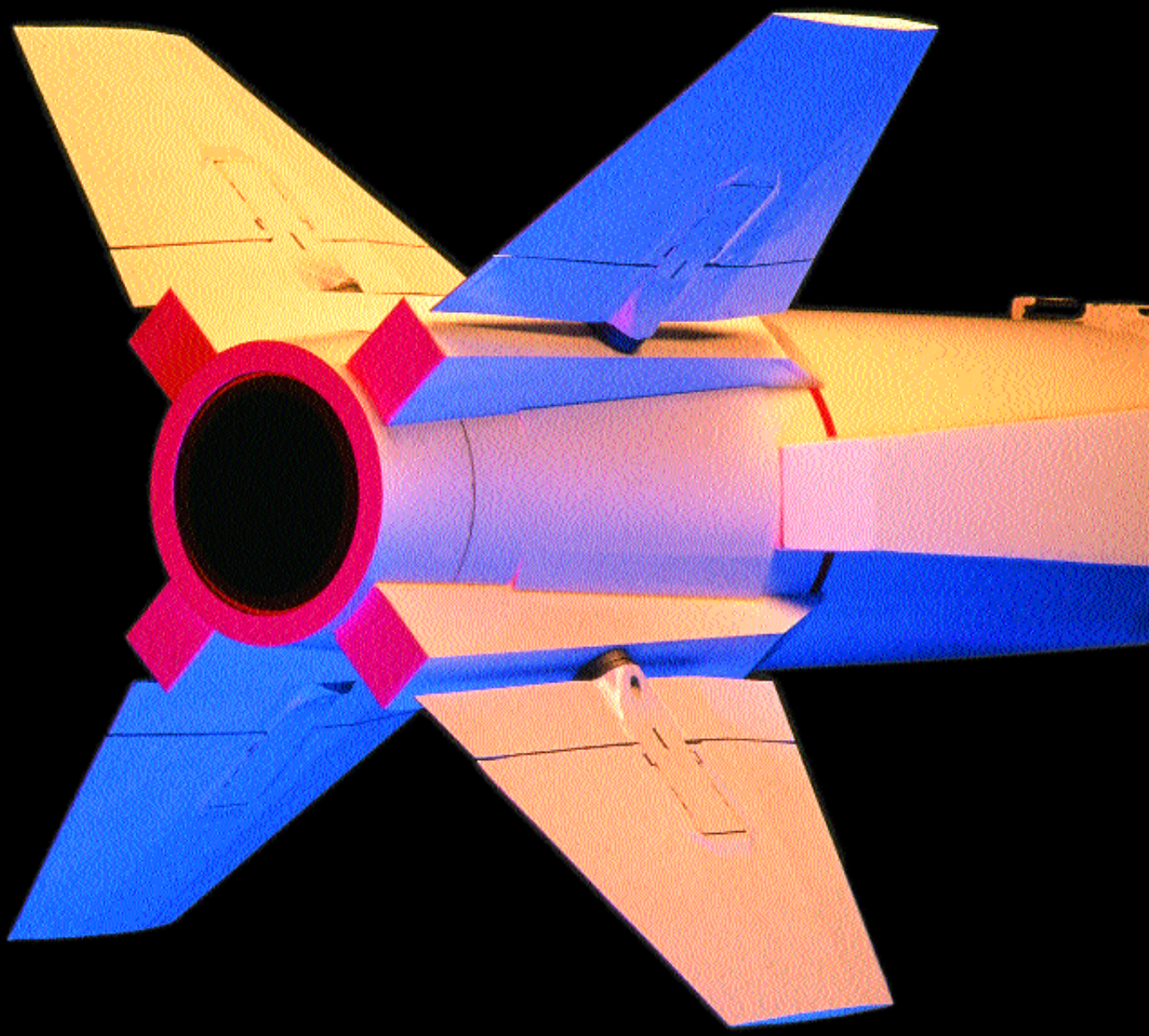
Department of the Navy SBIR/STTR Successes



Thanks to all of the companies for their participation in this Navy SBIR/STTR Success publication. We appreciate the time and effort it took to compile and share facts, details, and graphics for the stories.

For more information about this publication or additional copies, please contact:

Office of Naval Research
Attention: John Williams
Deputy Navy SBIR Program Manager
ONR 364, SBIR Program
Ballston Tower 2, Room 106
800 North Quincy Street
Arlington, Virginia 22217-5660

Telephone (703) 696-0342
Facsimile (703) 696-4884
E-mail williajr@onr.navy.mil

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Department of the Navy SBIR/STTR Successes

Foreword

US small businesses have always been “hot beds” of creative and innovative ideas, but their journeys from drawing board to commercialization are often made difficult, if not impossible, by inadequate funds and limited marketing opportunities. To assist these small businesses in their efforts to develop cutting edge, cost-effective technologies and products for the Military, the Department of Defense funds over $550M in research and development through its SBIR/STTR program annually. Since 1982, the SBIR program has helped fund the critical research and development necessary to develop key military technologies and products to protect the warfighter and the Nation.

Through their acquisition programs, the Navy and Marine Corps are working diligently to increase the implementation of SBIR/STTR-funded technologies into the Fleet. Many invaluable technologies and products are a direct result of an acquisition office's role in topic development and sharing critical information, such as specific requirements and schedules, with small businesses. The Navy’s Commercialization Assistance Program (CAP) was specifically designed to help SBIR Phase II companies transition their SBIR-funded technologies into the Navy and Defense Acquisition communities and to market their business to potential strategic allies and investors.

In this edition of the Success publication, the Navy is proud to highlight the successes of some small businesses that have made important contributions to the Military and the private sector through the Navy SBIR/STTR Program. Utilizing entrepreneurial spirit, hard work, and creativity, these companies have labored to fulfill specific research and development needs of the government to help the DoD maintain technical superiority. We salute their success.

JAY M. COHEN
Rear Admiral, US Navy
Chief of Naval Research

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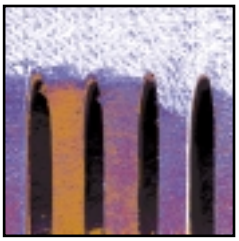

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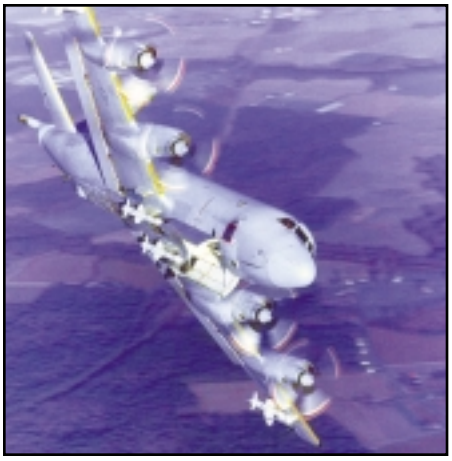
INTRODUCTION

The Navy's SBIR Program

The SBIR program was designed to provide funding that would stimulate technological innovation in small businesses to meet government research and development needs. After more than 18 years of existence, the program has established itself as one of the most effective technology development programs in the federal government while providing the technical advances that propel economic growth. Studies by Congress, the General Accounting Office, and the Small Business Administration have consistently produced very positive reports on the program. *Inc.* magazine has called the SBIR program "the most important piece of small business legislation yet enacted in our lifetime."



The SBIR program is a highly competitive three-phase system.

- ***Phase I*** contracts focus on the evaluation of an idea's scientific merit. They also support small scale testing as appropriate. The base award for this phase is up to $70,000, with a $30,000 option if the project is selected for continuation into Phase II. Phase I usually lasts six months.
- ***Phase II*** demonstrates an idea often by building and testing prototypes. This second phase normally lasts two years. The Department of the Navy typically offers a Phase II base award of $600,000, with an additional $150,000 option.
- ***Finally, Phase III*** supports either production or additional research and development by the DoD, federal government, a defense prime contractor, or the private sector. During Phase III, a company can receive either government or private sector funds, but no longer receives SBIR funds.

We measure the success of the Navy's SBIR program by the companies that transition their SBIR efforts into products, tools, or services that benefit the Navy acquisition community. One important strength of the SBIR program is that once a company has received a Phase I award, the follow-on Phase II and III awards can be awarded in a non-competitive process since the competitive process has already taken place under Phase I.

The companies included in this Navy Success publication have all reached the Phase III level of the SBIR program. For each story, we have tried to describe:

- the technology developed by the small business
- the military and commercial significance of the technology
- the application of the technology
- additional information about the company

A description of the company's SBIR investment and follow-on non-SBIR revenues is also provided. In some cases, SBIR awards from more than one SBIR program developed the technology. However, the dollars in the project revenues in each story are only those associated with the Navy's SBIR award. The dollar amounts are broken into:

SBIR Investment - the dollar amount the SBIR program invested in the company for development of the technology

Project Revenue - the non-SBIR dollars that have been invested in the company for additional research and development or the result of sales of the product.

If you would like to know more about the SBIR program, would like to identify the latest technology advances, or would like to participate in the SBIR solicitation, please visit our website at http://www.onr.navy.mil/sbir or contact one of the Navy program managers listed on pages 80-82.

THE SBIR DIFFERENCE

This section provides a company view of how the SBIR program can be the critical component in the successful growth of a high-tech small business. Each of these companies started with a few innovative people, some great ideas, and Navy SBIR funding. All have had incredible growth and success and two have graduated from the "small business" designation. The following three stories provide insight on how these companies successfully used the SBIR program to transition ideas into products that have benefited the Department of the Navy, the Department of Defense, and the Nation.

Advanced Ceramics Research, Inc.

All The Right Moves

A small company's application for an SBIR research and development (R&D) award in 1989 turned out to be the right move! Advanced Ceramics Research's (ACR) first revenues came from the US Government's SBIR program and $1,000 in start-up capital. Within six months, ACR had secured a Phase II SBIR contract for $500, 000 from the US Naval Surface Warfare Center and since then, there's been nothing but "fast forward" motion at this Tucson-based small business. Funding from the Navy has been critical in helping ACR become what it is today – as Anthony Mulligan, President of ACR, said, "The Navy's support has been invaluable to ACR. We could not have attained the technical superiority we enjoy today without Navy funding."

■ ACR's $3 million company owned facility in Tucson, AZ.

Since 1989, ACR has received nearly $6 million in SBIR/STTR funding that has led to over $30 million in follow-on non-SBIR/STTR funding and an additional $35 million in signed license and technology transfer contracts. Much of the early follow-on funding was Federal research dollars from the Office of Naval Research, the Defense Advanced Research Projects Agency, and the Department of Energy. Now a majority of it comes from defense prime contractors and Fortune 500 companies.

