colleges but move away to pursue interesting and challenging work.

Perhaps southern Indiana's Ohio River Valley may someday rival Silicon Valley in total high-tech jobs. Until then, SHOT's success with the SBIR program continues to provide encouragement to local economic development officials who ask the important questions: "Why San Jose? Why Houston? Why not here?"

Iowa Thin Film Technologies

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Iowa Thin Film Technologies (ITFT), located in western Ames, Iowa, is a leader in roll-to-roll semiconductor technologies. ITFT develops and manufactures ultra flexible solar modules that are thin and lightweight. ITFT's expertise in thin film roll-to-roll technology is being leveraged to develop breakthrough thin film transistors and diodes for products in computing and memory.

NASA and DOE Phase I and Phase II SBIR grants "allowed us to go from laboratory curiosity to a company with a real process and real product prototype," said ITFT founder Dr. Frank Jeffrey. Dr. Jeffrey attributes ITFT's SBIR funding as the foundation for the successful development and commercialization of PowerFilm™ photovoltaic modules. This achievement has positioned ITFT to become one of Iowa's most successful new high tech companies and has generated revenue and employment for Iowa.

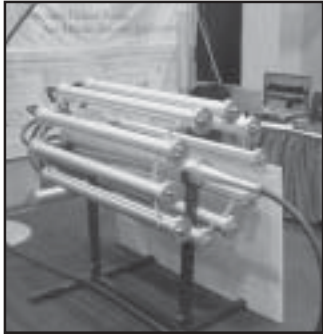
Iowa Thin Film Technologies is the only company in the world manufacturing and selling amorphous silicon thin film photovoltaic modules on a plastic substrate. It has proprietary technology, is selling product, has several strategic partnerships, and is poised for significant growth as it commercializes thin film power and electronic devices.

Dr. Frank Jeffrey and Dr. Derrick Grimmer founded ITFT in 1988. Dr. Jeffrey now serves as President and Principal Scientist for ITFT and Dr. Grimmer serves as a Principal Scientist. Steve Martens is Vice

President and Mike Coon is the Chief Operating Officer.

ITFT develops, manufactures, and sells thin lightweight flexible solar modules with the brand name PowerFilm™. PowerFilm™ photovoltaics are ultra flexible and based upon thin film amorphous silicon on plastic technology. The primary application markets are Consumer Electronics, Outdoor and Recreation, Remote and Military, and Building Integrated Photovoltaics (BIPV). Specific applications for PowerFilm™ range from consumer market applications such as portable audio products and chargers for cell phones, CD players, and handheld computer games to outdoor lighting, remote sensors and security systems, Army tents, and integrated building materials.

The vision of Iowa Thin Film Technologies was to develop and market thin film photovoltaics products on a plastic substrate. The ITFT founders agreed that products developed by ITFT would only be marketed and sold after a replicable fine-tuned roll-to-roll manufacturing process to produce consistent high quality products was realized. This manufacturing technology foundation is the basis for current and future business development and sales of photovoltaics, as well as thin film transistor and thin film diode developments. The roll-to-roll manufacturing technology enables future growth opportunities for ITFT to manufacture product applications ranging from ultra-thin flat panel displays to digital memory.



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William Carey is co-owner of Applied Physical Electronics – a small technology company located in Whitewater, KS. The company’s principal technology involves the generation of extremely high intensity, extremely short duration electromagnetic pulses.

Mr. Carey is active in promoting the SBIR program in the KS area through planning and speaking at regional workshops. He also provides one-on-one consulting services. He is a valuable source of information and proposal writing ideas for new and potential SBIR participants.

William Carey’s company, Applied Physical Electronics, is the recipient of multiple SBIR awards, including four Phase I and two Phase II awards this year. Initial SBIR research was in response to a BMDO topic for technology for disabling guidance circuitry in cruise and sea skimming missiles, with potential spin-offs in commercial areas.

Pulse generators have been sold to a number of customers, including Old Dominion University for cancer research and Lawrence Livermore National Laboratory for internal research and development efforts.

Applied Physical Electronics has won a total of eight Phase I and three Phase II SBIR awards for work in defense technologies. Applied Physical Electronics’ resulting technologies have demonstrated strong dual-use capabilities and significant sales potential for commercial applications, which are part of the ultimate goal of every SBIR award – commercialization into the government or private sector marketplace.

Murty Pharmaceuticals, Inc.

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Murty Pharmaceuticals, Inc. (MPI) is located in Lexington, Kentucky, and is a recipient of two SBIR phase II contracts from the National Institute on Drug Abuse, NIH. MPI has made some highly innovative accomplishments in developing two novel delivery systems for the drug delta-9-tetrahydrocannabinol (THC). Dr. Murty Mangena, R&D Manager, and Mr. Syam Murty, CPA and CFO, contributed significantly in the establishment of the company.

Currently, THC is commercially available and marketed in the form of oral gel capsules (Marinol®/Dronabinol®). To improve the absorption and bioavailability of THC (a lipophilic substance), MPI has developed two alternate delivery systems for THC. These two formulations could be more effective and better tolerated in patients: (1) a superior quality marijuana placebo (containing no THC), and marijuana (containing known amounts of THC) cigarettes with original color and texture of marijuana (for lung delivery); and (2) a transdermal gel formulation containing different strengths of THC (for skin delivery). The cigarettes were manufactured utilizing marijuana that was

extracted by super critical fluid and solvent extraction techniques. The preparation of the gel formulation utilized marijuana extract, obtained as a by-product during marijuana extraction for cigarette manufacturing.

It appears that for the first time MPI has produced a superior quality of marijuana placebo and marijuana cigarettes having original marijuana color, texture, and flavor for better acceptance by patients. These cigarettes might have profound application in clinical research for evaluating the application of marijuana for clinical research.

Besides developing formulations, the MPI has also evaluated the efficacy of transdermal formulation through in vitro studies. The gel formulation had excellent diffusion of THC through skin and its application had no skin irritation in experimental subjects. It appears that further preclinical and clinical studies could lead this transdermal formulation to commercialization as an alternate, effective, and less toxic drug for the treatment of pain, nausea, and vomiting in AIDS patients.



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Neptune Sciences, Inc. is a privately owned Louisiana small business founded in 1991 and dedicated to providing high-quality technical products to its customers in the ocean science and engineering communities. Neptune Sciences, Inc. began with three employees and has grown to approximately 55 employees whose skills are at the highest levels of the science and engineering professions, including a core of personnel who are internationally recognized for their expertise in ocean science and engineering. Neptune is unique in Louisiana for its large number of SBIR awards, for the economic impact of these awards (\$4.2 million), and for the exceptional growth of a high-tech private business in a region not generally known for many high-tech businesses.

This exceptional growth in technical capability has been fueled by Neptune's impressive success in the Small Business Innovation Research (SBIR) Program. During the past ten years, Neptune has earned a total of 15 SBIR awards, including eight Phase I awards and five Phase II awards for an excellent Phase II success percentage of over 60 percent. Two Louisiana Phase 0 awards have supported Neptune's SBIR efforts. Additionally, commercialization is underway on two of the Phase II projects currently nearing completion. These projects contribute to the development of important internationally employed environmental measurement capabilities and to the

quest for alternative energy sources through the use of ocean wave energy conversion.

Neptune is a recipient of the 1999 Department of Defense Value Engineering Award for its role in the development of a smart battery charger.

With the help of the SBIR program, Neptune has formed its Wave Energy Group (WEG), which has focused its capabilities on wave energy conversion (WEC) technology. The mission of the WEG is to apply its expertise and knowledge with the ultimate goal of providing renewable energy from the sea to coastal military, residential, and industrial communities.

The corporation is composed of specialists in all areas of deep and shallow water (littoral) oceanography. The SBIR program has been used by Neptune to develop and manufacture advanced environmental sensors for military and commercial applications for sale in the U.S. and overseas. Other interesting areas of research conducted by Neptune include aerospace services; environmental surveys; oceanographic data processing; computer science wave/surf modeling and analyses and underwater acoustic research; modeling; and signal processing. Neptune's capabilities have contributed significantly to the National Defense and alternative energy exploitation.

Janet Yancey-Wrona

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Under the leadership of Dr. Janet Yancey-Wrona, the Maine Technology Institute (MTI) has enhanced SBA initiatives such as FAST and ROP to promote the SBIR program across Maine. In just two years, MTI has scores of accomplishments.

MTI has conducted seventeen SBIR/STTR workshops including the successful SWIFT Tour-2001 and the SBIR Summer Session-2002. Small business participation at these workshops totaled over 500. In 2001 over 100 small businesses were given specialized one-on-one technical assistance and counseling with SBIR proposal preparation.

MTI received the FAST Program award from the SBA. MTI was only one of five organizations that received the maximum award in FY01 for its well-rated FAST proposal. A mentoring program and commercialization workshops are set to begin this fall. These workshops will include past SBIR awardees as well as other small technology-based companies. The focus is to provide in-depth assistance for businesses in the commercialization of new products and services.

In support of the SBA Rural Outreach Program, MTI provided matching state funds for the SBA Maine Rural Outreach Program in collaboration with the Maine PTAC. Over 200 small technology-based companies were contacted in 2001 to inform them about the SBIR program.

MTI has a Seed Grant program (Phase 0). Starting in early 2000, MTI has funded 158 seed grants for a total of \$1.5 million. Several of these seed grants have been used to help companies obtain a technical writer to help them with an SBIR Phase I or Phase II solicitation or to help them get additional technical data to complete a Phase II application. Maine companies nearly doubled the total dollars obtained from SBIR in 2001 than the previous year.

Efforts by MTI to stimulate SBIR program awareness and technical assistance are clearly paying dividends. John Massaua, Director of Maine's SBDCs, recently said, "Maine's SBDCs have witnessed a dramatic change in small business innovative research throughout the State of Maine last year. This is in large part due to the leadership of MTI in raising the awareness of opportunity windows for Maine's existing and start-up technology businesses. Maine now is at least in the race due to the hard work, business savvy and commitment to excellence by the MTI staff and especially its director, Janet Yancey-Wrona."

MTI, under Dr. Yancey-Wrona's leadership and her ability to work collaboratively with other partner organizations, has been able to strengthen Maine's capability to help small businesses to effectively participate in the SBIR/STTR program.

**Jo Anne Goodnight**

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Jo Anne Goodnight is the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Program Coordinator of the Public Health Service and the National Institutes of Health (NIH). She has held this position since 1999 and within a very short time has made a significant impact within the NIH SBIR/STTR programs. She is an exemplary ambassador for NIH and the SBIR/STTR programs. Ms. Goodnight has 16 years of government service and holds a BS in Microbiology from Virginia Polytechnic Institute and State University.

A creative supporter of the SBIR/STTR programs, Ms. Goodnight shows exceptional skill working with the small business community and also in working with the NIH to ensure its maximum responsiveness to the needs of small businesses as they seek to meet their missions. Her personal qualities of being flexible and communicative have contributed to make notable improvements to these programs across the entire country. Ms. Goodnight has demonstrated a dedicated commitment to the mission of the SBIR/STTR programs. Through her dynamic leadership, she has tirelessly promoted these programs – and true to the Congressional mandate, she has innovatively developed numerous informative and entertaining presentations for diverse populations. Ms. Goodnight is always among the first to volunteer and remains resolute in her support until each project is successfully accomplished – both within and outside her agency. She has been integral in making the SBIR and STTR programs more accessible, more relevant, more effective, and just plain better every day.

Ms. Goodnight's involvement in various SBIR/STTR activities reads like a virtual menu – whether it is developing a combined single solicitation for NIH's SBIR/STTR programs; co-chairing the SBIR Program Managers' National Conference Planning Committee; supporting agency efforts to construct an SBIR Evaluation Study by the National Research Council; or assuring that the SWIFT (SBIR: Where Innovation Focuses Technology) Bus Tour remains viable and effective. In each case, Ms. Goodnight resolutely and competently assumes an integral role.

Her unique assets and tireless efforts have helped concepts become research efforts and research efforts produce outcomes. There is no doubt that these outcomes will benefit small businesses and ultimately our country. During her tenure as the NIH SBIR/STTR Program Coordinator, Ms. Goodnight has presided over an impressive increase in the agency's Program budget due to Congressional legislative action. However, she has used her energetic initiative to take that opportunity and develop a remarkable program.

This silver anniversary of the SBIR program is a golden moment to recognize one of its platinum personalities – Jo Anne Goodnight.

Immersion Medical, Inc.

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Immersion Medical (formerly HT Medical) has benefited greatly from the SBIR/STTR programs and, as a result, the company's medical simulation technology is benefiting the healthcare industry worldwide. Immersion has a proven record of success at channeling SBIR funds into marketable products. Since its release in 1998, 500 CathSim® systems for IV insertion have been sold to over 450 institutions, including Harvard University, the Walter Reed Army Medical Center, Stanford University, and the Mayo Clinic. Ninety-one of the company's AccuTouch® Endoscopy simulators have been bought and installed at training facilities, as have 48 AccuTouch® Endovascular simulators.

In all, Immersion Medical has received almost \$4 million in SBIR/STTR funds for more than a dozen projects – all of which have contributed to the company's advancement of technology to improve healthcare delivery. Some product highlights stemming from the SBIR/STTR relationship are listed below.

- Training Simulator for Central Venous Catheterization (DoD STTR Phase I, 2001 + Phase II 2002-2004). Used toward ATLS training simulators for both civilian and military training.
- ERCP Virtual Reality Training System (NIH SBIR Phase I, 1998-1999). Seeking Phase II funds to add therapeutic modules to recently released diagnostic module.
- Catheter Insertion Simulation for Epidural Anesthesia and Spinal Tap (DoD SBIR Phase I,

2001-2002). Seeking Phase II funding to complete project development.

- Needle Thoracentesis Simulation Workstation for Medical Training (DoD SBIR Phase I, 2001-2002 + Phase II, 2002-2004). An important trauma procedure and a foundation for simulation of related procedures.
- Simulator for Catheter-based Cardiovascular Procedures (NIH Phase I SBIR, 1999-2000). Simulating coronary stenting and aortic aneurysm repair for the rapidly growing field of endovascular surgery.
- Diagnostic and Operative Hysteroscopy Simulator (NIH Phase II SBIR, 2002-2004).

Improving training standards and procedural competence in a high patient volume procedure, benefiting women patients everywhere.

- Benchmark VR Innovative Procedural Quality Assurance & Maintenance Tools (HCFA Phase I SBIR, 1997-1998 + Phase II SBIR, 1998-1999). Built-in metrics for trainee performance evaluation is one of the key benefits of simulation-based training.
- Virtual Environment Training for Trauma Management (NAVY SBIR Phase I, 1995 + Phase II, 1996-1998). This project spawned the first CathSim®, which now comprises six modules, with three more in development.

Immersion Medical thanks the SBIR/STTR program for its generous contributions, which have enabled the company to pursue technical excellence and to open up new horizons in medical simulation.



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Paul Mexcur, NASA's SBIR/STTR Program Manager, has consistently emphasized four basic principles in the management of these important programs. These principles are:

1. Alignment of the research topics to the highest technologies priorities of the Agency. Each year, a majority of the NASA SBIR research topics are either entirely new or involve a substantial rewrite from the previous year's topic. Researchers across the Agency are invited each year to compete for the opportunity to sponsor a research topic.
2. Focus on the program effectiveness as measured by Phase III commercialization. One indicator of this success has been the significant increase in the number of documented commercial success stories. Currently, these programs have over 400 documented success stories posted on the NASA SBIR/STTR homepage (<http://sbir.nasa.gov>). This represents over a 200% increase in the number of documented success stories within the past 3 years. It should also be noted that approximately 40% of the articles published in the NASA 2001 SPINOFF publication are based on SBIR or STTR-funded research.
3. Utilization of advanced information technology to operate the programs more efficiently and with shorter time requirements. This goal has been made possible by the development and utilization of a web-based innovative paradigm – Electronic Handbooks (EHBs). EHBs have proven themselves to be a cost-effective and efficient means of reengineering and modeling business processes. The elegance of the EHBs is that they not only guide the user through his/her roles, but they also contain the necessary forms and menus to actually execute the defined processes. The handbooks have electronically modeled the end-to-end management process flow within the program including solicitation development, proposal submission, proposal evaluation and selection, contract negotiation, and contract reporting. Major benefits of EHBs include greater data accuracy and quality, faster turnaround time, synergy (common view) among all participants, imbedded e-mail features for effective communications, and rapid acceptance by a diverse user community.
4. Provide opportunities to a broad cross section of US businesses to participate in NASA's SBIR and STTR programs. In recent years, over 25% of NASA's SBIR awards have been made to firms owned by socially and economically disadvantaged persons or by women.

Another key objective of these programs is to enable future NASA missions by developing advanced technologies that meet NASA's technology needs. An indicator of this success has been the large increase in the number of Phase III (non SBIR/STTR-funded) contracts that have been issued in the past several years.

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NASA/DFC Cryogenic ALHP



NASA/DFC Room Temperature ALHP

TTH Research, Inc. provides thermal design, analysis, test, and consulting services for a variety of government and commercial customers. Most of its current SBIR work involves research in the advancement of Loop Heat Pipe technology and analytical modeling.

Success of the NASA-funded Advanced Loop Heat Pipe (A-LHP) demonstration program prompted the US Naval Research Laboratory (NRL) to award TTH Research \$500,000 to study the feasibility of A-LHP as the main heat transport device for the NRL Central Thermal Bus (CTB) and Deployable Radiator (DR) concept. The CTB/DR is a revolutionary spacecraft thermal design concept aiming to reduce the size and weight of its thermal control system. If successful, TTH Research expects that all future spacecraft and satellites will adopt the CTB/DR concept in their TCS design, which could potentially result in an estimated \$50 million in annual sales of the A-LHP technology.

A miniature version of the A-LHP (mini-LHP) was also successfully developed under the NASA SBIR program. Even though it was originally designed for spacecraft usage, the mini-LHP was perfect for terrestrial electronics cooling applications (e.g., high power converters and computer microchips). Now the biggest challenge is to lower the mini-LHP unit cost to less than \$50.

As the power and power density of microchips outgrow what existing technologies can provide,

manufacturers of commercial electronics will need to incorporate miniature cooling devices, such as the mini-LHP, into their designs. Intel, Motorola, and Alcatel have already contacted TTH Research to obtain technical information about the mini-LHP. In return, these companies provided TTH Research specific cooling requirements of future electronic devices. TTH Research has also learned that companies manufacturing expensive shoes, ski jackets, and bio-hazard suits are also considering cooling devices like the mini-LHP for their products. A market survey conducted by TTH Research in 2001 concluded that a market potential of \$500M for the mini-LHP could be realized in the next twenty years.

TTH Research is in the process of applying for a US patent for its Advanced Loop Heat Pipe (A-LHP) design. The A-LHP is recognized as one of the most important innovations of the CPL/LHP technology. With technological successes achieved in the SBIR programs, TTH Research, Inc. is in a position to commercialize the capillary pumped devices for spacecraft and satellite thermal control systems. Technology demonstration programs of the TTH-invented Advanced LHPs/CPLs (sponsored by NASA, Air Force, and Navy) have shown their tremendous commercial potential for next-generation spacecraft thermal control systems and cryogenic cooling of infrared sensors and detectors.



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Since its establishment in 1983, Charles River Analytics Inc. (CRA) – a pioneer in developing innovative solutions incorporating intelligent systems technology – has been in the forefront of innovative research and development, with the goal to transition today's cutting-edge technology to tomorrow's advanced systems.

CRA has achieved success in applying intelligent systems technology to provide innovative custom solutions by relying on one of its strengths – the ability to match customer needs with evolving advanced computational technologies. Current development efforts in custom solutions focus on three areas: intelligent agents for real-time systems; decision support systems; and large scale modeling, simulation, and analysis.

In designing and developing leading-edge intelligent systems, CRA uses a project-focused approach to integrate three core competencies: hybrid computational intelligence; cognitive science and engineering; and software engineering and development.

CRA has supported the US Air Force's ASC/HPM office for over 10 years. Initial involvement was a highly competitive effort (over 40 submissions) in a Phase I SBIR to create a new and adaptive pilot decision logic. CRA created the Situation Assessment Model for Pilot in the Loop Evaluation (SAMPLE). SAMPLE was so far ahead of its time that only now can it be implemented to its fullest capacity in the latest USAF model design. The SAMPLE product is

a quantum leap in the ability to produce realistic dynamic pilot models to augment virtual tools in support of acquisition development and test and evaluation (T&E) for the USAF.

From SAMPLE through OLIPSA, ACTOGA, TACT, and GRADE, CRA has continued to excel in producing not only a valuable and exceptional product but also a business climate that reflects the spirit of the SBIR process – teamwork. CRA definitely considers itself part of a team working together to achieve similar goals. That business philosophy is reflected throughout the company and is aptly demonstrated through the non-funded activities that CRA continues to support. CRA has performed countless integrations of the SAMPLE software with Air Force simulations over the last ten years. A number of those integration efforts were performed at no cost to the USAF/ASC/HPM office as part of a CRA philosophy to build a product valuable and useful to the customer, stay attuned to the customer's requirements and needs, and foster an atmosphere that transcends business transactions.

According to a USAF/ASC/HPM office representative, CRA willingly exceeds the standards established by the SBIR program. The CRA products derived from the SBIR process have proven invaluable in adding innovation and demonstrating the power of a focused, hardworking, and diligent team. These types of teams are always sought but rarely found in today's business environment. CRA has routinely demonstrated its value to the Air Force mission and continues to do so.

Flight Landata

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Flight Landata has developed highly innovative hyperspectral and multispectral imaging systems that can fit into manned and unmanned aircraft. The firm's researchers have already succeeded in making the systems smaller, lighter, and easier to use.

The technology of Flight Landata has great potential in both the public and private sectors, ranging from national defense to engineering and construction. For NASA, low-cost remote sensing would be extremely useful in its mission of charting and mapping with satellites. It would be a powerful tool in the study of the Earth's ecological changes. Outside of NASA, governments could use the technology to prevent forest fires by identifying areas that are dry and densely packed with brush. It could be used for precision agriculture in which aircraft

flying over large farms determine water, fertilizer or insecticide needs of specific areas. The Army Corps of Engineers and construction companies could use the technology to fly over areas and identify invasive species, wetlands, and landfills.

Flight Landata is an excellent example of the research fostered by the SBIR program. The company is located in an old mill town of Lawrence, Massachusetts – a town centered on the textile, apparel, and shoe industries and struggling economically. Innovative technology firms, such as Flight Landata, provide the type of high quality jobs desperately needed to revitalize the economy. Congress intended for SBIR awards to advance innovation in this country and to foster small businesses and job creation. Flight Landata does this and more.



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Radiation Monitoring Devices (RMD) specializes in high performance X-ray and optical sensors and instruments. Grateful for the opportunity that SBIR has provided to grow significantly and focus on commercial products, RMD has conducted a number of successful SBIR projects that have resulted in commercial products. As part of this research, RMD established collaborations with over two dozen universities and national laboratories. RMD has provided millions of dollars of funding to universities through these collaborations.

More than \$100,000,000 has been raised through commercial sales and private investment in SBIR technologies. However, the success of some of RMD's products cannot be measured in terms of sales only. For example, non-destructive test equipment was developed that improves the productivity of large manufacturers. The sales of equipment are significant but tiny compared to the amount of money saved by manufacturers in increased productivity. Many millions of dollars have been saved in the manufacture of reinforced plastic automobile parts because of the Compuglass Analyzer developed with NSF SBIR funding. It is even harder to quantify the benefit of systems that are designed to prevent loss. RMD built another inspection system for America's largest manufacturer of TV tubes. The total sales were \$200,000 but the true benefit of the system is that it virtually

eliminates the possibility of a financially devastating recall of defective TV sets, which would represent millions of dollars in losses.

Some of the most important successes go beyond financial. RMD has investigated technologies that impact the quality of life of patients. There are several examples of systems that improve surgical technique, which have been documented to reduce the probability of postoperative problems and increase patient recovery rates. Also, RMD's lead-in-paint analyzer is not only a hot new product, but helps ensure the safety of children in homes that might have lead paint.

Two notable commercial successes are the LPA-1TM Lead-in-Paint Analyzer and the Navigator TM Surgical Probe. LPA-1TM was funded by the National Institute of Environmental Sciences under Grant # 2-R44-ES05688. It resulted in commercial products being sold before the end of Phase II. LPA-1TM weighs 3 pounds and can produce a non-destructive measurement of lead in painted surfaces in 10 seconds. It is listed on the GSA schedule as approved for government use. Sales are several million dollars per year and it is estimated that over 3000 inspectors are employed using this system and that over 40,000 homes have been inspected, helping to protect children in those homes.

American Commodities, Inc.