ACR has used the SBIR/STTR program the way it was intended. Early in the company's life, ACR developed a strong business plan that focused on two core technologies. Then, ACR only focuses on SBIR/STTR topics that directly correspond to these technology areas. After assessing the value of the project to its core business, ACR develops a plan that includes the Phase I and II work plus the requirements necessary to transition the technology into defense and/or private sector applications. ACR typically brings in partners from universities and private industry to complement its expertise, thus assembling the complete team to take the project to a successful, marketable product. ACR only invests time in SBIR/STTR topics that are part of its business plan because it also invests its own dollars into the project, using SBIR/STTR funds to supplement internal R&D programs. This makes for a win-win partnership between the government and this small business.

ACR has concentrated on two main business areas: Fibrous Monoliths (FM) and Rapid Prototyping/Rapid Manufacturing (RP/RM).

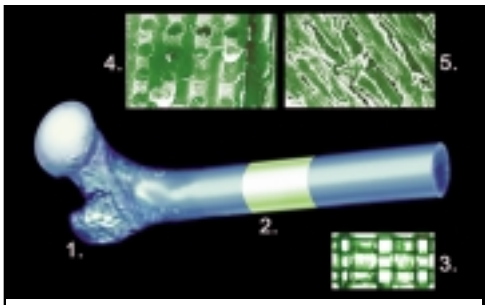
FM composite ceramics are a novel class of high strength, high temperature composite materials that are manufactured using a patented process. This process uses inexpensive ceramic powders to create a high performance composite material that is difficult to fracture and that tends to fail incrementally, instead of catastrophically, unlike traditional ceramic components. FM

composites can withstand temperatures up to 6000ºF and are extremely abrasion resistant. The material's wear resistance makes it ideal for the manufacture of equipment for drilling in the oil and mining industry, in road milling machines, and in cutting tools. This technology originated from ACR's first SBIR award during which it drew upon the research expertise at the University of Michigan, the University of Arizona, and the growing technology base of Tucson to address the increasing need for more economical high temperature, wear resistant components for aerospace and defense applications.

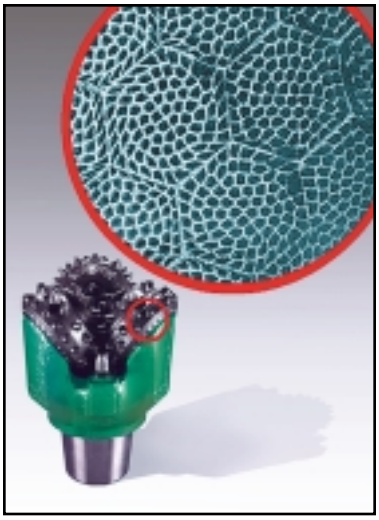
Applications for FM materials include electronics, high power X-ray targets, wear parts, rocket motors, turbine engines, and high temperature structural components. Some of ACR's most successful commercial transitions have come from its FM materials. ACR recently signed a 10-year, multi-million dollar license agreement with Smith International, Inc. for the use of this technology to improve the efficiency of oil and rock drilling. ACR and Smith believe that the FM technology will increase tool life many-fold and allow Smith and ACR to garner millions of dollars in additional revenue and increased market share. ACR is also working closely with several jet engine and rocket propulsion manufacturers to develop parts made with FM materials for Navy engine platforms. These components are not only cheaper than the ones they replace but also last several times longer, thus providing savings through reduced maintenance and replacement costs.

On another Navy funded STTR program, ACR and the University of Arizona are developing strong polymer-ceramic composites for superior bone substitute products for orthopedic and other reconstructive surgical applications using ACR's Extrusion Freeform Fabrication (EFF) rapid prototyping method. The porous polymer/ceramic parts created through EFF do not degrade rapidly and are much stronger and stiffer than currently available copolymers.

ACR has developed several cost-effective methods of RP/RM. One is the use of its proprietary water-soluble mandrel material for the manufacture of polymer matrix composites. Current mandrel materials such as eutectic salt, sodium silicate bonded sand or poly vinyl alcohol (PVA) bonded ceramic microspheres have several disadvantages such as being environmentally unfriendly (eutectic salt), brittle (sodium silicate bonded sand), and temperature limited (PVA). ACR's mandrel material overcomes all these problems and makes this step of polymer composite manufacturing, once one of the largest cost drivers, into one of the smallest.

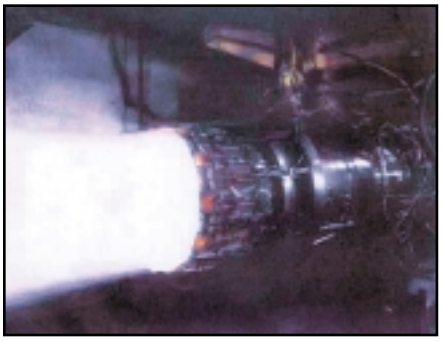


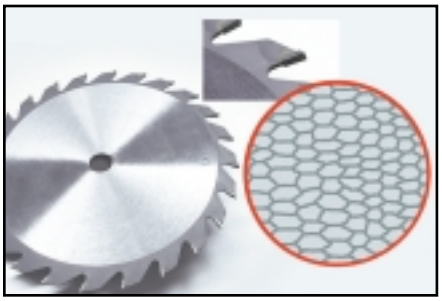
1 Human Femur
2 Porous Polymer Scaffold
3 Scaffold Section (25x)
4 Impregnated Detail (30x)
5 Bone Tissue Growth (+7 days)



■ Top: Schematic of ACR's polymer/ceramic composite implants showing biocompatibility in short-term in vitro tests.

■ Bottom: Fibrous Monolith drill bit used in oil drilling with a close-up showing the FM microstructure.





■ Top and middle: Sinboron™ Fibrous Monolith afterburner component for F110 engine.

■ Bottom: Fibrous Monolith concrete cutting wheel.

Since the early days of the company, ACR has teamed with university researchers to help develop cutting edge technologies, and then to commercialize these technologies by partnering with large Fortune 500 companies. Over the last 12 years, ACR has established close business relationships with corporations such as Honeywell, Smith International, Raytheon, Lockheed, Kyocera, Phelps Dodge, Inco Mines, IBM, Seagate, Thiokol, Alliant Tech, Aerojet, Varian, General Electric, and BF Goodrich.

Collaborative efforts with colleges and universities are an important contributor to ACR's success. Collaborative research with the University of Michigan added significantly to the development of Fibrous Monolith ceramic composites. ACR is presently working with the University of Delaware on further development of rapid prototyping technologies for ceramic composites. The University of California-Santa Barbara and the University of Arizona are joining ACR's current program for developing wear resistant components for the mining industry. ACR is also working with Michigan Technological University on processing technology for mining and excavation tools.

ACR's collaborative research activities have not been restricted to the Navy and academia; ACR also works closely with government-sponsored laboratories. ACR has worked with the Wright-Patterson Air Force Research Laboratory and currently has a Co-operative Research and Development Agreement (CRADA) with the Army Research Laboratory in Aberdeen, MD. This CRADA focuses development efforts on high temperature, high-pressure consolidation of ACR's FM composites. Outside of the Department of Defense, ACR collaborates with two Department of Energy National Labs: Argonne in Illinois and Oak Ridge in Tennessee.

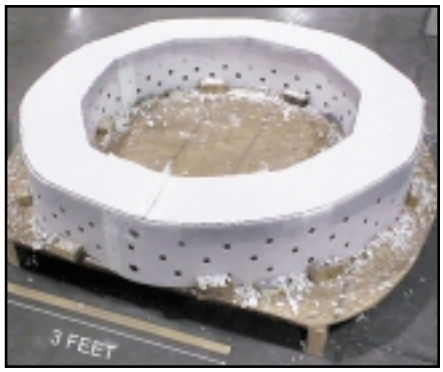
In March 2000, ACR formed a new joint venture called Advanced Ceramics Manufacturing LLC (ACM) with the Pasqua Yaqui Tribe of Arizona. ACM is now converting ownership to several Native American individuals from the Tohono O'odhom Tribe of Arizona. The San Xavier Business Development Authority, owned by the Tohono O'odhom Tribe, will be buying out the Pasqua Yaqui portion of ACM, making ACM a 51% Native American owned high tech small business. ACM's focus is on the volume manufacturing scale-up of the FM technology and it will begin construction of a large hot isostatic press facility on the Tohono O'odhom reservation by late summer 2001. These new state-of-the-art facilities will be capable of fabricating parts as large as 24" x 48" at pressures of up to 30, 000 psi and temperatures of up to 2200ºC.

Specific Navy needs and successful collaborative efforts with universities, along with creative and dedicated employees, have been key to ACR's success, but that initial SBIR funding set the wheels in motion for this company on the move.

Contact

Advanced Ceramics Research, Inc.
3292 East Hemisphere Loop
Tucson, AZ 85706-5013

Anthony C. Mulligan
E-mail a.mulligan@acrtucson.com
Telephone (520) 573-6300
WWW http://www.acrtucson.com



■ Top: Aquacore™ water soluble composite tooling.

■ Bottom: President Anthony Mulligan and Chairman Benito Valencia of the Pasqua Yaqui Nation sign a historic joint venture to form Advanced Ceramics Manufacturing Inc. Congressman Jim Kolbe (R-Arizona) and former Chief of Naval Research Vice Admiral Paul J. Gaffney look on.

IntelliSense Corporation

Perfect Sense

Dr. Fariborz Maseeh, founder of IntelliSense, in front of a clean room at the new facility.

Dr. Fariborz Maseeh had the idea; the Office of Naval Research had the need. Together with SBIR funding, a combination was formed that really made sense – in fact, it made "IntelliSense"!

IntelliSense got its start with a Navy SBIR Phase I award in September 1993 when Dr. Maseeh was a one-man show, fresh out of MIT. The ONR award entitled "New CAD Software for the Development of Micro Mechanical Systems" led to a Phase II and the start IntelliSense needed to establish a product and a presence in the MicroElectro Mechanical Systems (MEMS) arena. In May of 2000 Corning acquired IntelliSense for approximately $750 million in Corning stock. Not bad for an SBIR startup!

Dr. Maseeh's doctoral dissertation at MIT was on developing software tools to aid in the design and ultimately manufacturing of MEMS. MIT received funding from the Federal Government on this work, but their interest was a mostly academic one. Seeing beyond the academic to the commercial potential of this software, Maseeh wrote a proposal to a Navy SBIR solicitation for further research & development of MEMS software. Once he was awarded the Phase I contract, he started his company in a loft near the MIT campus. At the end of Phase I, Maseeh tried unsuccessfully to gain interest and funding from the government sources that had funded the MIT efforts. Undeterred, he wrote a successful SBIR Phase II proposal, moved out of the loft into a space on Boston's high tech corridor, and continued the development of the MEMS software that is the core product of IntelliSense.

For the company to grow and succeed, Maseeh knew that he had to get his software into the hands of the user community. So he set low prices for the software and charged nominal license/use and upgrade fees. Even before his Phase II work was complete, he had sold several dozen copies to universities and industry worldwide. Word spread quickly on how the software could reduce both time and cost between the design and manufacturing stages for MEMS devices. It wasn't long before orders and acclaim poured into the company.