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Flint, Michigan-based American Commodities, Inc. (ACI) provides recycling solutions and recycled products to the automotive industry. ACI is a compounder, processor, and recycler of engineered thermoplastics supplying products and services to the Tier I and Tier II suppliers to automotive manufacturers. Through its paint removal and multi-laminate separation technology, millions of pounds of scrap materials have been recovered and have been subsequently re-used in their originally intended applications.

ACI has excelled in all the categories the Tibbetts Awards seek to highlight and in addition it has used innovative technology to combine manufacturing and recycling. In 1998, ACI received Phase I and Phase II SBIR grants from the National Science Foundation to do research for a process that it has since patented to remove paint and other contaminants from certain thermoplastic resins. ACI used this technology to create a successful business that recycles over eight million pounds of painted plastics annually and employs 60 people. Using its SBIR-developed technology, ACI reclaims material

from old bumpers to make new bumpers. It recovers over one million plastic bumpers per year and provides many important services for its customers, including size reduction, compounding, and contaminant and paint removal as well as maintaining a full-service testing laboratory.

Among ACI's accomplishments in the area of high technology innovation is its development of a patented closed loop recycling system engineered for restoring properties of materials that have undergone prior heat treatment and processing. This technology allows the material to be reused in its originally intended application. ACI also provides a means for customers to recover and recycle the scrap they generate. These recycling-oriented innovations and the creation of a strong and viable business employing 60 people in a region that has seen significant job loss in the automotive sector is compelling. These accomplishments help make ACI an outstanding example of a high technology small business that successfully commercialized its SBIR research.



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During the past year, Sordal Incorporated has won four SBIR awards – three Phase I's and one Phase II (with one Phase II pending) – from the US Navy and the US Department of Education. Dale Danver – CEO NASA licensee Principal Investigator for Sordal's SBIR activity – was also able to obtain matching funds from the Michigan Economic Development Corporation (\$100,000) and recently received grants – from the Michigan Public Service Commission and NASA. This year Mr. Danver received the "2002 Innovation of the Year Award" for the State of Michigan and the "2002 People Friendly Workplace Award" from the Holland Chamber of Commerce.

Mr. Danver's work is focused on developing NASA patented polyimide foam. The US Navy seeks this material because it is very lightweight, non-flammable, non-combustible, and more durable than current insulation materials. Mr. Danver is developing the material, now commercialized as SOLREX, in a brush-on/spray-on form or in neat sheets. US Navy savings should exceed \$5 million per year.

The US Department of Education SBIR work with SOLREX is focused on a new insert or cushion for below-the-knee amputees. This novel work in prosthetics may one day lead to the elimination of blisters and sores for amputees, thus improving their well-being and life style. A Phase II effort is pending. Currently there are over 1.4 amputees in the USA and this new approach to the insert/cushion may save over \$10 million annually. This SBIR has also

led Sordal to apply for a \$4 million grant with the Michigan Life Science Corridor Project in 2003.

The Michigan Economic Development Corporation awarded Mr. Danver matching funds for each of his 2002 Phase I projects with the US Navy and the Department of Education. This funding allows research to continue until the Phase II funds or other sources become available.

In July 2002, because of his SBIR expertise and extraordinary results, Mr. Danver was awarded \$584,448 from the Michigan Public Service Commission to make machines to produce SOLREX in commercial sizes for use in commercial, industrial, and residential applications. Once completed, this work will be diffused nationwide.

Additionally, Sordal Incorporated is a subcontractor to Boeing and Northrop-Grumman to supply SOLREX for the next generation Space Shuttle. This work too was the result of Mr. Danver's SBIR effort.

As a direct result of Mr. Danver's 2002 SBIR activity, approximately 25 new jobs will be created in the near future and over \$5 million in sales in 2003 alone will be generated. Sordal Incorporated expects significantly higher sales and headcount increases after SOLREX has received all certifications and qualifications. Mr. Danver has also proposed new legislation to his home state of Michigan to create an SBIR mentoring program to increase Michigan's activity in this valuable resource.

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QRDC, Inc. specializes in the design and development of cost-effective and innovative solutions for noise, acoustic, vibration, and shock problems. QRDC, Inc. has received seven SBIR Phase I awards and four SBIR Phase II awards from the Department of Defense and the National Science Foundation, in addition to a Department of Energy \$2.3 million contract to provide innovative solutions for the mining industry. QRDC's commercialization strategy has included licensing and spinning-off three companies to commercialize its SBIR funded technologies. These companies are:

Smart Screen Systems Inc. (S3i), located in Northeastern Minnesota – commonly referred to as Minnesota's "Iron Range," has licensed and developed an innovative vibrating processing screen that will penetrate the \$2 billion worldwide mining market. DARPA and MDA-funded SBIR projects provided the basis for this innovative vibrating processing screen. The benefits of using this new screen will result in energy cost savings of up to 96% and noise reduction up to 98%. This new screen will enable the U.S. mining industry to become more competitive and will greatly enhance export activities. Additionally, US Steel's UEC division, a promotion and marketing arm for US Steel, has partnered with QRDC and S3i to promote and market QRDC and S3i products and services to the worldwide mining industry. By 2005, S3i revenues are projected to reach \$55M and add 60 new high paying jobs in an economically depressed region of Minnesota.

The second spin-off is SmartSkin Inc. (SSI), located in Minneapolis, Minnesota. SSI is developing solutions for noise and vibration reduction in aerospace, automotive, and building applications. SSI revenues are projected to reach \$50M by 2005. 30 new high paying jobs will be created during that timeframe.

ProtoPhase Inc. (PPI) is a prototyping and fabrication facility with small-scale manufacturing capabilities. PPI offers services to QRDC, Inc., S3i, and SSI. By 2005, PPI sales are expected to reach \$10M and the company will have 15 employees.

Since its inception in 1992, QRDC has provided an astounding return on investment through innovative technologies and job creation. QRDC and its affiliates have secured over \$2M of equity investments from strategic alliances and customers. By 2005, the overall impact of QRDC on the Minnesota economy will be more than 105 new, high paying jobs with overall revenues that exceed \$130M.

QRDC's innovative approach and application to noise and shock vibration have resulted in numerous strategic alliances with major prime contractors and large commercial companies.

**ZirChrom Separations, Inc.**

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ZirChrom Separations, Inc. is a company formed in 1995 and located in Anoka, Minnesota. ZirChrom manufactures a full line of zirconia-based high performance chromatographic materials for analysis and purification by high performance liquid chromatography (HPLC).

ZirChrom's most recent product introduction, DiamondBond, combines chromatographic particles created by ZirChrom with proprietary carbon-surface chemistry developed by Cabot Corporation (NYSE: CBT). Cabot Corporation is a Fortune 500 global specialty chemicals and materials company, headquartered in Boston, Massachusetts.

DiamondBond HPLC columns eliminate the tradeoffs that method development chromatographers traditionally have had to make between selectivity, efficiency, and stability. The first member of the DiamondBond family, DiamondBond-C18, is now available. The DiamondBond-C18 column offers a broader range of selectivity, higher efficiency, and unparalleled durability compared to other columns currently on the market.

ZirChrom has started to achieve commercial success as a result of almost \$2 million in SBIR grant

support. ZirChrom's initial grant, awarded by the NSF, is now in the Phase IIB stage. As a requirement of Phase IIB, ZirChrom secured over \$700,000 in outside commercialization support for the new technology. Additionally, ZirChrom executed a formal supply and cooperation agreement with Cabot Corporation. Starting in January 2002, Cabot assumed full marketing and sales responsibilities for a large portion of ZirChrom's commercial products, including the technology developed under the NSF support. ZirChrom and Cabot are on target to achieve \$500,000 in new sales for FY2002.

NIH grant support has also produced some promising technology that ZirChrom intends to commercialize with the help of a large marketing partner by the end of 2002.

ZirChrom now employs 15 full-time employees in the state of Minnesota, each enjoying a high quality of living. Half of these employees have advanced degrees in science, engineering or manufacturing. ZirChrom also provides financial support (non-SBIR) to assist in ongoing research activities at the University of Minnesota. During the summer of 2002 ZirChrom supported two undergraduate researchers as part of the REU Supplement program offered by NSF.

ElSohly Laboratories, Incorporated

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ElSohly Laboratories, Incorporated (ELI), is a multifaceted analytical laboratory servicing the drug testing industry and engaged in product development activities. ELI was founded in 1985 and has earned national and international respect in its area of expertise.

ELI is recognized for two highly innovative accomplishments: the development of an extraction process for natural and cost-effective delta-9-tetrahydrocannabinol (THC) from marijuana plants and the development of a critically needed alternate pharmaceutical formulation of THC using a prodrug.

ELI has developed a method to produce an economical supply of natural THC from marijuana plants. Currently, THC is produced synthetically by a single source with exclusive license to the company that manufactures the capsule Marinol (dronabinol). Therefore, THC is not available to carry out research activities and/or to manufacture a generic version. ELI's production of natural THC would promote the availability of an economical supply of THC for research and for the manufacture of generic brands of dronabinol.

ELI has also developed a new formulation of THC using a prodrug for the treatment of any condition for which THC might be an effective drug. The FDA has approved THC in the form of Marinol for the treatment of nausea and vomiting associated with

chemotherapy and appetite stimulation of AIDS patients suffering from the wasting syndrome. The only available formulation is an oral soft gelatin capsule that suffers from erratic and low bioavailability. To improve the bioavailability of THC, ELI has designed and developed a suppository formulation containing the hemisuccinate ester of THC as a prodrug which provides consistent and sustained release of THC. This formulation is licensed to a pharmaceutical company and has gone through phase I clinical trials. If successful through further phase II clinical trials, this formulation could be more effective in treating disease conditions, be economical for patients, and promote growth of generic drug companies to produce cheaper and more effective dronabinol.

The development of a natural and economical source and a new formulation of THC by ELI (once successful through phase II clinical trials) would significantly impact the economy. An easy-to-obtain supply of natural THC would enable availability of the drug at a lower cost to research investigators for research purposes and also to pharmaceutical companies to produce a generic brand of dronabinol at lower cost for the patient population. A new formulation of THC will increase the efficacy of the drug and thus indirectly reduce the cost to patients.



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Brewer Science, Inc. (BSI), founded in 1981 by Dr. Terry Brewer, is a leading supplier of specialty chemicals and equipment into the micro- and optoelectronics industries worldwide. The technologies of Brewer Science can be found in products such as computers, cameras, video recorders, cellular phones, medical instrumentation, telecommunications equipment, automobiles, games, and flight instrument displays on military and commercial aircraft, and NASA's space shuttle.

Since 1984, BSI has received forty SBIR awards from six different SBIR agencies, and has used SBIR funding as a strategy to develop commercial products. While not all awards have directly resulted in commercial products, the technical innovations resulting from SBIR programs have positioned BSI as a global technology leader. BSI has a demonstrated track record of turning SBIR-funded research into successful commercial products. In part, SBIR awards have funded g-line, i-line, deep ultra-violet, 193nm, and 157nm bottom anti-reflective coating (BARC) products currently on the market.

Collaboration with SEMATECH (US), IMEC (Europe), and Selete (Japan) consortia and integrated circuit and flat panel display manufacturers worldwide is an important part of BSI's plan to provide products and services that meet customer needs. BSI supports its products with a high level of technical service and customer support via sales and technical support specialists in the field. In addition to new BARC products, BSI is developing new dyed-red/green/blue color sets for high resolution color

imaging. These products will offer ease in processing and enhanced resolution compared to competitive products. The Cee Division is involved in customization of processing equipment to meet special and unique needs of various end-users. Recent innovations include automated spin coat and bake instruments as well as instruments capable of handling 300mm silicon wafer substrates.

A key part of BSI's strategy is to diversify its products and services. BSI is currently developing polymer-based infrared sensor platforms and chemical/biological sensors. In addition, BSI has active programs in MEMS materials to include lift-off layers, protective layers, and high refractive index polymers.

BSI – a company “Of the People, For the Customer, and By the Technology” – is an active member of the Rolla, MO business community and provides a large number of highly skilled technical job opportunities in this rural area. Today, over 270 employees are based in four US locations, with additional staff located in the United Kingdom and China. One of its core values is to support the community: BSI's “We Care Committee” allows its employees to be personally and financially supportive of over 40 organizations and activities in the local community.

Parvis, Inc.

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Parvis is an innovative and energetic new small business that is developing exciting new ways to make foreign language learning more accessible in the United States and around the world. Clearly in the wake of the tragedies of September 11th, Parvis is aiming to meet critical needs which are essential to not only global business but to U.S. national security.