The company began to grow quickly; in fact, revenues and employment have doubled every year since its start in 1993. Maseeh began to expand his facilities and hire employees who could help him make IntelliSense into a viable business. Maseeh was committed to hiring employees who shared his vision and drive, and much of the company's success comes from the dedicated and creative team of employees that he has assembled. Maseeh also developed strong business relationships with key companies and actively traveled the world marketing his software.

Maseeh now wanted the capability to manufacture MEMS devices. Being an entrepreneur and having little capital, Maseeh bought used electronics manufacturing equipment, expanded the office, and built a clean room. Now IntelliSense was able to build prototype MEMS devices. This provided a second source of revenues, critical feedback to his MEMS software, and allowed him to hire electronics manufactur-

ing engineers to his team of mainly software engineers. IntelliSense quickly became the leading provider of MEMS software for the design, simulation, modeling, and manufacturing of MEMS devices. IntelliSense is still the only company that combines MEMS-based design-tool development, process, and product engineering as well as MEMS manufacturing.

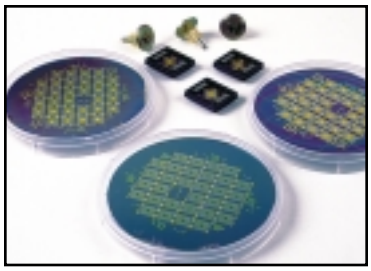
What is it that IntelliSense developed? MEMS devices are constructed from silicon or glass wafers and are measured in millionths of a meter. Highly scalable production techniques make them ideal for many emerging applications since they allow new technology to be mass-produced and quickly incorporated into new products. Besides the early products (read/write heads for hard disk drives, inkjet printer heads, and airbag accelerometers), today MEMS devices are used in an expanding number of applications, including cardiac pacemakers, labs-on-a-chip for in vitro diagnostics, hearing aids, and micromirrors. However, designing and manufacturing MEMS devices was very time consuming and often required dozens of iterations, which are costly and impede the development of MEMS devices. IntelliSense developed software that draws from large databases to provide the performance characteristics of the materials used in MEMS devices. This software simulates the design, manufacturing, and operation of the MEMS devices, thus avoiding the trial and error previously required and allowing a MEMS design to produce successful products after only a few iterations. This can save millions in development costs and allows the development of devices that would have been too costly to develop without IntelliSense's "Total MEMS Solutions ™" software.

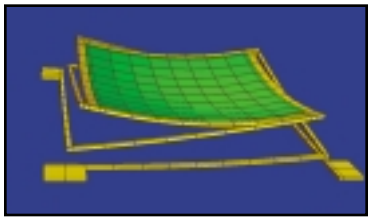
Currently, IntelliSense serves customers in sixteen countries and its products are widely used in the telecommunications, biomedical, semiconductor, and aerospace industries. The company recently completed construction of its 55,000-square foot MEMS facility in Wilmington, Massachusetts – the largest flexible MEMS processing facility in the United States. The new building contains design facilities, clean rooms, manufacturing lines, and packaging/assembly areas for four and six inch wafers. Because of its acquisition by Corning and by actively growing its business to serve the needs of innovative MEMS researchers and developers worldwide, IntelliSense is positioned to continue as a major contributor to the industry, projected to become a $38 billion dollar market by 2002.

Contact

IntelliSense Corporation
36 Jonspin Road
Wilmington, MA 01887

Dan Green
E-mail dgreen@intellisense.com
Telephone (978) 988-8000
WWW http://www.intelliSense.com





■ Top: Wafers and MEMs devices.

■ Middle: IntelliSuite™ provides the platform that incorporates process, material, data, mask layout, and device analysis.

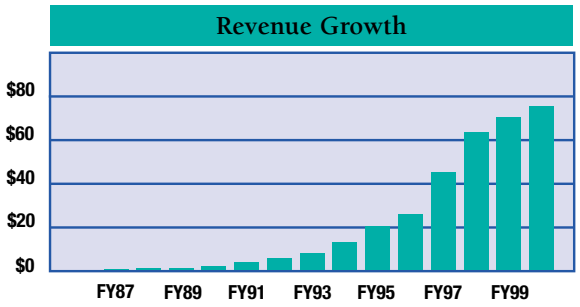
■ Bottom: Clean room at IntelliSense.

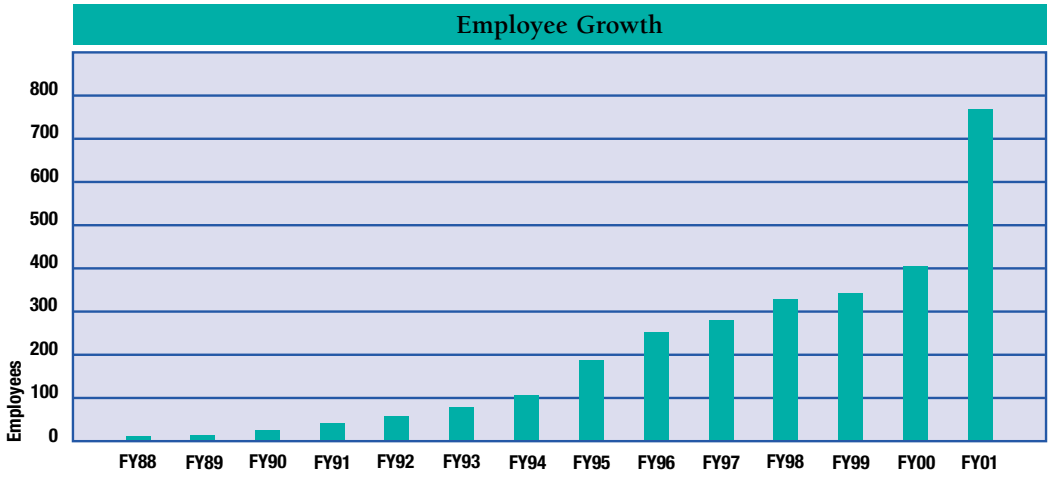
ViaSat, Inc.

What a Difference!

There is no doubt that SBIR funds have made a big difference at ViaSat, a digital communications company specializing in satellite and wireless networking technologies. Founded in 1986, ViaSat received its first SBIR contract in 1987 and since then has been on the fast track to growth and prosperity. As the graph shows, ViaSat has experienced tremendous growth in both sales and personnel over the last ten years. In fact, ViaSat's acquisition of a business unit from Scientific Atlanta last year increased its staff to over 750, removing it from the ranks of small business and mandating graduation from the SBIR program. In the words of Jim Collins, Vice President of Business Development, "The new technology and products that have resulted from the SBIR sponsored projects have been a major determinant in the rapid and successful growth of the company." ViaSat truly epitomizes what Congress intended when it established the SBIR program in 1982.

ViaSat has been extremely successful at transitioning SBIR funded work into products and services that are needed by the Military and private sector. Over time, ViaSat has established an understanding of the technology needs of the DoD and grown the company through non-SBIR funded sales and R&D while reducing its reliance on SBIR funding. Over the last ten years it has received over $175 million in Phase III (non-SBIR) funding directly from the DoD for a variety of products ranging from ones used in training to ones for the electronic transmission of sensitive information. Even though ViaSat was a small company, its tech-

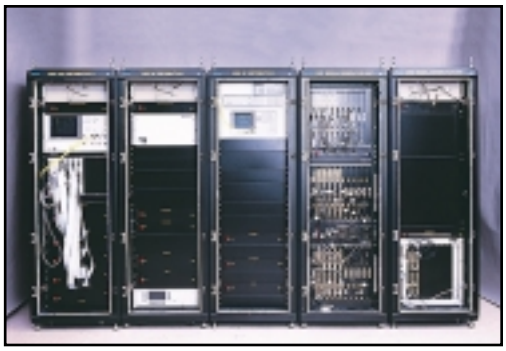




nology has played a vital role in the DoD and has been used in conflicts such as Kosovo and Desert Storm. ViaSat has also achieved the dual use goal of the SBIR program by successfully developing private sector products and applications for many of these technologies.

ViaSat's first SBIR Phase I contract was from the Navy for the Communication Environment Simulator (CES), a technology that has evolved into a state-of-the-art simulator for testing the F-22 Fighter Aircraft avionic systems and has also resulted in several spin-off programs. This system can accurately and quickly simulate information communications during air combat situations, not only between various DoD component systems but also among the allies. Typically, these systems must be tested with live flights that are very expensive. ViaSat's CES can be used during the development stage, saving the taxpayer money by avoiding the need to make corrections later in the development cycle. It allows the DoD and allies to integrate, test, evaluate, and train with communication, navigation, and Identification Friend-or-Foe systems to ensure performance before a pilot is in combat. The Navy and Air Force have used this system to ensure system performance in support during Desert Storm and Kosovo. The DoD, Lockheed Martin, and GTE, Inc. have awarded ViaSat more than $60M for the CES technology with a majority of the funding from the Central Test and Evaluation Investment Program Office.

ViaSat's early work on networking was funded through the SBIR program. Since then, ViaSat has emerged as the dominant supplier of UHF Satcom Demand Assigned Multiple Access modems to our military forces. The Navy's Space and Naval Warfare Systems Command (SPAWAR) funded the development of increased thru-put techniques for 5 and 25 kHz UHF Satcom channels resulting in the MD 1324A Turbo modem. "The modem has been installed on most of the Navy's UHF Satcom capable ships, providing enhanced services to the fleet," says Marv Reiser, Business Development Manager for ViaSat's UHF Satcom products. Over two hundred MD 1324 modems have been installed on US Navy ships. The P3 and S3 programs have installed the MD 1324 modem as part of their ongoing communication upgrade programs for airborne use. The UHF Satcom Network Control Stations are located at four Naval Communication Stations around the world. The circuit boards in the MD 1324 have been repackaged for use by ground troops with over 7,000 modem modules already fielded and another 5,000 on order.



■ The Compact Environment Simulator.

Early on, ViaSat recognized that information security is vital not only to national security but also to commercial business transactions over the Internet. An entire business area has been created around networking technology and information security. A Navy/ViaSat jointly held belief that encryption should be combined network protocols to create secure but user-transparent networks led to the development of

■ The Embeddable Infosec Product.

the KIV 21, a network encryption system capable of sending encrypted data over the Internet and other TCP/IP based networks. Another ViaSat security product – the Embeddable Infosec Product – is a combination of a Type 1 encryption device and networking protocol software to accommodate the needs of many new networks by incorporating a trusted bypass that allows data packets to navigate through standard wide area commercial infostructure to secure destination networks.

Since 1987, 48 Phase I contracts have been awarded to ViaSat – 26 went on to Phase II for prototyping. ViaSat has converted these contracts into 17 Phase III commercializations that have resulted in excess of $250M in business. After approximately three years, the revenue from SBIR-funded work began to reach 30% of sales. This fluctuated between 20 and 35% for the next 10 years and then started to decline as more of ViaSat's work became Phase III follow-on work based on the SBIR-funded technologies.