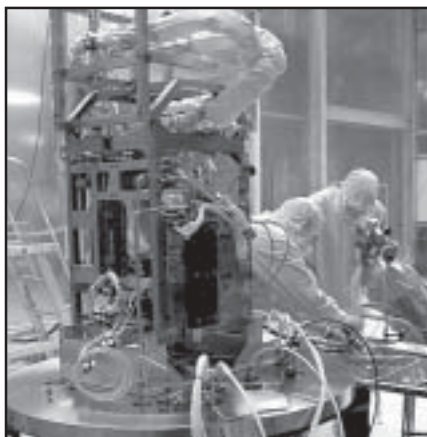
Parvis founder Dawn D'Atri won a National Science Foundation SBIR Phase I award in 2001 which provided the impetus to bring the innovative European eTandem computer-based distance learning method to the U.S. and in particular to her home state of Montana.

The young company is utilizing technology, combined with an innovative approach to foreign language learning developed in Europe with considerable success, to offer new educational services to students, business professionals, and others. The fundamental approach is called Tandem language learning that provides a structure through which language learners are paired up to help one another learn each other's languages. Parvis has utilized this concept to develop an electronic variation it calls "eTandem," and links people through the Internet to assist one another in language learning. This approach has great promise, particularly in helping students to learn less-commonly-taught languages not offered on most university campuses. Educational institutions are especially interested in utilizing this

product for students preparing to study abroad in countries in which these less-commonly-taught languages are spoken, because Parvis can link these students with Tandem partners in the country in which they will be studying.

Parvis represents the kind of energetic entrepreneurs the Tibbetts Awards recognize. It is creating new technological applications with very important social impact. The Parvis eTandem language learning method addresses the growing need for diverse language skills, flexibility in how to learn those skills, and intercultural understanding in this age of the global marketplace. This method of learning can only grow in importance as more and more companies develop international business networks. Additionally, many of the languages in its 300 different language combinations are pertinent in maintaining national security.

In an international market of 2 billion foreign languages learners, Parvis anticipates attracting over 10 million customers within five years. This level of dynamic commercial success will no doubt contribute significantly to Montana's economic vitality. But equally important is the role Parvis will play in stemming the "brain drain" of Montana's liberal arts, business, and information technology college graduates by expanding the opportunity to create in-state clean, high-paying jobs in the technology industry.



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Drawing on technologies developed under SBIR contracts over 16 years, and meeting a vastly accelerated NASA timetable, Creare engineers revived a critical scientific instrument on the orbiting Hubble Space Telescope (HST). Under the leadership of Walter L. Swift, the Creare team created a low-power, vibration-free cryocooler that restored the functioning of the multi-million dollar Near Infrared Camera and Multi-Object Spectrometer (NICMOS). Images taken at near-infrared wavelengths cut through interstellar dust that obscures images in visible frequencies, sharpening our vision of the distant early universe.

In March 2002, astronauts from the space shuttle Columbia successfully installed the cryocooler on the HST, and within nine weeks it returned the NICMOS detectors to temperatures suitable for operation (77 K). The first new images were obtained shortly thereafter and widely hailed for their clarity and research significance. Since Creare's cryocooler enables fine tuning of the detector's operating temperature, the detector's quantum efficiency has increased by about 30%, allowing scientists to state that NICMOS is "working better than ever."

In early 1997, when NASA and the Goddard Space Flight Center (GSFC) discovered that a heat leak would curtail the life of the NICMOS, they asked if Creare could create a cryocooler for space testing within 18 months. Millions of dollars of research and thousands of hours of astronomical observations

hinged on the project. The compressed development time frame – dictated by scheduled testing and Hubble servicing missions – severely challenged the limits normally expected of NASA contractors. Creare stepped up and, in October 1998, its cryocooler was flown on the space shuttle Discovery and qualified for use on the HST.

Since 1982, Creare has been developing advanced components for miniature cryocooler systems under SBIR contracts for BMDO, the Air Force Research Laboratory, and NASA/GSFC. Over the years, these contracts have generated Phase III funding exceeding ten times the initial SBIR funding amounts. The new technologies have included unique miniature turbo-machines achieving ultra-high speeds on vibration-free gas and magnetic bearings; novel power inverters suitable for space applications; high efficiency (>99%) recuperative heat exchangers; and both Stirling cycle and reverse Brayton cycle cooling loops that operate at low powers and achieve temperatures down to 4 K. Many of these employed novel electric discharge machining techniques invented by Creare engineers expressly for these applications.

The revival of NICMOS demonstrates the national and international impact that small business, aided by SBIR, can have in the development of cutting-edge scientific capabilities.

Structured Materials Industries, Inc.

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Structured Materials Industries, Inc. (SMI) is a small business that has successfully leveraged SBIR funding to develop new products and achieve significant growth in 2001. SMI was founded in 1992. The company has its foundation in The Stevens Institute of Technology and Rutgers University. Dr. Gary S. Tompa joined SMI as President in 1994. Since then, Dr. Tompa has focused SMI's technology and business strategy in the area of complex oxide thin films.

SMI develops technology and applications for oxide materials with unique electronic, optical, ferroelectric or piezoelectric properties. It then commercializes the thin film deposition equipment for customers in electronics, sensors, semiconductors, electro-optics, MEMS, superconductors, and related markets.

SMI's deposition technology is based on metal organic chemical vapor deposition (MOCVD). Its products are based on rotating disk reactor technology, which was originally pioneered for compound semiconductor deposition by researchers at MIT Lincoln Laboratories, Sandia National Laboratories, and Bell Laboratories. SMI has refined the rotating disk reactor concept and applied the technology specifically to complex oxide deposition.

SBIR funding has played a critical role in the development of this technology. In 1997, SMI was

awarded SBIR funding to develop "Advanced Transparent Conductive Oxides for Displays." The program was funded by the Ballistic Missile Defense Organization. Through this effort, SMI successfully developed thin film deposition technology for n-type ZnO, which is both electrically conductive and transparent to visible radiation. This material has numerous applications in displays, sensors, solar power, and static dissipation. After just a few years from the beginning of this program, SMI has achieved over one million dollars in revenues from ZnO thin film deposition systems and related components. This includes one full system and two partial systems. As a result of this success, SMI has grown to 12 employees in 2002, contributing not only to the technology for transparent conductive oxides, but also to the local economy.

Presently, SMI is building on this success. It is currently working to develop deposition technology for p-type ZnO, which would open applications for lasers, detectors, and electro-optical components based on wide bandgap semiconducting ZnO. Two other programs that are nearing commercialization stages are MOCVD of Al₂O₃ thin films for hydrogen barriers in microelectronics, and MOCVD of CeMnO₃ thin films as the ferroelectric material in non-volatile memories. Additional programs have been initiated to develop materials for thin film batteries, electro-optics, spintronics, biomedical, superconducting, and MEMS devices.



Nextek Mobility Corporation

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Nextek Mobility Corporation of Albuquerque, New Mexico utilized SBIR resources in developing a revolutionary new power wheelchair technology that will increase the freedom and safety of power wheelchair users. This new power wheelchair incorporates a technology called Parallel All-Wheel Steering (PAWS). Nextek's patented PAWS technology constitutes a radical advance in the basic design and operating mechanics of power wheelchairs. The PAWS system literally pivots on a point for maximum maneuverability yet provides enhanced stability and control in rough terrain as well as at traveling speeds.

Nextek has developed the technology into a family of products through funding by the National Institutes of Health's Small Business Innovative Research program. This project has been highlighted on the National Center of Medical Rehabilitation Research's website at www.nichd.nih.gov/about/ncmrr/innovations/innovations.htm.

Within Phase I and II of the SBIR grant, Nextek has developed this radical new concept into a series of prototypes for testing and finally a production build of 25 PAWS power wheelchairs for extensive user evaluation.

Nextek developed its technology with assistance and collaboration from Sandia and Los Alamos National Laboratories, the University of Pittsburgh, the University of New Mexico, Technology Ventures Corporation, Beneficial Designs, Inc., and others. The technology was developed with input from hospital staff, clinicians, and wheelchair users.

Nextek has additionally developed relationships with several local hospitals and rehabilitation centers for its user studies, including the Albuquerque VA Spinal Cord Center, Carrie Tingley Children's Hospital, and St. Joseph's Rehabilitation Hospital.

The international power wheelchair market is approximately \$650 million per year. The social impact of increasing the freedom and mobility of the power wheelchair user is significant. Nextek is negotiating a license to manufacture and market the PAWS device which may culminate before the completion of Phase II.

Impact Technologies, LLC

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Impact Technologies, LLC was formed in 1999 as an information technology and engineering firm specializing in developing advanced health management solutions for various military platforms including: fixed and rotary wing aircraft, destroyer class ships, aircraft carriers, ground vehicles, and more recently, unmanned combat vehicles. While having significant expertise in turbine engine systems used for both power generation and aero-propulsion systems, Impact Technologies has also developed solutions for aircraft hydraulic health monitoring, rotordynamic system prognostics, aircraft avionics, and vibration diagnostics. Founded by five engineers, success with the SBIR program has allowed the company to expand to 31 employees, with offices in three states. Annual sales have increased more than 50% each of the past 3 years with projected revenue of \$4.2 Million for 2002, with more than 50% projected to be from SBIR contracts. With over \$3M in SBIR awards in each of the last two years, Impact's SBIR track record has been the most successful in Western New York history and ranks among the top in the entire nation. Of additional significance to the local economy, thirteen of the newly created full-time jobs have gone to graduates from local colleges and universities, while maintaining an average of 2-3 ongoing co-op positions for college students.

Impact Technologies was awarded two Navy SBIR Phase I contracts during its first year in business. In the three years since, Impact has won an additional

twelve Phase I contracts and nine Phase II awards. All of Impact's contracts have been DoD-sponsored with the US Air Force, US Navy, and DARPA being the funding agencies. As a testament to the quality and significance of the Phase I demonstrations, all but one of the completed Phase I efforts led to a Phase II contract.

Dr. Michael J. Roemer, Director of Engineering, has been the driving force behind the SBIR success experienced at Impact, being either the Principal Investigator or a Key Person on eleven of the Phase I awards and on all nine Phase II awards. With degrees in both electrical and mechanical engineering, he has pioneered the approach of using physics-based models in combination with signal processing, artificial intelligence, and probabilistic methods in developing prognostic and health management solutions. This approach has significant advantages over traditional methods that are unable to reliably predict future operation of critical components when subjected to new operating profiles or for components with no operational experience.

The experience and results obtained from the DoD SBIR research are already being transitioned to practical applications in the commercial aircraft and electric power industries with contracts in excess of \$2M with Boeing, Honeywell, and the Electric Power Research Institute.



Mohawk Innovative Technology, Inc.

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Mohawk Innovative Technology, Inc. (MiTi®) is a research and product development company employing its patented core component technologies in non-contact bearings, seals, unique biosensors, and pumps to develop aerospace and biotechnology products. The company is now ready to establish a premier biotechnology company based on its unique heart pump system. MiTi® is recognized as a world-class R&D company, especially in the area of oil-free foil bearings.

Founded in 1994 with four employees and headed by Dr. Heshmat, MiTi® has grown to 34 employees with plans to hire 100 more within the next several years. MiTi® has become a \$5 million operation and has established several partnerships in the development of high tech products, such as Oil less-Gearless high-speed industrial gas compressors and biz-jet class aircraft gas turbine engines in addition to crucial systems for the DoD. Its rapid growth is due in part to numerous contracts, such as one from NASA to work with Williams International to develop the world's first oil-free turbine fan engine for passenger aircraft.

Because of initial SBIR funding, MiTi® has advanced development relationships with such distinguished companies as Pratt & Whitney, GEAE, Sundstrand, Samsung, and Boeing. Through acquisition of SBIR grants, MiTi® has developed a variety of projects leading to significant industrial advances and allowing tremendous savings. MiTi® has received \$12 million in SBIR funding and \$7 million in contracts for further development of SBIR-sponsored prototypes. At the present time MiTi® is seeking

investment for further development of an SBIR-sponsored program. The SBIR funding is the enabling mechanism in the development and flourishing of MiTi® technologies and the root of all its successes.

MiTi® has published more than 100 technical papers and holds 26 US patents. The company received the International Gas Turbine Institute's Small & Vehicular Turbomachinery Committee Award for the best technical paper published in 1999. Additionally, the Society of Automotive Engineers, Inc. awarded an MiTi® paper its Manly Memorial Award for best technical paper in 2000. Also MiTi® was recognized as a semi-finalist at the Smart Start Venture Forum. The Albany-Colonie Chamber of Commerce selected MiTi® to receive the Small Business Council's Innovative Enterprise Award and named MiTi® Small Business of the Year. MiTi® was identified as the second fastest growing company and the only technology company listed on the Business Review's list of 25 fastest growing small companies in the Capital Region.

Dr. Heshmat is an ASME & STLE Fellow and received the ASME Thomas Edison Award for his High Load Capacity Journal Bearings patent. In a collaborative effort with several government agencies and private sector companies, MiTi® foil bearings were integrated into a 150-hp, 120,000-rpm turbocharger for a heavy-duty diesel engine application. MiTi® has recently completed two SBIR Phase I projects with two partners – Williams International and Hamilton Sundstrand.

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Dawnbreaker® has provided commercialization assistance to over 100 Navy SBIR firms for the last three years through the Navy's Commercialization Assistance Program. Dr. Servo and her team have provided similar assistance to other Federal SBIR programs for over ten years.

The business development training and assistance that Dawnbreaker has provided to over a thousand SBIR and STTR firms has reaped huge rewards for many of these firms and made the difference between "getting by" and becoming a highly successful firm. As a small business founder and proprietor herself, Dr. Servo understands the problems and challenges that many small businesses face. She is a staunch advocate for small businesses and for the SBIR program.

Dawnbreaker provides the highest quality service and has provided tireless support and dedication to the small business community and the SBIR program.



MetaMetrics, Inc
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MetaMetrics Inc.'s flagship product, the Lexile Framework for Reading, is recognized as a leading technology in reading comprehension measurement. Through its major partners – Scholastic Publishing, Harcourt Educational Measurement, CTB-McGraw-Hill, and Riverside Publishing – children across the country can now receive a Lexile measure allowing both measurement of reading comprehension growth and selection of books that match their reading abilities. Books measured by the Lexile technology now total 35,000 titles and continues to grow. The Lexile Framework technology is found in major reading products such as Scholastic Reading Counts and SRA McGraw-Hill's Open Court reading program. Major states have adopted the Lexile Framework including North Carolina, California, Texas, and Utah. In addition, school districts across the country have adopted the Lexile Framework as their measure for reading comprehension.

Development of the Lexile Framework was funded by five SBIR NICHD grants, beginning in 1984 and continuing through 1994. The first commercial application occurred in 1996 when the State of North Carolina became the first adoptee of the Lexile Framework.

From an economic perspective, development of the Lexile Framework has resulted in the creation of MetaMetrics, Inc., which employs 20+ people and will generate revenues of approximately \$3.6M in 2002. In addition, MetaMetrics' partners will generate millions of dollars of revenue through their sales of Lexile-linked products and services.

Perhaps the most important outcome from the development of the Lexile Framework is that it provides a common metric for both reader and text. This common metric has been linked to all major norm-referenced assessments used in the US and several state-developed assessments. It is also used in interim reading assessments such as Northwest Evaluation Assessment (NWEA) and Scholastic Reading Inventory (SRI). Having a common metric without introducing another assessment into the school systems saves assessment time and provides valid comparisons across different assessment instruments. This will become increasingly important in measurement of adequate yearly progress (AYP) as mandated by current legislation. Finally, having a common metric that is tied to books allows parents, teachers, and others the opportunity to take actionable steps to improve children's reading skills.

Technology Applications Group

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Technology Applications Group, Inc., (TAG) is a North Dakota company founded in 1989 by Mr. Don Smith of the University of North Dakota's Center for Aerospace Science for the purpose of investigating new coatings for non-ferrous metals. The company is now a woman-owned business, owned by Mrs. Marilyn Whitney, a Kulm, North Dakota native and graduate of UND. In 1992, TAG identified a need in the market for magnesium coatings, and has taken the lead in filling that need. TAG has developed a highly advanced coating for magnesium alloys. The coating, TAGNITE is superior in every respect to existing technology and is used by aerospace companies like Sikorsky Aircraft, Boeing Helicopter, Orenda Aerospace, Pratt & Whitney, and others for their magnesium castings.

Many helicopter and aircraft components are made from magnesium alloys, due to its high strength and lightweight characteristics. The only problem with magnesium is that it corrodes easily. Existing coatings offer only limited corrosion protection because they are soft and porous. TAGNITE, being a hard coating with smaller pores, is better able to resist the environmental factors that cause corrosion.

TAGNITE coating was developed because existing magnesium coatings were inadequate for the demanding environments in which the metal was being used. The coatings lacked inherent corrosion resistance and, due to the chemicals employed, were

environmentally hazardous. TAG developed TAGNITE to address those problems and to provide superior corrosion resistance and be environmentally friendly. The TAGNITE coating has unmatched abrasion resistance and unequaled coating uniformity and is an excellent base for paint.

TAG has been awarded Phase I and Phase II SBIR awards from the U.S. Army. The Phase I award, received by TAG in December of 2000, was originally \$70,000, but the Army picked up the option on the award, raising the level of award to \$110,000. This award was used to study the feasibility of using handheld equipment to apply TAGNITE to magnesium helicopter components while in the field, without taking the helicopter apart. The Phase II award, received in December of 2001, is being used to test and develop that equipment. The Phase II award is for \$570,000 and will take two years to complete. Upon the completion of the Phase II, TAG hopes to market several types of repair kits for aerospace OEM and overhaul/repair facilities around the world. "The SBIR Program has allowed us to jumpstart our R&D efforts to bring products to market years before we had planned," said Bill Gorman of TAG. "We are proud to fulfill a crucial need by helping the Army keep its helicopter fleet in the air." Marketing the kits is expected to result in an increase of two to three employees from the company's current 18 full-and-part-time employees.


Cleveland Medical Devices Inc.

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Consistently one of Ohio's most successful SBIR contractors, Cleveland Medical Devices is the only manufacturer of FDA-approved wireless brain monitors in the western hemisphere. The SBIR program provided the funding for the development of this device, the Crystal-EEG®. It has been awarded over 40 SBIRs, primarily in the areas of wireless patient monitoring and pressure sore prevention. It also makes military asset monitors.

The wireless monitoring has been successfully adopted by the academic, research, and medical communities. The BioRadio and 8-channel wireless data acquisition system can be used to measure the brain (EEG), heart (ECG), muscle (sEMG), eyes (EOG), sleep (PSG) or respiration. It is used for both teaching and research. About a dozen universities have adopted the BioRadio Lab Course as the standard for teaching electrophysiology. Other researchers studying diseases such as Parkinson's, epilepsy, and sleep disorders are using the BioRadio to determine the efficacy of drugs and other treatments. The BioRadio is even used in the Arts. By monitoring a dancer, the University of Utah has converted physiological signals to images projected onto a stage screen, allowing the artist to dance with his physiological representation as a partner. This is an early example of the new field of Brain Computer Interface (BCI).

The RatPaak and BioRadio Jr. are new, 2-channel, wireless monitors that are the size of a US quarter,

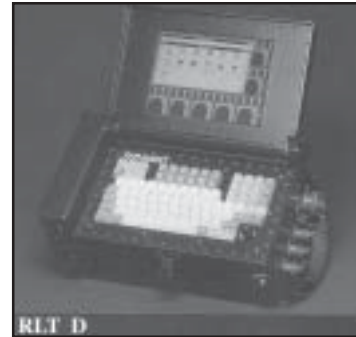
small enough to be carried by a rat measuring EEG during untethered drug studies or by other small animals or humans. The FDA-approved versions of the BioRadio are the Crystal-EEG Model 15 and Crystal Monitor Model 16. Two examples of their uses are measurement of the effect that intracranial stimulation used to reduce tremor may have on the brain and conducting sleep studies in non-traditional rooms in hospitals and other locations.

Cleveland Medical Devices has experienced extraordinary growth. In 2000, it was named by *Inc. Magazine* as the 336th fastest growing company in the United States. This placed it as the 3rd fastest growing medical device manufacturer in the US, the 10th fastest growing company in Ohio, and the 2nd fastest growing company in Cleveland. It has been on the Inc. Inner City 100 list as one of the 35 fastest growing companies in an inner city in the US for three years in a row. Similarly, it has been locally selected to the Weatherhead 100 list as being one of the 50 fastest growing companies in Northeast Ohio for the last three years. The governor of Ohio has recognized the company's contribution to the economy of the state of Ohio by awarding Cleveland Medical Devices the Thomas Edison Emerging Technology Award. Sales of the company products, many of which were created in SBIR programs, range from Canada to Korea, and in the US from Los Angeles and Seattle to Boston and Miami.

UES, Inc.

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Since its incorporation in 1973, UES, Inc. has been dedicated to innovative R&D that provides its employees the opportunity to work on challenging projects. With a background in aerodynamics, computer programming, engineering, human factors, and physics, UES decided, in 1980, to specialize in advanced materials R&D, identified by DoD as a major thrust area. At that time it invested heavily in facilities and specialized personnel. When the SBIR program was started in the early 1980s, UES was well positioned with a talented staff to vigorously pursue this new type of opportunity.

At first, only a few UES personnel ventured into the SBIR arena. As its success became known and the successful individuals were recognized, a large percentage of the UES scientists and engineers began to write SBIR proposals. To date, 25 different individuals have won SBIRs for UES.

Through September 2001, UES has been awarded 89 Phase I SBIRs, 3 Phase I STTRs, and 24 Phase II SBIRs. Six of the Phase II SBIRs have been successfully transitioned to commercial products and services with total commercial revenues over \$185 million. Another four of the Phase II SBIRs, still in progress, appear to have good potential for commercialization. More than 75 jobs have been created.

UES scientists and engineers are encouraged to participate in the SBIR program through individual and team efforts. During Phase I efforts, the Principal

Investigators are constantly reminded of the commercialization purpose of the program. Successful Phase II Principal Investigators are offered the opportunity to participate in the ownership of the resultant commercialized product/service company.

UES sponsored commercialization of SBIR opportunities include:

- Ruggedized portable computers for military and industrial uses Paravant Inc. (NASDAQ PVAT)
- Workflow management software for commercial use
- Computervision/Consentis
- FEM software products and services for simulation of casting and forming UES Software, Inc.
- Materials surface modification for semiconductors
- Unique high-quality coating services for tools UES Materials Laboratory Division

The government has already experienced a financial return from SBIRs awarded to UES. As of September 2001, the resultant companies and employees from the SBIRs have returned \$7 million more tax revenues to the federal government (from corporate income and payroll taxes and individual payroll taxes) than the total SBIR awards to UES and will continue to return in excess of \$3 million every year.

**William F. Whalen**

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Bill Whalen manages the Midwestern Regional Office of the Defense Technical Information Center (DTIC) located in Dayton, Ohio. He provides invaluable support for Department of Defense SBIR applicants in many ways. Most of these relate to his ability to show the path to the money. Mr. Whalen calls upon three other individuals in his presentations: Jerry McGuire, Deep Throat, and Willie Sutton. Their philosophies of “Show me the money!”, “Follow the money.”, and (Why do you rob banks?) “That’s where the money is...” make his presentations memorable.

Mr. Whalen has attended hundreds of workshops and conferences from Ohio to Missouri, Minnesota to Arkansas. He was twice invited to present papers at National Business Incubator Association conferences. He usually presents his “R&D 101” briefing. This virtual tour of the DoD research and development environment explains the who, what, when, where – and more importantly – how much. This knowledge is necessary to the R&D community so they can learn how they fit into the scheme and where they can find the information needed to get access to opportunities and succeed.

DTIC is the clearinghouse for all the technical information flowing in and out of the DoD R&D cycle. This technical information – or lack of it – can mean success or failure for the SBIR competitor.

DTIC has always been a major supporter of the SBIR program. DTIC compiles bibliographies on every

topic, provides free technical reports, and maintains a topic author question and answer website. Delivering high quality information products is the way to ensure that the SBIR community provides the DoD with high quality research and development.

Many years ago Mr. Whalen saw the need to get more and better technical information to SBIR firms. He understood the need for allowing small businesses into the Potential Contractor Program (PCP) and pushed for allowing DTIC information providers to enroll businesses into the PCP. The PCP allows firms with the potential to do DoD-level research and development the same access to information as firms that are already contractors.

DTIC began enrolling firms into the PCP in 2000. Since that time, over 300 small businesses joined the DTIC PCP community – this represents about 20% of all the firms registered with DTIC. Mr. Whalen has enrolled over 200 of these companies himself and their success rate has zoomed (six are 2002 Tibbetts Award winners). He keeps contact with these companies through a well-liked email list.

Mr. Whalen feels that “work is fun, and fun is work.” He is not passive about his job or about his hobbies (such as teaching canoeing and kayaking). His professional acquaintances call him a “high-energy, nice guy” and a man with “a personal mission” and a “passion for leading others to success.”