Most of ViaSat's current business areas were started with SBIR-funded technologies. The diversity of SBIR topics and technologies helped attract brilliant engineers who have excelled at the challenges offered by such an array of interesting R&D opportunities. ViaSat gained invaluable knowledge from the funded R&D and was guided along the way by customers with suggestions and potential applications. SBIR projects have become a focal point for innovation and growth.

ViaSat went public in 1996, under the symbol VSAT, and is now a major player in the satellite communications and data link business, with strong revenues and taxpaying employees. ViaSat products include terminals for battlefield data collection and distribution, data encryption devices, wireless data collection and monitoring systems, communication test and training simulators, and Bandwidth on Demand satellite communication services. ViaSat has been particularly skillful in evolving its technology and products to meet the needs of today's market. ViaSat now has over 780 employees with facilities in Carlsbad, California, and Norcross, Georgia. It was recently recognized as one of *Forbes*' "200 Best Small Companies" and *Business Week*'s "100 Best Small Corporations." ViaSat would agree that a relatively small SBIR award arrived at the right time and made a world of difference to this former small business.

Contact

ViaSat, Inc.
6155 El Camino Real
Carlsbad, CA 92009

Jim Collins
E-mail jim.collins@viasat.com
Telephone (760) 476-2200
WWW http://www.viasat.com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DIREC

SECTION 1 - NAVAIR

Advanced Rotorcraft Technology, Inc.

Learning By Simulation

About the technology

Both military and commercial pilots have demanding schedules that are often incompatible with traditional training programs. Advanced Rotorcraft Technology, Inc. (ART) has developed an interactive PC-based simulation and analysis tool, FLIGHTLAB, for the design of complex aircraft systems. This innovative technology enables flight test engineers and test pilots to perform realistic tests of their systems before integrating hardware and software into the actual aircraft. System tools include: database management for comparison of test and simulation data; signal processing to reduce noise, eliminate bad data, ensure kinematic consistency, and reconstruct unmeasured states; and test scenarios to simulate performance, stability, dynamic response, handling qualities, and load tests.

Military and commercial significance

Computerized programs are cost-effective and offer flexibility for "on the job" training. The convenience of a PC-based tutorial, along with a "virtual" flight test laboratory, extends the benefits of this training program to a much larger audience. The availability of affordable Operational Flight Training Simulators for helicopters will benefit the entire helicopter community. Military helicopter pilots from the Army, Navy, and Marines will benefit the most from increased access to high fidelity flight training simulators due to both the cost and the limitations of training in expensive military helicopters. Military helicopter pilots can be exposed to emergency procedures training and "edge of the envelope" limitations in a risk-free environment. The availability of lower cost helicopter simulators will allow military training centers to expand the capability of flight training programs and apply their limited funding to increased training staff rather than expensive equipment.

For commercial helicopter pilots, safety can be tremendously enhanced by regular utilization of quality helicopter simulators to maintain proficiency in emergency procedures, such as autorotation. Operational efficiency can also be improved by using simulators to practice a wide range of flight procedures in a compressed training period and a controlled environment.

Applications

- Simulation identification of critical points in planned SH-60 testing
- Flight test support of Comanche and other Army helicopters by Army Aviation Technical Test Center
- Helicopter weapons test scenarios at Yuma Proving Grounds

■ ART's simulation for rotorcraft training.

About the company

Advanced Rotorcraft Technology, Inc. was founded in 1982 as an aerospace consulting firm. It emphasizes the application of cutting edge methods of analysis to highly specialized technical problems of the aerospace industry, particularly the rotorcraft field. ART has developed two commercial software tools to expedite the modeling, analysis, and real time simulation of virtually any flight, ground, or multi-body dynamic system.

Contact

Advanced Rotorcraft Technology, Inc.
1685 Plymouth Street
Suite 250
Mountain View, CA 94043

Dr. Ronald Du Val
E-mail ron@flightlab.com
Telephone (650) 968-1464
WWW http://www.flightlab.com

fyi *ART's simulator includes a 180° by 60° visual projection system that rides on a motion platform and displays images on a 15-foot diameter cylindrical screen that also moves with the motion platform.*

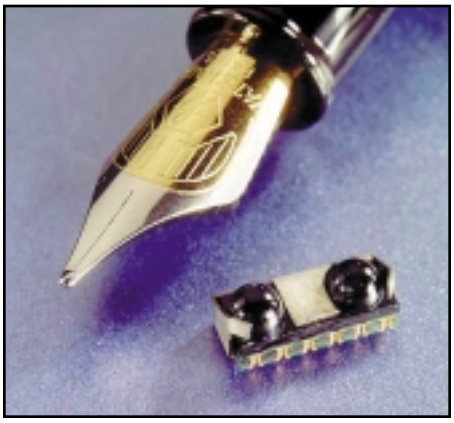
■ **SBIR Investment: $628K**
■ **Project Revenue: $1.67M**

Irvine Sensors

No Wires, But Still Connected

About the technology

Irvine Sensors assisted the Navy in its quest for a fast and efficient Infrared (IR) detector system by designing and fabricating a readout circuit for multi-color IR detector arrays that includes pre-amplification, 9 bit analog to digital converter, and multiplexing on chip. The Dual Spectrum Detector Array enables multi-color on-array processing that enhances dynamic range output of the fielded IR system. This technology has led to many military and commercial applications in the wireless data transfer world and resulted in the spin-off company, Novalog, a subsidiary of Irvine Sensors.



■ Novalog's Mini™SIR2 and IrDA® Transceiver Modules.

Military and commercial significance

This technology supports fast, efficient use of multi-color IR detectors that enhance resolution, target detection, and countermeasure protection in DoD IR systems. Other military and private benefits include low cost IR data communications, enhanced wireless data communication, and more secure data transmission.

Applications

- IR data link into a Special Operations Command secure distributed sensor network
- Medical instrumentation products (medication tracker, blood pressure monitor, etc.)
- Transceiver/receiver units for wireless IR point-to-point communications between peripherals such as printers, pagers, and laptops
- Developed partnerships with Palm, Motorola, and Sony
- IR data links part of SIRtel™, Mini®SIR2 and Baybeamer products

About the company

Irvine Sensors pioneered the development of advanced signal processing and image stabilization technologies for focal planes. Today, the company continues to develop advanced technologies for a multitude of products including 3D stacked integrated circuits, flexible circuits, embedded systems, miniature cameras, wearable bio-monitors, and smart sensors. The company holds over 60 patents and since its start in 1980 has spun off five subsidiaries for further development and manufacture of its various product lines. Irvine Sensors is publicly traded under the symbol IRSN and has a market cap of $65M.

Contact

Irvine Sensors Corporation
3001 Redhill Avenue
Building #3
Costa Mesa, CA 92626

Lynn O'Mara
E-mail lomara@irvine-sensors.com
Telephone (714) 444-8718
WWW http://www.irvine-sensors.com

■ Modules permit wireless infrared point-to-point data communications between computers and peripheral devices.

fyi *Novalog, an Irvine Sensors wholly owned commercial spin-off company that produces IR data links, is projected to average $5M per year in revenue.*

■ **SBIR Investment: $783K**
■ **Project Revenue: $15M**

Isothermal Systems Research
Way Cool Spray Cool

About the technology

Faster more powerful computers typically generate more heat. Conventional cooling techniques, which have fundamental limits that will fail to satisfy the demands of many next generation electronics, create issues with poor reliability, excessive noise, and an increasing inability to meet form factor constraints and EMI compliance. Spray cooling solves these problems with performance to spare and enables significant increases in electronics performance, power density, and reliability. Spray cooling's flexibility allows new applications to be designed and fielded quickly and cost-effectively. Isothermal Systems Research's (ISR) patented process sprays electronics with a harmless dielectric fluid that vaporizes and takes the heat with it. This process is extremely efficient and can reduce the cost, size, weight, and power needs over conventional technologies.

■ Top: The Multi-purpose Processor Unit for the AAAV (shown below). These units can be mounted so that they are isolated from shock.

Military and commercial significance

ISR has developed a family of industry standard electronic packaging that can be used across military and commercial systems for all types of digital, RF, analog, and power electronics applications. All systems utilize standardized components to lower cost and speed the development of new systems. Products are optimized for applications ranging from land combat vehicles to tactical aircraft to commercial server facilities.

Applications

- EA-6B Repackaging Legacy Power Supply
- AAAV tactile switch router, display processor unit, hull electronics unit, and multiprocessor unit
- Crusader Land Combat Mobile Howitzer: weapons control, vehicle navigation, and other vetronics systems
- Active cooling systems for high power amplification, power distribution, and other electronics systems
- Embedded High Performance Computers fielded in harsh environments for special forces applications
- Commercial: server development; telecommunications and wireless development; and industrial/high performance workstations

■ EA-6B *Prowler*.

About the company

ISR is a privately-held C-Corporation located in Clarkston, Washington. ISR has developed an integrated system level solution to the challenges faced by the electronics industry in the continuous drive for improvement in price and performance. Development efforts are currently focused on requirements related to challenging environments, heat, size, and power consumption. ISR technologies solve these problems in a more cost-effective way while enabling new horizons for future generations of electronics.

Contact

Isothermal Systems Research
511 Third Street
Clarkston, WA 99403

David D. Tilton
E-mail ddtilton@spraycool.com
Telephone (509) 758-2613
WWW http://www.spraycool.com

fyi *ISR has received a $35M Phase III ID/IQ contract from NAVAIR that has already had over $13M placed on it from the NAVAIR EA-6B and Marine Corps AAAV programs.*

- **SBIR Investment: $761K**
- **Project Revenue: $13M**

KVH Industries, Inc.

Point Me In The Right Direction

About the technology

Since the first mariner set sail on a boat containing metal, using a compass for safe and accurate navigation has been a challenge. How do you ensure that your navigational tool, which is governed by the laws of magnetism, is accurate when placed aboard a vessel that is moving in three dimensions and contains metal? Two SBIR awards played key roles in KVH Industries' development of compass and stabilized attitude heading systems that met this challenge. KVH created a compass capable of sensing the changing magnetic environment and recalibrating itself without external reference and incorporated it into the MC401 heading sensor and the commercial C100. A parallel effort to develop a marine-specific automatic calibration compass resulted in a family of autocomp-based sensors that measure the earth's magnetic field as well as the vessel's effect on this field and compensate to maintain optimal heading accuracy on vessels ranging from 35' sailboats to aircraft carriers. KVH's self-calibrating magnetic compass sensors became an embedded part of its Triaxial Magnetic Attitude Heading Reference Systems (M-AHRS) technology. By integrating this sensor with 3-axis rate and accelerometer technology, the resulting gyro-like attitude heading reference sensor evolved into the KVH GyroTrac™ digital heading reference system, which became a primary stabilized, earth-referenced, pitch, roll, and yaw sensor for KVH's Tracphone® and TracVision® products. The GyroTrac™ sensor provides critical vessel motion, azimuth, and altitude information that allows KVH's in-motion satellite antennas to rapidly acquire the correct satellite so that users can be assured continuous television, phone, fax, and email aboard vessels at sea.