Fort Environmental Laboratories, Inc.

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Fort Environmental Laboratories (FEL), an environmental toxicology consulting and laboratories firm, is the only commercial laboratory in the US to specialize in the toxicological study of amphibians and reptilian species. Founded in December 2000, FEL enjoys a unique market niche specializing in the development of rapid, cost-effective, toxicological test methods using amphibian and reptilian species as indicators of environmental and human health concerns.

Doug Fort started FEL with no clients, but 15 years of experience in this field. As of December 2001, FEL routinely works with over 30 different clients, including government agencies, universities, and industry. Clients include the National Institute of Environmental Health Sciences (NIEHS), Environmental Protection Agency (EPA), Oklahoma Center for the Advancement of Science and Technology (OCAST), S.C. Johnson Wax, U.S. Borax, AM Laboratories, Phillips Petroleum, Unocal, and Battelle. In addition to new clientele, FEL has formed research associations with several institutions including Oklahoma State University, the University of Oklahoma, University of California – Davis, and the University of Kentucky. FEL also works closely with local schools, state agencies such the Department of Environmental Quality and Oklahoma Water Resource Board, and regional agencies, such as US Fish & Wildlife and regional EPA labs and offices. FEL has grown from a company

of two to an employer of eight over the past year. Revenue exceeded corporate goals during the first year of operation and continues to exceed goals this year. FEL provides employment and unique research opportunities for graduate students and internships for undergraduate students.

FEL has been awarded prestigious research grants from NIEHS, EPA, and OCAST totaling nearly \$580,000. FEL and Battelle Memorial Institute share a multiple year contract with EPA to develop and validate test methods evaluating effects of chemicals on the endocrine system of amphibians. Recently, EPA awarded FEL a Phase I SBIR grant to develop high throughput, inexpensive methods of detecting environmental contaminants with the potential to disrupt reproduction. FEL has developed over a dozen unique test methods. Most significant is a rapid, cost-effective, surrogate bioassay using amphibian embryos that is capable of predicting chemicals and environmental samples with the potential of causing human birth defects. By reducing the need for costly early product testing, this assay has saved pharmaceutical and agricultural chemical companies millions of dollars in research and development.

FEL's SBIR research has been featured on radio and in print and television media. FEL presents research findings at national scientific meetings and publishes research papers in reputable scientific journals.

**Molecular Probes, Inc.**

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Molecular Probes was founded by Dr. Richard Haugland in 1975 for the purpose of providing fluorescent dyes for biomedical research. Molecular Probes plays an important role in developing tools for fluorescence imaging, flow cytometry, DNA sequencing, high-throughput screening, nucleic acid and protein detection, and numerous other areas.

Molecular Probes has utilized SBIR grants to develop several hundred of its 2600+ products. Without support of the company's research program from SBIR grants, Molecular Probes may not have been able to survive, thrive, and grow from approximately 20 employees in 1985 to over 220 employees currently. Molecular Probes has a compounded growth rate of 20-25% a year since 1990.

Among the products commercialized by Molecular Probes utilizing SBIR support are:

- Dyes for DNA sequencing used by Applied Biosystems and Amersham to sequence the human genome
- BODIPY dyes as tracers, labels for cells, and enzyme substrates and in FluoSpheres and TransFluoSpheres microspheres
- Oregon Green dyes – superior to fluorescein-based dyes
- SNARF and SNAFL dyes – the best indicators for intracellular pH
- Cascade Blue dyes – ideal for a new 405-nm laser
- Fluo-4 – the best indicator for intracellular Ca²⁺ for high-throughput screening
- SYBR dyes – the best dyes available for nucleic acid detection in gels and quantitation of real-time PCR

- PicoGreen, RiboGreen, and OliGreen – premier reagents for nucleic acid quantitation in solution
- SYTO and SYTOX dyes – important reagents for detection of bacteria (including biowarfare agents) and cell viability
- TOTO and TO-PRO series of dyes, which can detect single molecules of nucleic acids
- SYPRO dyes for detection of proteins in SDS gel electrophoresis
- ELF substrates for ultrasensitive detection of targets in cells, on microarrays, and on blots

Dr. Haugland and others at Molecular Probes have served as external reviewers of SBIR grants. Dr. Haugland and Molecular Probes are internationally recognized for the company's *Handbook of Fluorescent Probes and Research Products*. Over 200,000 copies of the 984-page ninth edition of the *Handbook* will be published in September 2002. The company's website (<http://www.probes.com/>) receives over 120,000 user sessions and 7 million page hits a month, demonstrating the impact of its products in biomedical research. A recent survey of 1100 life sciences researchers by Bioinformatics rated it as one of the three best vendor websites (with Sigma-Aldrich and Invitrogen).

Molecular Probes continues to develop reagents and products from its SBIR-funded research; however, its financial success has made it unnecessary to depend on funding from this source. Part of this financial success is also related to out-licensing of the company's more than 60 issued US patents.

TerraSim, Inc

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TerraSim is a Pennsylvania-based company developing software for simulation and training in urban environments.

Under funding from the DARPA SBIR Program and subsequent support from the Army SBIR Program, TerraSim, Inc. has pioneered the generation of urban terrain databases for real-time modeling and simulation. DARPA's objective was to insert emerging image understanding technology into this labor-intensive, data-intensive problem domain, while the Army sought enhanced commercial tools for a faster, affordable generation of high-resolution urban terrain databases. This SBIR enabled TerraSim to extend its main product, TerraTools®, for the collection and utilization of many types of urban feature information.

TerraTools® was introduced in 1997 to construct visual simulations – “virtual worlds” – for training, mission rehearsal, and visualization. Using digital cartographic and GIS data, TerraTools® automatically constructs a 3D world that users can fly over or walk and drive through. Initial versions of TerraTools® were oriented toward the simulation of relatively open terrain suitable for air and mechanized ground operations training; however, military training today places increasing emphasis on urban areas, while municipal and regional governments require urban visualizations for planning, development, and environmental applications.

Building realistic simulations of urban areas requires

highly detailed cartographic data, which seldom exists, or the ability to capture or generate sufficient urban feature information. For instance, given the basic road network in a region, TerraTools® can infer the location of stop signs and traffic signals and then place 3D sign and light models. Computer-aided design (CAD) models of important buildings can be integrated into the overall scene, and building roofs and other features can be extracted directly from aerial imagery.

The urban modeling capabilities of TerraTools® have enabled several civil and military projects, including a simulation of downtown Philadelphia constructed by the Institute for Defense Analyses for the training of National Guard units responding to terrorist incidents. This detailed virtual world includes traffic lights, street markings and signs, and CAD models of landmark buildings. Other government users include the Army Topographic Engineering Center and the Secret Service. Commercial projects include visualizations of dense urban areas generated automatically from city planning department GIS data.

With critical SBIR support, TerraSim has commercialized tools for generating urban terrain databases that both military and civilian customers are using to produce realistic simulations of urban environments. This work in “Computer Assisted Modeling of Urban Environments” provides an outstanding example of small business innovation to address critical national needs.



Marine Acoustics, Incorporated

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Marine Acoustics, Inc. is a small business headquartered in Middletown, RI, with its primary technical office in Arlington, VA. MAI provides across-the-board engineering support technology in solving scientific, R&D, and operational applications. MAI has been providing research, engineering services, and technology support to a wide variety of Department of Defense customers for more than 15 years. MAI moved its headquarters to Middletown, RI, in 1990. The company also has technical offices in Virginia and Connecticut, employing scientists, managers, and support personnel totaling 29 employees.

With the support of a DARPA SBIR Phase I award in 1999, followed by a Phase II award in January 2001, MAI has developed a handheld one-way translation device called Phraselator to provide our military forces with the ability to communicate with overseas local populations and indigenous military personnel. Halfway through the Phase II contract, following September 11, MAI received an order from its project officer at DARPA with the instructions, "Build now." This order was the beginning of a new \$2 million Phase III contract calling for the rapid buildout of 600 Phraselator units. Six months and two days later, the first twelve Phraselators on the Phase III contract were delivered to US military units in Afghanistan. The contract calls for the delivery of 1,000 Phraselators to US Special Forces, Marines, and other military units in support of Operation Enduring Freedom.

The Phraselator is a handheld, voice-to-voice, machine-based phrase translation system. When an English phrase is spoken into the system's microphone, speech recognition software matches the input phrase with a pre-recorded translation in a target foreign language. The translated phrase is then played back through an electronic speaker in that language. Typically the phrases and their associated translations are grouped into mission-based and task-specific modules such as security, medical evaluation, law enforcement, and even tourism. Module size generally ranges from 500 to 1,500 phrases translated into two to ten different languages. The system is flexible and allows for the easy addition of necessary phrases and languages, as well as the ability to change modules and languages on the fly. As an example, the units provided for Operation Enduring Freedom contain a Force Protection module designed for use by US Special Operations Forces and Marines in the field. These units support languages such as Arabic, Pashto, Dari, and Urdu.

MAI leads a unique team of several high-tech and innovative businesses on the Phraselator project, including Applied Data Systems of Columbia, MD; SRI International, provider of speech-recognition software; Digital Models and Drawings of Methuen, MA; and PTA Corp. of Oxford, CT. Trouvere of Providence, RI is the assembler and tester of the pre-production units as well as the coordinator and distributor of the finished Phraselator product.

OctaFlex Environmental Systems

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OctaFlex Environmental Systems is a manufacturer of innovative products designed to offer “Practical Solutions to Environmental Problems.”

Following the World Trade Center attack, OctaFlex proudly responded to a request from the EPA and FEMA to manufacture and deliver equipment for three wash stations to New York City Ground Zero. These stations are used for decontamination of asbestos from trucks hauling debris from the World Trade Center. Each of the three cleaning units washed 1000 trucks per day for the duration of the cleanup efforts.

Terry R. and Barbara Gross, owners of OctaFlex, are the recipients of two SBIR Phase I and II awards. The first award in 1995 from the USDA was to develop a modular, portable containment/loading deck to aid in ground water protection and rinseate recovery. Effective research resulted in Phase II. The Bureau of Land Management utilizes this pad as a fire bombing aircraft loading pad, and the aerial/ground chemical application industry uses it for environmental compliance. The SBIR/USDA technology resulted in OctaFlex entering into a contract to prototype a Corrosion Service Center for the US Army. Vehicles drive onto modular wash decks for cleaning, rinsing and anti-corrosion application.

In 1997 the US Marine Corps SBIR Programs Office awarded OctaFlex a Phase I and subsequent Phase

II for the Containerized Assembled Washdown Facility (CAWF). This environmentally compliant wash system was designed to utilize recycled water to remove agricultural pests from military vehicles. NBC decontamination, anti-corrosion, and disposal of sludge and solid waste are addressed. Space Projects, a collaborating SBIR company, provides a vital CAWF component: Enhanced Mobile Electrical Power Distribution System (EMEPDIS). OctaFlex is the manufacturer of the Vehicle Service Ramps that are compliant with CAWF.

In 2002, OctaFlex entered into the ONR BAA 02-004, Marine Corps Vehicle Corrosion Prevention and Control Technology Wash Down System. The objective of this effort is to enhance CAWF capabilities by identifying or developing cost-effective and environmentally acceptable corrosion prevention and control technologies to remove or inhibit corrosive substances from USMC vehicles.

Current and potential markets include US and foreign military, Homeland Defense, and Incidence Response to Chem/Biological decontamination processes such as in Foot and Mouth Disease.

OctaFlex is located on the Cheyenne River Indian Reservation of South Dakota, a region with one of the highest unemployment rates in the Nation. The company's success, thanks to SBIR, is a big boost to the vitality of this vast, impoverished region.



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Dr. Terry Payne, Program Manager of the Oak Ridge National Laboratory's Government Partnership Programs Office, is a strong advocate of government-industry research partnerships and strives daily to make the Government Partnership Programs Office at the Oak Ridge National Laboratory a valuable resource for industry.

Dr. Payne has been a key promoter and supporter of the Federal SBIR and STTR programs. His promotion of the programs consists of educating small businesses about the opportunities afforded to them via the SBIR and STTR programs, and encouraging small businesses to participate in the programs including submission of SBIR and/or STTR proposals.

Specific actions which reflect Dr. Payne's leadership in the SBIR and STTR programs include:

- Sponsoring, organizing, and speaking at conferences to educate small business owners about SBIR/STTR program opportunities. These conferences have occurred in numerous states including Tennessee, Georgia, Alabama, Kentucky, North Carolina, Montana, Illinois,

South Dakota, and Alaska. Recently Dr. Payne has helped organize conferences that include the Tennessee SBIR Week and various SBIR/STTR Proposal Writing Workshops.