■ TrackVision® products.

Military and commercial significance

KVH's heading sensors can measure and account for the variations caused by the structure of steel vessels and armored vehicles, making these compass systems ideal for use aboard a variety of military and commercial platforms. By eliminating the need for discrete and lengthy calibration procedures, military platforms can also operate more efficiently and cost-effectively. Likewise, the small size and variety of digital/analog data outputs give KVH compass systems exceptional versatility.

Applications

- Standalone vessel and vehicle navigation systems
- Compass-based backup system for GPS navigation
- Ship compasses (US Navy, commercial, and recreational vessels)
- Mobile TACAN and Exdrone RPV (US Marine Corps)
- US Army SCAMP MILSTAR radio terminal and Radar Direction Finding Systems
- Towed arrays (US Navy)
- KVH TracVision® and KVH Tracphone® in-motion satellite TV/telephone systems (US Navy, Coast Guard, and commercial vessels)
- Commercial: agricultural irrigation and ProLink golf course management system

- Top: C100 Compass.
- Bottom: KVH MV103 with display.

About the company

KVH Industries, Inc. is an international leader in developing and manufacturing innovative, mobile, high-bandwidth satellite communications systems, navigation products, and fiber optic sensors. With its award-winning products, KVH offers proven systems that link people on the move around the world to satellite television, telephone, navigation, and Internet data services. KVH is also developing next-generation systems with greater precision, speed, durability, and versatility for satellite communications, navigation, high-speed optical networking, and OEM applications.

Contact

KVH Industries, Inc.
50 Enterprise Center
Middletown, RI 02842

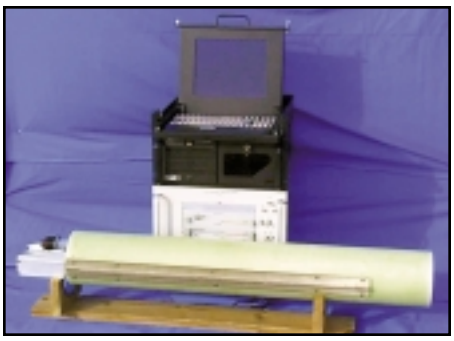
Christopher Burnett
E-mail cburnett@kvh.com
Telephone (401) 847-3327
WWW http://www.kvh.com

fyi KVH's Tracphone® and TracVision® systems were named the Best Satellite Telephone and Television products by the National Marine Electronics Association for the last three years.

- **SBIR Investment: $1.5M**
- **Project Revenue: $55.2M**

Polatomic, Inc.

Oh, Buoy!



■ Polatomic 2000 Laser Magnetometer.

About the technology

A Polatomic magnetometer developed under an SBIR award filled the US Navy's need for a high performance sensor for detection and localization of magnetic targets of interest for Anti-Submarine Warfare (ASW). Polatomic designed and fabricated a high performance, low noise, laser-pumped magnetometer for the Navy to detect airborne Extra-Low Frequency Emissions and static dipole magnetic signatures. The non-acoustic sensor is incorporated in an amplitude modulated electromagnetic field buoy. The magnetometer provides improved detection capability in littoral regions and is applicable to the P-3 and SH-60 aircraft. Its sensitivity is an order of magnitude better than current magnetometers and costs promise to be significantly lower than existing technology.

Military and commercial significance

Successful flight test evaluation will establish the potential of this technology for the next generation fleet replacement for the AN/ASQ-81 Magnetic Anomaly Detector Set. NASA selected Polatomic to design and prototype the scalar helium magnetometer for the Cassini mission to the planet Saturn and to develop the laser-pumped Self-calibrating Vector Magnetometer, the next generation magnetometer for space exploration. Polatomic has been awarded more than twenty government contracts from sponsors including NASA/JPL, Naval Air Systems Command (NAVAIR), and Naval Sea Systems Command (NAVSEA). Polatomic was selected by NAVSEA to develop a laser-pumped gradiometer for mine countermeasures. The National Science Foundation (NSF) is sponsoring the development of a portable laser-pumped magnetometer for geophysical research and exploration.

Applications

- Automatic degaussing system for mine hunter ships - NAVSEA
- Geophysical (oil & mineral) exploration - NSF
- Next generation space magnetometer - JPL/NASA
- Non-acoustic sensors for amplitude modulated electromagnetic field buoys
- Scalar helium magnetometer for the Cassini mission to Saturn - NASA

SH-60 towing a sonobuoy.

About the company

Dr. Robert Slocum founded Polatomic, Inc. in 1982. Development and manufacturing of advanced magnetic sensors for government and commercial use is a primary business strategy of the company. Polatomic has pioneered the development of laser-pumped resonance magnetometers that have advanced detection capability one order of magnitude improved over conventional resonance magnetometers. Polatomic also manufactures a proprietary line of optical polarizing filters that is in international distribution. The Polatomic staff now includes fourteen members with in-depth experience with design and manufacturing of high-performance magnetometers.

Contact

Polatomic, Inc.
1124 Commerce Drive
Richardson, TX 75081-2307

Dr. Robert Slocum
E-mail bob_slocum@polatomic.com
Telephone (972) 690-0099
WWW http://www.polatomic.com

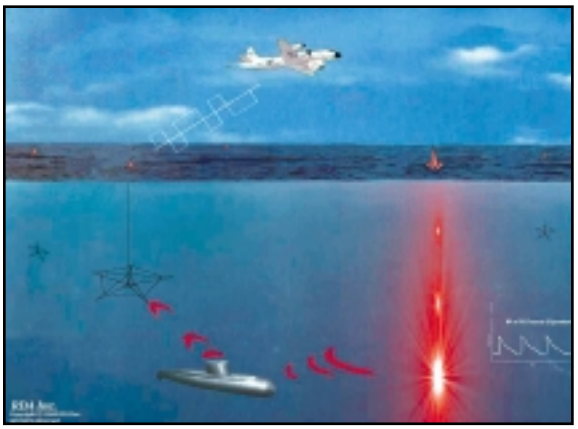
fyi *A space version of Polatomic's Scalar Laser Magnetometer has been selected by JPL for the INSIDE Jupiter NASA Discovery Mission.*

- **SBIR Investment: $584K**
- **Project Revenue: $2.2M**

RDA Inc.
Impulsive Behavior

About the technology

Impulsive acoustic sources offer significant advantages to the airborne Anti-Submarine Warfare (ASW) mission, due primarily to their high degree of mobility and delivery of a high source level without the use of connecting cables. RDA has developed an innovative impulsive active sonar source along with the signal processing algorithms required to exploit the source's unique properties. The source is altered to yield intrinsic clutter rejection properties while maintaining or enhancing directivity. This results in a directed and encoded transmit waveform which can be used to obtain target classification and motion data. The source and signal processing algorithms are transitioned into Air Common Acoustic Processing. RDA has demonstrated the feasibility of this technology for air deployed ASW platforms and has shown a significant performance improvement for shallow water operations. This technology reduces false alarm rates by a factor of five to ten. It is environmentally invariant and maintains the source level and directivity advantages of current Navy impulsive sources. This approach reduces operator workload and requires low computational resources, which result in lower overhead costs.



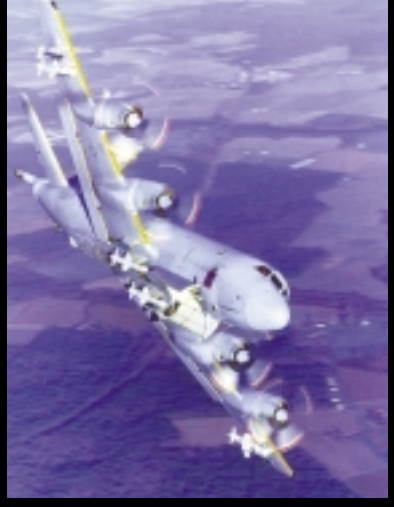
■ Advanced Signal Processing of Impulsive Waveform.

Military and commercial significance

RDA's innovative source technology can be applied to any incoherent impulsive sonar system that stands to benefit from a reduction in the false alarm rate. Some candidate systems include Extended Echo Ranging, Improved Extended Echo Ranging, and Distant Thunder. Under a Phase III contract with the Naval Air Warfare Center, RDA has developed specifications for its use in the P-3C AN/USQ-78B acoustic processing and display system. NAVAIR's planned improvement for the AN/SQQ-110 source sonobuoy is a direct result of this SBIR project. The technology also has potential for oil exploration and mining applications.

Applications

- P-3C and SH-60R ASW missions
- Surface Ship Multi-Static Sonar
- Real-time data acquisition and processing
- Multi-Mission Maritime Aircraft



■ P3-C *Orion*.

About the company

RDA has steadily increased its impact in Naval Airborne ASW since its inception as a consulting firm in 1986. Revenues have grown from under $200,000 in 1986 to over $2.4 million in 2000. Through the SBIR program, the company has expanded its business base from providing services for DoD contractors to playing a key role in the innovation and development of Airborne ASW technology for the Navy. RDA has also licensed the use of its technology for third party application development.

Contact

RDA Inc.
P.O. Box 49
Doylestown, PA 18901

Richard E. Dator
E-mail redator@rdainc.com
Telephone (215) 340-9514
WWW http://www.rdainc.com

fyi *RDA has been awarded a $7.6M Phase III contract with the Naval Air Warfare Center, Patuxent River, with over $3.6M placed on the contract to date.*

■ **SBIR Investment: $888K**
■ **Project Revenue: $3.6M**

Science and Applied Technology, Inc.

No Hiding From This Seeker

■ Passive anti-radiation homing seeker.

About the technology

The development of Surface to Air Missile (SAM) systems has become a major concern of military planners. These systems are difficult to destroy due to the countermeasures and tactics they employ. Under a Navy SBIR award, Science and Applied Technology, Inc. (SAT Inc.) is developing the Advanced Anti-Radiation Guided Missile (AARGM) system, which uses a passive anti-radiation homing seeker integrated with an active millimeter wave terminal seeker that provides a "Hard Kill" capability against mobile and stationary enemy air defenses. SAT Inc.'s digital system incorporates the latest engineering techniques to provide for system growth as operational requirements and capabilities change or evolve well into the next century. The technology utilizes a sensor-fused architecture and is specifically designed to counter known tactics by Integrated Air Defense Systems, including threat radar shutdown. It is effective against a variety of strategically relocatable targets.