- Coordinating access to and the use of special ORNL facilities and capabilities by companies performing SBIR/STTR-sponsored research.
- Providing lectures on SBIR and STTR research funding opportunities to students in the University of Tennessee's Technopreneurial Leadership Program.
- Assisting the State of Tennessee Department of Economic and Community Development in its development of the Tennessee FAST Proposal submitted to the US Small Business Administration.
- Counseling small, technology-based businesses seeking assistance from various high-tech business incubators.
- Working with State Small Business Development Centers to develop knowledge management capabilities of SBIR/STTR opportunities.
- Coordinating the ORNL Technical Assistance Program which provides small businesses with access to specialized ORNL capabilities at no expense to the company.

Karta Technologies, Inc.

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Karta Technologies, Inc. is a high tech small business specializing in solving engineering, IT, logistics, and training needs for government and commercial practices. With a number of SBIR awards, Karta is a leader in creating innovative products and pushing the envelope in innovative research.

Karta was incorporated in November 1986, and, over the past 15 years, has grown to a dedicated staff of 250 professionals whose work has generated over \$20 million in revenues. Approximately 34% of the Karta staff holds post-graduate and doctorate degrees in engineering, computer science, or life sciences. Karta's expert staff has executed a wide variety of complex projects on time and on budget. This has resulted in the steady expansion of Karta's corporate capabilities.

Karta provides solutions within the fields of engineering services, environmental services, strategic planning, medical technology, logistics, information systems technology, innovative distance learning and computer-based training, non-destructive evaluation and testing, and engineering design and prototype development. Karta's customers include federal, commercial, and international clients.

The objective of most of the Karta SBIRs has been to develop new NDE technologies and products. Examples of SBIR projects include development of laser ultrasound sensing technologies, a high frequency automated ultrasonic system for ceramic material inspection, hybrid inductive-capacitive probes for thermal barrier coating characterization, and an automated intelligent system for pipe-weld inspection. Using the SBIR grants, Karta is currently developing NDE products for residual stress measurement, non-contact thickness measurement, and plasma spray process monitoring and control. These products are based on the application of fiber-optic, electromagnetic, and laser-based ultrasonic sensing technologies.

Karta has been selected for twenty SBIR Phase I and four Phase II awards – one of the largest accumulations of awards for a small business in Texas. These awards came from all three services in the Department of Defense (Army, Air Force, and Navy), the Department of Energy, and NASA.

**OmniSite BioDiagnostics, Inc.**

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OmniSite BioDiagnostics, Inc. (OBI), based in Austin, Texas, originated as a Systems and Processes Engineering Corporation (SPEC) SBIR-funded Biodiagnostic organization in 1999. It has successfully emerged as an independent commercial entity. After winning SBIR Phase I and II awards, OBI has used the technology developed to enter the highly competitive commercial arena with innovative and patented technologies. Projected instrument sales are \$18M for the FP Reader, \$12M for the FI Reader, \$20M for the MEMS-ELISA, \$15M for the MEMS-ECL, \$5M for the Mini-PCR, and \$20M for the FP GeneArray.

The potential benefits from the application of these technologies are truly enormous, extending into human diagnostic, therapeutic, home care, and pharmaceutical sectors, along with homeland defense, biowarfare, veterinary, agricultural, and environmental markets. Teaming arrangements are underway with major pharmaceutical and diagnostic companies like Abbott Labs, Diagnostic System Labs, and IGEN International to market these products and technologies both nationally and internationally.

Despite the present economic downturn, OBI has added staff with professionals, new graduates, and college interns, employing 15 highly talented, dedicated scientists and engineers. Further hiring and expansion is expected once pending commercial contracts are finalized. OBI expects to continue growing its research acumen by recruiting locally from Texas' flagship college, the University of Texas, with a campus of over 52,000 students and from a large professional base of high-tech computer and software companies, along with several small biotech companies.

The future is bright at OBI, powered by our dedicated employees, Intellectual Property, and technical innovations. OBI is analogous to a small acorn sown in the biotechnology field, fully expecting to mature into a large oak tree. OBI is proud of its achievements and confident that they will make an impact on the quality of human life through furthering medical diagnostics and the environmental and homeland defense fields.

OBI is very grateful for the SBIR program and owes much of its success and hope for obtaining future goals to the program's financial support.



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Echelon Biosciences Inc. (EBI) is a growing private biotechnology company committed to accelerating drug discovery and bringing lifesaving therapeutics to market. EBI was founded in 1997 to characterize signal transduction pathways that transmit messages into a cell and its nucleus for drug discovery. It has since expanded its development of drug discovery tools to include enzymes key to bacterial survival. These technology platforms will provide basic and applied research with new tools for the identification of enzyme inhibitors and signaling antagonists to create a new generation of pharmaceuticals in the fields of cancer, diabetes, and infectious diseases.

EBI has three principal elements of its growth strategy:

- Develop and supply scientists with basic research tools for molecular biology/chemistry in cell signaling
- Develop assays to measure cell signaling and enzyme activity for targeted compound screening for the pharmaceutical industry
- Discover and develop new therapeutic molecules that inhibit, modify, or enhance cellular signaling pathways involved in cancer and diabetes

Small Business Innovation Research (SBIR) grants from the National Institutes of Health (NIH) have allowed EBI to fund research to develop unique antibodies and lipid recognition proteins (LRP), fluorescent markers, and express enzymes for drug discovery assay development. EBI has developed and

is now offering the first non-radioactive assays for high throughput screening (HTS) for lipid signaling enzymes which are involved in or direct carcinogenesis, metastasis, apoptosis, and mechanisms in diabetes, cardiovascular disease, and inflammation. Two 2002 Phase II SBIR grants will advance development of a phosphoinositide 3-kinase assay for cancer diagnosis and a shuttle lipid for monitoring intracellular function for real-time cell-based assays.

EBI was awarded a Phase II Small Business Technology Transfer (STTR) grant in 2000 and a Phase I SBIR grant in 2002 to develop bacterial strains for discovery of antibiotic compounds aimed at interrupting enzymes in the methylerythritol phosphate biosynthetic pathway (an essential isoprenoid compound in many bacteria). This new drug target will identify compounds with specific action against problematic organisms like *Bacillus anthrax*, *Mycobacterium tuberculosis*, and drug resistant bacteria while not affecting friendly bacterial flora or mammalian cellular biology.

EBI has been the beneficiary of multiple SBIR and STTR grants which have allowed it to expand from 13 employees in 1999 to 30 in 2002 with product sales of \$1 million in 2001. Recent Phase I SBIR grants will allow EBI to explore additional signaling areas and apply assay technology to microdevices and microfluidic systems for faster drug screening, offering greater cost efficiencies.

Paul D. Hale

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Since 1999, Dr. Paul Hale has served as the Executive Director of the Vermont Technology Council and Special Assistant to the President at the University of Vermont. Dr. Hale has been invaluable to the State of Vermont's small business community by providing SBIR education and outreach through a variety of activities.

As a founding member of Vermont's SBIR Coordinating Council that was established in 2000, he has worked to create and implement a formal SBIR outreach program within the State. Dr. Hale has served as chair of the Vermont Experimental Program to Stimulate Competitive Research (EPSCoR) SBIR Phase 0 Review Panel. Vermont EPSCoR's SBIR Phase 0 program provides "pre-Phase 1" grants to help companies better compete in the federal SBIR programs. Vermont was the first state to establish such a program.

Dr. Hale has developed strategic partnerships with other State organizations that provide education, outreach, and technical assistance to SBIR participants. His role as a liaison between the State's research institution, the University of Vermont, and Vermont's innovative business community has been invaluable.

When Dr. Hale first joined the Vermont Technology Council and the University of Vermont in 1999, there was no formal SBIR outreach program within Vermont. At that time, Dr. Hale served as the ad hoc SBIR outreach person for the State of Vermont,

in partnership with the Vermont EPSCoR program. In 2000, the Vermont Department of Economic Development received a Rural Outreach Grant through the SBA to create and implement a formal outreach program. At that time, Vermont EPSCoR was awarded a grant from the Department of Commerce to expand its SBIR capabilities. Dr. Hale's participation in the State's effort to get funding for SBIR outreach was instrumental in the State's successful bid for funding and program creation.

During his tenure in the private sector, Dr. Hale was awarded a total of 17 SBIR grants from the National Institutes of Health, the Department of Energy, and the National Science Foundation. This experience has allowed him to serve as the lead presenter in SBIR workshops throughout Vermont. His "SBIR 101" seminars serve as an excellent foundation for companies and individual entrepreneurs interested in learning about the SBIR program and how to participate.

Dr. Hale also provides direct technical assistance to new SBIR applicants by providing proposal review assistance, by linking companies to appropriate research expertise at the University of Vermont, and by referring companies to other State resources that are available to help in technology commercialization efforts.

Dr. Hale has served as an outstanding contributor in Vermont's efforts to educate our small businesses on the benefits of the SBIR/STTR programs.



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Barron Associates, Inc. (BAI) is a 17-employee engineering/scientific R&D company whose focus is to provide clients with novel solutions to demanding measurement, modeling, prediction, and control problems. These solutions frequently employ intelligent and adaptive technologies, resulting in improved performance, safety, and efficiency. An important foundation for this business is BAI's leadership in computational neural networks/statistical modeling, a field in which it is recognized for its pioneering work and the advancement of polynomial neural networks and their applications.

BAI is among the highest ranking firms for SBIR commercialization success, with a DoD Achievement Index score of 80%. Based on all Phase II awards, investment in BAI returned almost \$17 million to the economy through sales and additional investment put into the technology developed under these awards.

BAI's strategy for commercializing SBIR-developed technologies consists of four parts: providing an ever-expanding range of engineering services to industry; licensing technology; sales of commercial software tools; and the formation of joint ventures to manufacture products. To enable BAI to remain focused on its contract R&D services and the resulting generation of intellectual property, BAI aggressively pursues new-business ventures for the development and marketing of particular applications.

Marketminer Inc. (www.marketminer.com) and Testengine.com: (www.testengine.com) are examples of successful joint ventures.

BAI has forged a superlative business record by working to the highest standards of creativity, thoroughness, and responsiveness to customer needs. An important part of BAI's business involves Phase I and Phase II SBIR contracts, and the largest sector of its work involves Phase III activities that have grown out of the SBIR program. BAI strives to develop a lasting partnership with every customer and team member. The company emphasizes technical excellence and close, open, honest relationships with its customers. Believing in on-time, in-budget performance, BAI has never requested overrun funding on its Government prime contracts!

Current BAI Phase III SBIR business areas include:

- Commercial Software Tools for System Modeling
- Aircraft Pilot-Aiding Technology
 - Reconfigurable Flight Control Systems
 - Limit-Avoidance Systems
 - Trajectory Optimization
 - Tactile Cueing Technology
- Optimum Guidance for Autonomous Munitions
- Control & Protection of Shipboard Electric Power
- Diagnostics and Prognostics of Machinery and Structures
- Healthcare Technology
 - Devices for Monitoring and Diagnosis
 - Software for Health Improvement
 - Medical Outcomes Assessment and Prediction

Luna Innovations Incorporated

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Luna Innovations is an R&D firm focused on the commercialization of practical technology applications to improve the quality of life. Due to the success of many successful SBIRs, Luna has spun off five new, independent companies since 1999. Its commitment to commercialization runs deep, raising more than \$60 million in non-government funds to market a variety of products in the areas of fiber optic sensors, components, measurement instrumentation, and advanced materials.

From a Navy Phase II on pharmaceuticals, Luna Analytics was launched. Analytics is manufacturing bioanalysis instruments to quantify protein and small molecule interactions. These instruments will revolutionize the way protein interactions are assessed, leading to disease diagnostics, treatment, and drug discovery.

Luna nanoMaterials was aided by a National Science Foundation program that focused on production and separation technology. Luna can now produce, in high yields, unique carbon nanomaterials that are proposed to increase the sensitivity of MRI scans, and simultaneously identify and attach individual cancer cells.

Luna Innovations has addressed the need for robust, low profile, low cost, optical fiber-based instrumentation for in situ simultaneous humidity/temperature measurements in buildings where undetected moisture can lead to structural damage and unhealthy living environments. Luna is exploring commercialization venues for corrosion sensing applications on aircraft. A fiber optic sensor-based

health monitoring system for aircraft and a condition-based approach for corrosion inspection of airframes has the potential to save the operators millions of dollars each year compared to current inspection practice.

Luna Innovations introduced a fiber optic sensor-based health monitoring system for large rotating industrial equipment. Systems have been installed in several industrial plants. These systems enable end-users to achieve significant manufacturing operations cost savings due to yield optimization and reduction of unnecessary maintenance.

Luna Energy focuses on fiber optic sensors for the oil and gas industry. Partnered with a Fortune 100 oil service company, Energy continues development of sensors begun under SBIR contracts. Sensors will provide real-time field management data to enhance production and safety while lowering costs.

The newest spin-off company Luna iMonitoring, which focuses on wireless remote sensing applications, is a product of a culmination of SBIR contracts with the US Navy and Air Force.

The Luna group of companies currently employs about 175 people with expectations on doubling by next year. Luna's companies are making optical communication systems faster, enhancing energy production and safety, enabling drug discoveries, and improving diagnostics for disease treatment. Luna exemplifies the values of the Tibbetts Awards in its faithful commercialization of government-supported research.

**Personal Improvement Computer Systems, Inc.**

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Personal Improvement Computer Systems, Inc. (PICS) is a research and development company in Reston, VA, which specializes in portable computer applications to change health behaviors. For 18 years, PICS has developed, researched, and commercialized a number of products designed to reduce tobacco use, increase physical activity, and improve diet to reduce obesity and other diet-related health problems. SBIR grant support has allowed PICS to produce products with important societal impact, while also increasing export activity, creating jobs, and sustaining development efforts that address important health problems.

With SBIR support in 1986, PICS developed LifeSign® – a credit card size computer designed to help smokers quit by scheduling and gradually reducing their smoking. With subsequent SBIR support, a family of LifeSign® products for smokeless tobacco users, teenage smokers, and pregnant smokers also has been developed and commercialized. The effectiveness of LifeSign® has been established in a number of studies with long-term quit rates ranging from 18 to 24 percent. Total sales of LifeSign® products have exceeded one million units. Based on total sales and quit rates, an estimated 210,000 smokers have quit as a result of using this product.

Heart disease remains the leading cause of death in the United States. In addition to smoking, diet and exercise are significant contributing factors to this mortality factor. With SBIR grant support beginning in 1990, PICS developed

DietMate® – the first handheld computer for promoting a healthy diet and regular exercise. Programs specifically for cholesterol and hypertension control also have been developed and marketed. To date, over 50,000 DietMate® units have been sold. The LifeSign® and DietMate® product lines have resulted in over \$100 million in total sales. These sales have been in North American markets and a number of international markets including Latin America, Australia, Japan, and numerous European countries. Over 250,000 units have been exported.

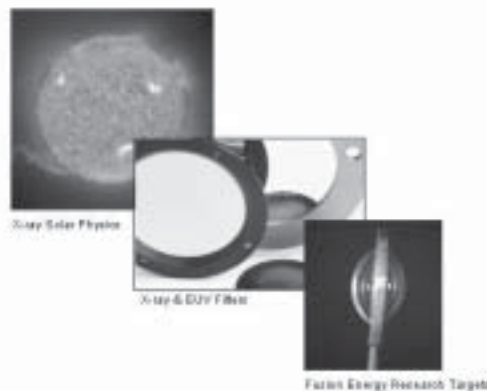
PICS has been the recipient of 30 Phase I and II Phase II SBIR grants from the National Institutes of Health. With continued growth, PICS currently has 15 full-time employees with additional job creation through outsourcing. Because of SBIR funding, PICS has been able to engage in extensive product development and research. In 2001 alone, PICS received 10 SBIR grants to continue development of innovative technologies, such as wireless communications to deliver behavioral interventions for a range of health problems.

The SBIR program has helped PICS pioneer innovative approaches to changing negative behaviors in an effort to improve people's health.

Luxel Corporation

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Luxel Corporation is the preeminent supplier of filters for X-ray astronomy. Significant improvements in mission productivity have come from Luxel's SBIR-seeded innovations in the development of new materials and new methods of fabricating ultra thin film filters. For example, the Chandra X-ray Observatory instruments all utilize aluminized polyimide filters made possible by a NASA SBIR project. Astronomers from all over the world are collaborating on the new scientific data being collected. A number of other space missions, including Astro-E, the Advanced Composition Explorer (ACE), and the Geostationary Environmental Satellites (GOES) weather satellites have benefited from the use of Luxel's aluminized polyimide. The savings from enhanced data collection efficiency on these various programs has been enormous.

Building on the success of Luxel's first SBIR contract in 1992, the company has grown from seven to 20 employees and sales have tripled to over \$2.2 million per year. The total number of SBIR contracts awarded to Luxel is now eleven, including five Phase II contracts. Improved filters for solar astronomy and improved filters for use with cryogenic detectors have been made possible as a direct result of the work

accomplished under these SBIR contracts. Two NASA Phase II SBIR contracts are currently ongoing. Both will further development of the polyimide technology and it is expected that Luxel's product sales will continue to grow at a rate of about 15% per year based on this new technology. Constellation-X, the next generation mission X-ray astronomy, will benefit directly from Luxel's past and current SBIR endeavors.

Luxel is the only high-tech manufacturer in Friday Harbor, Washington – a town of 2000 people. The year-round technical and research jobs provided by this company are much appreciated by this small community where many jobs are seasonal and service-oriented. The town is proud of the fact that the spectacular pictures coming from Chandra are made possible in part by filters made in Friday Harbor!

Luxel owes much of its success to the SBIR program. The investment in new technology required to meet NASA's needs in X-ray astronomy could not have been achieved without SBIR-funded materials and process development. Luxel's SBIR contracts have been of great benefit to both NASA and Luxel. Truly, Luxel has been given a new life.



HealthMark Multimedia

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HealthMark Multimedia (HMM), a former evaluation contractor with a staff of two part-time employees, has used the SBIR program to become a developer of innovative, interactive multimedia health education and treatment decision products for patients. Since receiving SBIR funding in 1999, HMM has grown to include ten full-time and two part-time employees in 2002. Staff includes entry- and mid-level professionals and technical personnel. Additionally, HMM now contracts with seven small businesses and has grown from a home-based business to downtown Washington office space. The company now holds five Phase II awards and six Phase I awards for multimedia applications of patient education and treatment decision products. For many of the SBIRs, HMM has collaborated with non-profit institutions, such as the American Foundation for Urologic Disease, The Children's Foundation, and the American Pain Foundation. This unique collaboration provides HMM with access to nationwide subject matter expertise while providing the non-profits with a source of income from contracts and product sales. These collaborations have led to expanded programs and increased revenue for the organizations.

HMM has used its SBIR funding to develop and test models and processes uniquely designed for patients and the health care setting of the current decade. HMM has conceptualized, tested, and

translated decision-making models into user-friendly products for consumers and health professionals. Patients facing life-threatening conditions need quality information that will assist them in making decisions that reflect their personal values and preferences. The HealthMark team has translated quality information into practical applications that are population appropriate and accessible to the greatest number of end users, in a variety of multimedia products, i.e., audio, short text, video, graphics, and photographs. The most recent product is Prostate Cancer: Your Decision Notebook® for men newly diagnosed with prostate cancer. Over the last 25 years, research has shown that diagnosing men in the early stages of prostate cancer and providing them with treatment choices improve their chances of survival. HealthMark has produced a patient-oriented CD-ROM to engage patients in the treatment decision process and that has the potential to assist the majority of American males over the age of 50. HealthMark is currently expanding the Your Decision Notebook® series to include other significant treatment decisions.

Ruth Lange

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Ms. Ruth Lange served as the assistant program director for the US Department of Agriculture's SBIR program for the past six years. During this tenure, she developed great rapport with other SBIR program managers, research scientists who serve as technical reviewers, and the small business community.

Ms. Lange has been especially effective in working with new applicants and with grantees in helping them with whatever questions they may have. She has provided expert assistance and advice in guiding them through the process. She is a very engaging person, who is very easy to work with. The USDA SBIR program has greatly benefited from her dedication, hard work, enthusiasm, and organizational skills.

Ms. Lange has been especially effective in outreach activities, and she has been a strong supporter of these efforts across the Nation and especially to rural states. She has traveled to many SBIR meetings where she has given talks on the USDA SBIR program and held one-on-one meetings with

potential applicants and current grantees. She has been very patient in providing these individuals with the information they need. Her calm demeanor and technical competence combine to provide exemplary customer service.

Ms. Lange has been a great help to various state and local SBIR programs by providing up-to-date information and statistics about the USDA SBIR program. She has provided this information whenever requested and has done so quickly and very accurately. Her efforts in these endeavors have helped broaden interest in the USDA SBIR program across the Nation.

Recently promoted to serve as Peer Review Director of her agency's competitive research programs, Ms. Lange will provide the leadership and direction essential for an effective peer review process. She has been a great asset to the Federal SBIR program and is very deserving of recognition as a Tibbetts Award winner.



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nPoint, Inc. was founded in 1997 as PIEZOMAX Technologies, Inc. by industry-veteran Max G. Lagally, Ph.D., who is also Erwin W. Mueller Professor of Materials Science and Physics at the University of Wisconsin-Madison. Dr. Lagally is recognized as a visionary leader and catalyst in promoting the growth of Wisconsin's high-tech small business sector and globally as an expert in the material science of surfaces and thin films and in design of precision instrumentation for materials characterization. He has translated leading-edge concepts in physical sciences, through the effective utilization of SBIR Phase I and Phase II awards, into numerous current and potential products to further advances in the field of nanotechnology.

nPoint produces nanomanipulation systems with the highest resolution and accuracy, and the quickest response time, currently available in the nanomanipulation world market. The company's nanomanipulation products are capable of achieving positioning precision and movement that make possible manipulation even at the atomic level. To date, nPoint is the successful recipient of five Phase I and four Phase II SBIR awards totaling more than \$3 million. These awards enabled the company to perfect its range of products and accessories and launch itself into the OEM world without the need for outside investment.

The company's products are essential tools to move and manipulate objects from millimeter levels down

to the sub-molecular level. These tools have applications for life science and semiconductor research, and in the semiconductor manufacturing and testing, biotech, and defense industries.

The devices provide a fundamental enabling technology that is used in an increasing number of research, manufacturing, and test applications in the semiconductor, biotechnology, and nanotechnology industries for nanoscale-precision positioning and controlled nanomotion in microscopy, metrology, lithography, and robotics applications. As manufacturing begins to reach into the nanotechnology space, the company's products will become increasingly important as enablers for ultra-high precision manufacturing, nanolevel critical metrology, nanocharacterization of materials, and applications in biological microscopy at the molecular level.

The products nPoint has developed with SBIR funding represent a paradigm shift in device capability – making possible advances that were thought not possible just a few years ago. Nanomanipulation and control is a fundamental enabling technology that is critical to the development of new products and applications. nPoint nanomanipulation devices are the single most significant and essential set of tools available today that facilitate the transition from micro to nanotechnology.

Jay O. Stender

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Jay Stender, President of Aspect Consultant Group (ACG Inc.) of Sheridan, Wyoming, has been a major contributor to the success of the Wyoming SBIR/STTR Initiative (WSSI). Mr. Stender first became aware of the SBIR program in 1996 when he attended an SBIR presentation by Dr. Chris Busch. Mr. Stender subsequently submitted a Phase I SBIR proposal to the NSF which was not funded. Following the path of true SBIR champions, Mr. Stender refocused his efforts and submitted a Phase I SBIR proposal to the USDA which was funded.

Since that initial success, Mr. Stender has provided proposal preparation and consulting services which have resulted in five Phase I awards and two Phase II awards to three Wyoming small businesses as well as consultation to small businesses throughout the western US. Currently, Mr. Stender is the Principal Investigator on a NASA Phase II SBIR contract which was awarded to Big Horn Valve, Inc. of Sheridan.

Mr. Stender continues to be an SBIR champion, serving as a mentor to Wyoming Phase 0 award recipients. The Wyoming SBIR/STTR Initiative is fortunate to have Mr. Stender's enthusiasm and expertise available to new SBIR/STTR program participants.

Mr. Stender's consulting business is focused on encouragement, development, and profitability of new technologies for natural resource protection and utilization. He emphasizes to small businesses that capturing an SBIR award and conducting the workplan requires discipline, that there are great potential benefits, and that, when completed, new options for economic success are possible. Mr. Stender views the SBIR/STTR programs as a critical opportunity for small businesses to investigate and evaluate high risk concepts – an opportunity that allows development without equity dilution.

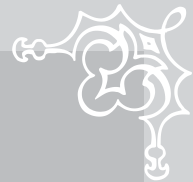


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