Military and commercial significance

AARGM technology can be easily adapted to all Navy and Air Force strike weapon systems and tactical aircraft. SAT Inc. has expanded its technology reach to include the Land Combat market for precision guided artillery projectiles and has signed agreements with major European defense companies. SAT Inc. has taken full advantage of the SBIR program by successfully transitioning its SBIR awards to a $170M Phase III program for the development of hardware and extensive testing including live missile test firings. The AARGM weapon and associated technologies form the foundation for a Department of Defense (DoD) Advanced Concept Technology Demonstration program known as Quick Bolt. Quick Bolt takes the AARGM system architecture and adds two additional capabilities – a receiver that links the weapon to National Systems targeting data and a burst transmitter that transmits critical target data into the US warfighter's "Information Warfare Network" prior to missile impact on the target. Quick Bolt maintains a high priority within the US DoD and operational warfighters and has been sponsored and funded jointly by the National Reconnaissance Office, the US Navy, and OSD.

Applications

- AARGM systems for the AGM-88 HARM airframe
- Quick Bolt missile system
- High Speed Anti-radiation missile Demonstration
- Upgrades to various US and Allied tactical missile systems

About the company

In six years, SAT Inc. has grown from a company of less than ten employees to one with over 160, including a team of engineers who perform conceptual design, engineering, prototype development, and testing of military weapon systems. SAT Inc. has significant management and technical resources plus capabilities in such areas as: threat and mission analysis; trade-off analysis; upgrades to existing weapons; weapon concepts; weapon system design process; assembly, integration, and test; and avionics subsystem level and "full-up" weapon level expertise. The company also has experience with the multi-sensor fuzed AARGM system, the AIM-9X Guidance and Navigation Control Design, and other tactical missile systems. SAT Inc. maintains DoD Secret Level Facilities.

Contact

Science and Applied Technology, Inc.
10815 Rancho Bernardo Road
Suite 300
San Diego, CA 92127

William D. Schroer
E-mail bill_schroer@sat-inc.com
Telephone (858) 675-6277
WWW http://www.sat-inc.com

- **SBIR Investment: $824K**
- **Project Revenue: $170M**

■ F/A-18 firing AARGM at the Surface to Air Missile (SAM) system during missile test firings in China Lake.

fyi *The US Navy selected AARGM technologies to form the basis for the seeker of the High Speed Anti-Radiation missile Demonstration program, funded by the Office of Naval Research from FY 2001 through FY 2005.*

Triton Systems, Inc.

Tuf Stuff

About the technology

Naval eyewear is primarily made of polycarbonate because of its toughness and impact resistance. But polycarbonate degrades easily due to scratches, abrasion, and chemical exposure. During Desert Storm, the Navy experienced excessive abrasion on canopies, windows, and eyeglasses due to wind and sand. Triton Systems' NanoTuf™ epoxy-based nanocomposite coatings are specifically designed to coat and protect polycarbonate and acrylic surfaces, making them more rugged and reliable. These coatings will not crack or shatter upon impact from a variety of projectiles and are resistant to chemicals and flame. Abrasion resistance and anti-reflection properties of the NanoTuf™ coatings increase safety in eyewear, windshields, and windows.

- Top: Example of polycarbonate eyewear coated with NanoTuf™.
- Bottom: Quality control of NanoTuf™ coated products.

Military and commercial significance

NanoTuf™ manufacturing processes are cost-effective for military and industrial applications. NanoTuf™ is a solution-based coating that allows application by a variety of low-cost, easy-to-manufacture coating methods. In the commercial market, the abrasion resistance and anti-reflection properties of NanoTuf™ will increase safety in industrial and sports eyewear, windshields, and airplane windows.

Applications

- Canopies for F/A-18
- Aircraft windows
- Industrial protective eyewear: masks, shields, goggles, and visors
- Specialty sports eyewear: motorcycle and ski goggles
- Prescription eyewear and sunglasses
- Windshields
- Chemical protection headgear lenses
- Laser protection visors and spectacles

■ A Sailor aboard the aircraft carrier USS Independence (CV 62) cleans a canopy on an F/A-18 Hornet.

About the company

Triton Systems, Inc. is a fast growing materials company that provides its customers with unique materials solutions. It combines state-of-the-art materials technology with services/processing expertise to create tailored solutions to complex problems. TSI's impressive growth (45% per year) comes from a focus on four key applications: Space; Automotive; Food Packaging; and Chemical/Biological Sensing. Triton has recently contracted with a Fortune 100 company for the testing of its NanoTuf™ coating on ophthalmic lenses and is in negotiation with a Fortune 500 company for coating airplane windows. A Phase III ID/IQ contract with a ceiling of $25M over 5 years is being processed by the Navy to further develop and produce the NanoTuf™ coating for a wide variety of applications within the Navy and other Armed Services.

fyi *In 2000, TSI received an SBIR Technology of the Year award for its NanoTuf™ line of polymer coatings.*

Contact

Triton Systems, Inc.
200 Turnpike Road
Chelmsford, MA 01824

Dr. George Kachen
E-mail info@tritonsys.com
Telephone (978) 250-4200
WWW http://www.tritonsys.com

- **SBIR Investment: $813K**
- **Project Revenue: $2.6M**

SECTION 2 - NAVSEA

AEPTEC Microsystems, Inc.

Sensible Sensors

About the technology

As the Navy continues to push technology and reduce personnel at the same time, the use of electronic wireless sensors to continuously monitor systems is on the rise. AEPTEC Microsystems created its Automated Maintenance Environment by using wireless remote links and self-identifying sensors, resulting in a system that is modular, scalable, and easily re-configured. The wireless remote sensor links conform to the new Bluetooth standard for lower cost, lower power, smaller size, and "plug and play" reconfigurability. The transducers utilize the IEEEE 1451 standard for self-identification and functional description (Transducer Electronic Data Sheet) and network capability. The sensors have the capability to predict failures before damage is done to equipment.

■ Integrated Maintenance Environment.

AEPTEC has been highly successful at transitioning SBIR Phase I and II awards into large multimillion dollar Phase III commercializations for the Navy acquisition community. Three recent contracts to implement telematic solutions that include services, applications, and wireless devices are valued at $85M.

Military and commercial significance

Low cost wireless sensors have applicability on equipment and in military and commercial buildings and factories. AEPTEC's all-in-one wireless access point has a dual use as a small office/home gateway product. The Military would benefit from lowered operational and support (life cycle) costs, less R&D risk due to cost-benefit decision methodology, and the capability to predict failures before equipment damage occurs. Wireless sensors offer reduced costs due to less cabling, increased value due to more equipment coverage, and increased equipment reliability due to enhanced monitoring. The sensors provide optimal sharing of resources and a migration path for incorporating future technology.

Applications

- CVN Carriers
- DDG 51, AEGIS, Cruisers
- DD-21 Surface Combatants
- Wireless monitoring of factories, buildings, and equipment
- Wireless home security, appliance monitoring, and networking

DDG 51 Destroyer.

About the company

AEPTEC Microsystems, also known as 3e Technologies International, Inc., began in 1997 with five employees and revenue of $37K. The company now has a staff of over 50 employees and has seen revenues more than double every year since 1997. AEPTEC won its first SBIR Phase I in 1998 and since then has received Phase III awards of over $85M. This is an incredibly fast transition for a company just starting in the SBIR program. An additional $80M of Phase III SBIR contract awards are expected in 2001. Several nationally known companies have expressed interest in teaming with AEPTEC to apply its technologies to the commercial marketplace.

Contact

AEPTEC Microsystems, Inc.
15800 Crabbs Branch Way
Suite 290
Rockville, MD 20855

Mike Hoban
E-mail hoban@aeptec.com
Telephone (301) 670-6770
WWW http://www.3eti.com

fyi *AEPTEC was awarded two Phase III contracts from the Navy in 2000 worth over $85M.*

- **SBIR Investment: $811K**
- **Project Revenue: $12.08M**

Chesapeake Sciences Corporation

One System For All

About the technology

Electronic telemetry components have always been a major cost driver for the US Navy's towed array systems. As a primary participant in the Navy's Towed Array Integrated Product Team (TAIPT), Chesapeake Sciences Corporation (CSC) has developed and qualified, and is currently producing, the common TAIPT telemetry. CSC leverages commercial network standards (ATM/SONET), components, and manufacturing processes to provide a cost-effective product for use in submarine, surface ship, and surveillance towed array systems. The components comprising the telemetry backbone were reduced in size to meet the length, diameter, and packaging constraints of high frequency and small diameter towed arrays. The basis of CSC miniaturized electronics in chip-on-board and standard surface mount technology. The ATM/SONET telemetry provides a seamless interface to the combat system's data network and supports the high bandwidth necessary for current and next generation sensors. The TAIPT telemetry is also being applied to shipboard monitoring systems, acoustic ranges, acoustic intercept sensors, and geophysical applications, providing further cost savings to the Navy.

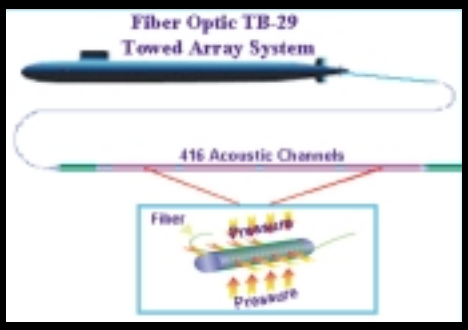
■ Fiber optic towed array components.

Military and commercial significance

The commonality of TAIPT telemetry across all platforms saves procurement, training, and maintenance costs. The Navy expects unit price cost savings on the order of 50% over earlier telemetry systems with additional and significant life cycle cost savings by having a common array maintenance and repair activity for all towed arrays. Since the system uses a common architecture approach, it will be more affordable to upgrade as better electronics come to market. This technology provides significant financial benefits to the geophysical exploration market by standardizing one common format to support land, marine, reservoir monitoring, and bottom profiling operations.

Applications

- TB-29 A thin line towed array
- TB-16 twin-line surveillance towed array
- Multifunction Towed Array (MFTA)
- Multiline Towed Array
- Acoustic Intercept Sensor
- TB-16 fat line towed array
- Geophysical towed streamer market: oil exploration platforms, temporary/permanent bottom mounted reservoir monitoring stations, and 4 dimensional sensor systems
- Seismic systems



■ Towed Array Construction.

About the company

Chesapeake Sciences Corporation (CSC) is a privately held Maryland company, chartered in July 1991. CSC specializes in the design and manufacture of electronic data acquisition systems for use in geophysical exploration, anti-submarine warfare, arms control verification, and seismic event detection. CSC employs a highly skilled staff of over 50 engineers and technicians in facilities located in Millersville and Fulton, MD, Houston, TX, and Stonnington, CT. CSC was listed in *Inc.*'s "500 Fastest-Growing Companies" and as a *Washington Technology*'s Fast 50 organization. As evidenced by $30M in orders in 2000, significant revenue growth is expected over the next several years due to increasing demand for high-resolution telemetry products for geophysical exploration and the selection of CSC as the Navy's primary supplier of towed array telemetry electronics and fiber optic sensors.

fyi *CSC was awarded a $37.5M contract for the development and production of a common set of telemetry components for use across all Navy towed array systems.*

Contact

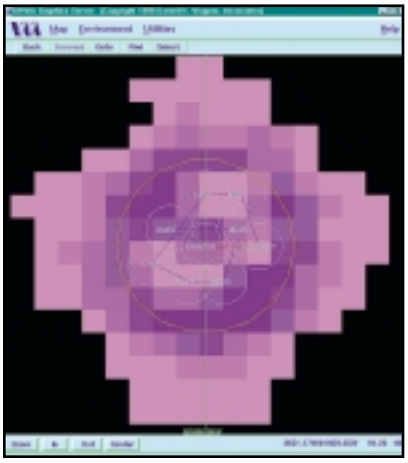
Chesapeake Sciences Corporation
1127B Benfield Road
Millersville, MD 21108

Robert Woodward
E-mail woodward@csciences.com
Telephone (410) 923-1300
WWW http://www.csciences.com

- **SBIR Investment: $1.38M**
- **Project Revenue: $21.59M**

Daniel H. Wagner Associates, Inc.

On Target



■ Estimated target position at end of search assuming the ALFS search does not detect the target.

About the technology

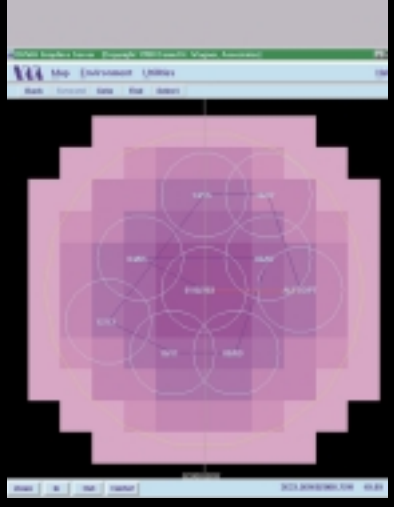
More accurate tracking of targets, especially under difficult detection conditions and with limited resources, is a high priority for the Navy and the DoD. Daniel H. Wagner Associates' Near Real Time Data Fusion (NRTDF) system is a marriage of a large-scale correlation engine with a non-Gaussian module for modeling target location and motion and optimally allocating scarce search and surveillance resources. This combination allows real time multi-sensor integration for large numbers of targets using multiple-hypothesis techniques along with automatic high fidelity tracking of hard to find or high-interest targets within the same architecture. Created to test and demonstrate the NRTDF for different scenarios, the Fusion Testbed has an easy-to-use GUI and database that allows an analyst to quickly create, modify, store, and run scenarios with a multi-hypothesis correlator. This correlator can handle multiple sensor types, multiple platforms, out-of-sequence reports, and both kinematic and attribute-based sensors. It also has a high-fidelity sensor simulation for radar, ESM, and acoustic and other sensors, along with a special module to evaluate the performance of the correlator. The testbed allows for simulation of complex scenarios in order to assess the impact of data fusion systems on tactical outcomes.

Military and commercial significance

This technology uses all information, including negative information, in making search and correlation decisions in real time. NRTDF can be used in any situation where the motion of the targets is complex or where partial information is available from surveillance sensors.

Applications

- Modeling of surveillance tactics on the SH-60R Multi-Mission Helicopter
- Mission planning modules for the SH-60R
- Testing of optimal SPY-1 radar scheduling for ballistic missile defense
- Crew station decision aids for Army ARDEC CRUSADER artillery vehicle
- Evaluated by Canadian Defense Research as a candidate correlation system for their ships
- Using NRTDF to fuse Moving Target Indicator (MTI) radar and SIGINT data within the Joint STARS Common Ground Station Module
- Evaluation of the feasibility of data fusion of MTI radar and imagery sources



■ Optimal Advanced Low Frequency Sonar (ALFS) Search Plan Produced by NRTDF Acoustic Mission Planner (AMP) magenta probability map shows target location at time of last detection (target is more likely to be in darker cells); blue circles show location of each ping and approximate coverage area of the ping.

About the company

Founded in 1963, Daniel H. Wagner Associates, Inc. is well known for its quality analysis and its ability to apply mathematics to difficult problems for industry and government. An experienced technical staff utilizes state-of-the-art tools to create accurate mathematical models and turn them into practical computer tools for everyday decision making. Wagner's corporate office is located in Malvern, PA, with branch offices in Hampton and Vienna, VA.

Contact

Daniel H. Wagner Associates, Inc.
2 Eaton Street
Suite 500
Hampton, VA 23669

Dr. W. Reynolds Monach
E-mail reynolds@va.wagner.com
Telephone (757) 727-7700
WWW http://www.wagner.com

fyi *Wagner recently received a $23M ID/IQ contract from NSWC Dahlgren that is being used for several different Phase III tasks, all of which utilize the Near Real Time Data Fusion software.*

■ **SBIR Investment: $1.25M**
■ **Project Revenue: $3.46M**

Electronic Warfare Associates, Inc.

Virtual Training

About the technology

The realistic simulation of scenarios that military decision-makers might encounter in real conflicts has become an effective training tool for the DoD. More cost-effective than full-scale enactments, simulations provide greater flexibility with respect to conflict types and training delivery time. The Cryptologic Systems Trainer (CST) provides the capability to stimulate/simulate the AN/SSQ-108 OUTBOARD II tactical system. It also can record scenario activities and operator/tactical system responses to support data collection for operator/team performance assessment. The CST Engineering Development Model design included a Battle Force Tactical Training (BFTT) Synthetic Theater of War interface using mandated Distributed Interactive Simulation protocol to take advantage of the inherent BFTT system capabilities. The CST is functionally modular and consists of four major segments that provide human/machine interface; unit level scenario control and signal generation to effect scenario-based stimulation of tactical systems; and direct digital/analog/radio frequency interfaces to the tactical cryptologic system in a non-intrusive manner that does not comprise or degrade system performance/security requirements. The design and architecture of CST permits high reuse and rapid adaptation of this training capability for all other existing cryptologic, electronic warfare, radar, and communication shipboard or land-based combat systems.

■ Radar screen monitoring other ships aboard the guided missile cruiser CG 63.

Military and commercial significance

The CST provides an organic cryptologic tactical team training capability for operators and decision-makers of existing US Navy shipboard cryptologic systems. The system increases expertise in professional knowledge and equipment operations by using an effective hands-on training system and also offers the ability to conduct refresher and scenario training at the operator, team, ship, and fleet levels. Shipboard proficiency training technology and techniques developed in the CST program have been applied to other warfare training areas, including Electronic Warfare (EW). The BFTT EW Trainer program leveraged from significant CST software and hardware reuse, particularly in its software development.

Applications

- Shipboard cryptologic systems to train afloat operators for tactical operations using their own tactical equipment
- Individual/team proficiency training otherwise unavailable due to Operational Security constraints
- Intermediate/advanced training in all areas of shipboard cryptologic operations
- Commercial applications: training for tactical or strategic organizations, e.g., the CIA, FBI, DEA, ATF, and police/emergency rescue departments

■ Advanced Combat Direction Systems in the Electronic Warfare (EW) module aboard the *USS Kitty Hawk.*

About the company

Electronic Warfare Associates, Inc. is a rapidly growing broad-based information technology (IT) company founded in 1977. With more than 20 years of steady growth and diversification, EWA has established a reputation for being fully responsive to customers' changing needs, committed to quality, and providing continuing support anytime, anywhere. EWA's wide range of IT applications is provided to a broad group of government and commercial customers, including the DoD, all military services, national intelligence and law enforcement agencies, the National Aeronautics and Space Administration, and international defense, security, and banking organizations.

fyi *EWA has already sold one OUTBOARD Advanced Development Model and three OUTBOARD II Engineering Development Models.*

Contact

Electronic Warfare Associates, Inc.
1000 Technology Drive
Suite 3210
Fairmont, WV 26554

Dan Holt-Gosselin
E-mail dholtgos@ewa.com
Telephone (304) 367-0770
WWW http://www.ewa.com

■ **SBIR Investment: $1.6M**
■ **Project Revenue: $5.0M**

Trident Systems, Inc.
Virtual Warehouse

About the technology

The Naval combat system of the future must accomplish a broad range of warfare missions in new operating scenarios that dwarf the connectivity, information processing, and systems integration requirements of previous combat systems. The developers of future systems must invariably meet broader and more aggressive capability objectives within stringent budgetary constraints.

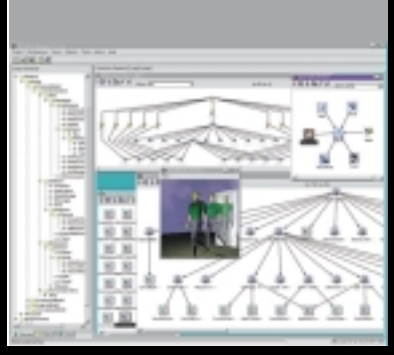
Trident Systems' Interchange Repository and Viewer/Editor Software is an advanced object-oriented information repository that enables users to collaborate in the design, development, and life cycle support of large complex systems. It contains mechanisms for existing/emerging engineering and management tools to extract and store information. A sophisticated client-server architecture allows Internet or WAN access to the design repository and provides mechanisms that ensure access control, baseline versioning, and configuration management. The software allows data sharing between similar applications so multiple participants within a project are not limited to only one tool for each domain. It also allows data from tools in different domains to be linked for traceability purposes.

Military and commercial significance

The Military faces a challenge in the synthesis, capture, and analysis of information required to take systems from concept through to development, deployment, upgrade, and retirement. The use of advanced engineering and management tools within a tightly integrated framework offers the promise of drastically reducing design and development costs while providing a foundation for assessing life cycle issues. Both the Military and the private sector can benefit from cross-domain application integration including financial, project, and engineering applications for traceability at the object level.

Applications

- Office of Naval Research: Human Centered Design Environment under the SC-21 Science and Technology Manning Affordability Initiative
- PEO Surface Strike – Land Attack Systems Engineering Workgroup
- SPAWAR, NRL, NAVSEA, NUWC under ASN (RDA) Chief Engineer of the Navy (CHENG) Collaborative Engineering Environment project
- Commercial applications: large system integrators in military/aerospace, automotive, and telecommunications industries; Enterprise Application Integration; and Enterprise Resource Planning



■ Screenshot of Interchange Repository Viewer Software.

About the company

Since its establishment in 1985, Trident Systems has consistently provided leading edge, cost-effective technology products and services. Trident Systems works in six primary business areas: Systems Engineering Research and Development; Systems and Software Engineering; Modeling and Simulation; Touch Screen Technologies; Image Processing; and Enterprise Collaboration Centers – all fully supported by a technical staff with a broad academic and professional background.

The SBIR/STTR program is a vital element of Trident's success by providing funding for key research and development within the company. Trident currently has two US patents pending as an indirect result of this SBIR project. Early commercial release of the Interchange Repository product, which is based on this research, resulted in combined product and services revenues of over $2M in 2000.

fyi *Trident received a $48.9M Phase III Navy contract for further development of a collaborative engineering environment based on Interchange.*

Contact

Trident Systems, Inc.
10201 Lee Highway
Suite 300
Fairfax, VA 22030

David Britton
E-mail britton@tridsys.com
Telephone (703) 691-7792
WWW http://www.tridsys.com

- **SBIR Investment: $799K**
- **Project Revenue: $2.55M**

Versatron, Inc.
G-Force Guidance

About the technology

When in flight, a missile must continuously modify its path to avoid detection or make changes due to wind and target movements. A Control Actuator System (CAS) is integral to the flight control of a munition or projectile, which is accomplished by rotating surfaces (moving the fins) in the airstream. These control surfaces are either pre-deployed or can be packaged within the airframe envelope until commanded to deploy. The CAS has to be inexpensive, small, and tough. Functionally, the CAS does not start to operate until after the projectile has been launched from the gun or cannon. The acceleration forces in the gun barrel for modern projectiles can exceed 30,000 G's. The CAS is a unique element of these gun-launched projectiles since its motors, drive mechanism, and control electronics must survive these g-forces, and is the only electro-mechanical element of most projectiles that must perform post launch.

■ DDG 65 fires its five-inch 54-caliber MK45 gun.

In order to meet these physical requirements, Versatron was able to develop a family of low cost components for use in gun hardened electro-mechanical CAS. A fundamental principle behind the approach was the realization that a wide range of application requirements can be met with essentially the same actuator components. Multiple applications have since leveraged common, qualified, off the shelf components in modular configuration. The modularity provides flexibility in reconfiguring the elements to the specific needs of the end program.

Military and commercial significance

The production cost of the Extended Range Guided Munition (ERGM) control system developed by this SBIR is 25% less than the control system in the Navy's Deadeye guided projectile (approved for service use in 1983). Over the complete production buy, this SBIR investment of $740K could save the Government $100M (40,000 rounds @ $2,500 each). Raytheon is the ERGM prime contractor and Versatron is providing the control system. The first production buy for ERGM is planned to be 8,000 rounds with as many as 40,000 rounds total over the complete program for a total cost of $5M.

Applications

- Navy's Extended Range Guided Munition
- Navy's Advanced Gun System
- Lockheed Sanders and CS Draper Labs control section of the Navy's Competent Munition Advanced Technology Demonstration
- US Army's XM982 guided projectile CAS EMD program

■ Low cost gun-launched munitions exceeding 12,000 G's.

About the company

In July 1999 Versatron was acquired by Primex Technologies (purchased by General Dynamics in January 2001). As a supplier of high performance warheads, structures, and ammunition systems to the United States military and its allies, Primex recognized the technology advantage Versatron had to offer. Versatron's technology complements and enhances Primex's objective to be the industry's key developer and supplier of "smart" munitions. Primex's acquisition of Versatron can be directly attributed to Versatron's ability to transition SBIR-developed technologies into viable product lines. The SBIR funding on this project allowed the background concepts and technology to be applied and demonstrated to the various agencies within the Department of Defense. Primex recognized the value of the technology and the central role that Versatron would play in future munitions programs.

fyi *A number of programs have already benefited from this SBIR: ERGM (Navy), CMATD (Navy), AGS (Navy), and XM982 (Army).*

Contact

Versatron, Inc. (now General Dynamics)
103 West North Street
Healdsburg, CA 95448

Steve Rezonja
E-mail SRezonja@ver.gd-ots.com
Telephone (707) 473-2249
WWW http://www. gd.com

■ **SBIR Investment: $740K**
■ **Project Revenue: $9.3M**

SECTION 3 - ONR

Ebert Composites Corporation

It's A Snap

About the technology

The "Snap-Fit" composite connections, developed and patented by Ebert Composites Corporation, allow rapid assembly and improved mechanical integrity of large, load-bearing composite structures. These connections do not rely on secondary bonding or fasteners; instead, innovative fiber architecture, combined with low-cost machining and pultrusion, produce unique joint connections of superior bearing surface and mechanical strength. Lightweight composite towers can be installed in one day as compared to three days for traditional steel towers, resulting in a significant savings of manpower and maintenance costs. Environmental benefits include on-site placement by helicopter and reduced magnetic fields. Ebert Composites' equipment support structure fulfills the Navy's space, weight, strength, shock, noise, and vibration requirements. The structure is designed to take advantage of the material's properties to mitigate shock loads and attenuate noise and vibration. An Ebert composite box beam truss forms the basis for a new generation of military and commercial platform trailers. ONR and a world renowned trailer manufacturer are currently sponsoring part of the development of this new vehicle.

■ The composite box beam truss.

Military and commercial significance

Large military composite structures can now be made affordable by combining pultrusion processing and in-line automatic machining of composite lineals. On an assembled, installed basis, these structures can be actually lower in cost than those made with traditional materials like steel and aluminum. A composite structure will have improved corrosion resistance for lower maintenance and longer life, significant weight savings, and superior shock, noise, and vibration characteristics. Commercial "dual-use" applications will benefit from lower installed costs and improved corrosion resistance at lower structure weight.

Applications

- Shipboard structures, supporting equipment, and decks
- Roll-on, roll-off ramps
- Lightweight bridges
- Transmission/communications towers
- Platform trailers
- Transportation vehicle frames
- Cooling towers

About the company

Ebert Composites Corporation is a closely held research and development company with offices located in San Diego, Otay Mesa, and Chula Vista, CA. Since 1990, Ebert has been involved in the development of numerous innovative solutions to structural problems by using composite materials. Through SBIR sponsorship by ONR, commercial sponsorship by Southern California Edison and San Diego Gas & Electric, and follow-on support from two NIST ATP grant awards, Ebert has advanced the designs and techniques for producing its new generation of composite structures and mechanical connections. Ebert's first commercial product was an electrical transmission tower. As a result of this commercialization, in 1998 a joint venture company was formed with Strongwell Corporation to manufacture and sell the towers.

Contact

Ebert Composites Corporation
651 Anita Street
Suite B-8
Chula Vista, CA 91911

David W. Johnson
E-mail djohnson@ebertcomposites.com
Telephone (619) 423-9360
WWW http://www.ebertcomposites.com

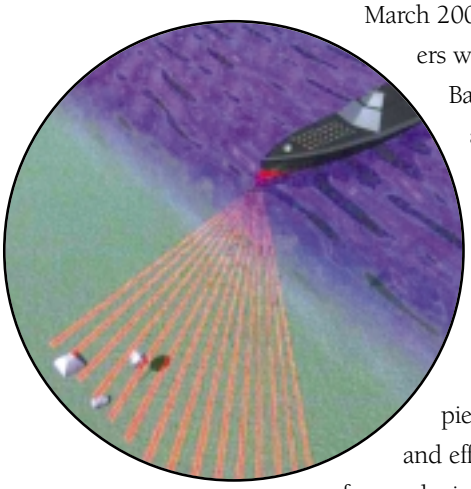
- **SBIR Investment: $350K**
- **Project Revenue: $5.25M**

■ The first commercial product resulting from this sponsorship was the electrical transmission tower.

fyi *Ebert was a co-recipient of the Civil Engineering Research Foundation's coveted "Charles Pankow Award for Innovation" for the composite tower.*

Materials Systems Inc.

Tracking Subs – And Manatees Too!



■ MSI develops and produces advanced sonar sensors for Navy undersea mine detection systems.

About the technology

Sensors for tracking submarines, originally developed by Materials Systems Inc. (MSI) with Navy SBIR funding, have been very useful in detecting manatees in Florida lock gates. In March 2000, these piezoelectric transducers were installed in lock gates on the Banana River at Port Canaveral and right away began saving manatees from being crushed by the hydraulic doors. "…seven confirmed saves in only a few weeks," says Les Bowen, CEO at MSI.

MSI has developed new piezoelectric composite materials and efficient manufacturing processes for producing acoustic transducers for sonar and ultrasound applications. MSI's unique piezocomposite transducers are rapidly becoming recognized as a key enabling technology in many ultrasound and sonar markets. In defense and commercial sonar, these transducers function like the lens on a camera, gathering and focusing sonic images from underwater objects and passing them electronically onto a computer screen. The increased bandwidth of MSI transducers allows more data to be collected or processed within a given timeframe. In nondestructive inspection, MSI transducers enable users to "see through" absorbing materials such as concrete, plastics, and fiber-reinforced composites. This results in better product performance and lower cost through more efficient materials utilization.

These transducers also transmit energy efficiently into air and other gases, thus expanding the range of operation of industrial proximity sensors and flow metering devices.

Military and commercial significance

A challenge facing the Navy is how to increase capability while reducing cost, weight, and size. MSI transducers are light and small, and can be formed to fit a vessel's shape. The injection molded MSI piezocomposite material performs better than others on the market, is cost-effective in large quantities, and can be adapted for applications ranging from sonar imaging to vibration/noise control.

Applications

- Mine hunting sonar
- Acoustic communications
- Mapping ocean floors
- Manatee/fish detection
- Hydrophone and flank arrays
- Vibration control
- Noise reduction
- Oil and gas mapping
- Atomizers
- Medical ultrasound imaging
- Inkjet tubes

■ MSI sensors detect manatees entering the Florida lock gates.

About the company

Materials Systems Inc. develops and manufactures piezocomposite materials and acoustic transducer products for underwater sonar, medical ultrasound, inkjet printing, proximity sensing, flow control, and vibration/noise control systems. The company's products, which utilize special acoustic materials to improve performance, often provide an enabling new system capability. MSI has a patented process for making these products – a process that is similar to the injection molding process widely used for high volume mass production of plastic parts. MSI's injection molding process is superior to competitors' process technology because it reduces labor-intensive assembly and provides high yield and quality at an affordable price.

Contact

Materials Systems Inc.
521 Great Road
Littleton, MA 01460

Leslie Bowen
E-mail lbowen@matsysinc.com
Telephone (978) 486-0404
WWW http://www.matsysinc.com

fyi *"We are delighted that our advanced composite transducer technology, originally developed for state-of-the-art defense sonar, also works so well in manatee protection."*

Les Bowen, President of Materials Systems Inc.

■ **SBIR Investment: $1.2M**
■ **Project Revenue: $8.0M**

METRATEK, Inc.

WINSAR: A New Look In Remote Sensing Radar

- WINSAR System.

About the technology

Airborne Synthetic Aperture Radar (SAR) is best known for its ability to generate high-resolution terrain maps. Typical SAR radars are large, heavy, and capable of only one frequency and waveform. METRATEK's Wideband Interferometric Synthetic Aperture Radar (WINSAR) brings a new look to high-performance remote sensing by combining extreme waveform flexibility with the capability to fly on small, inexpensive aircraft. WINSAR completed a one-year test program and is now operational as a Phase III SBIR program. METRATEK provides measurement services with the WINSAR prototype and has orders for three production systems.

Military and commercial significance

WINSAR's multi-band multi-polarization capability provides a potent new tool for enhancing target discrimination and understanding important oceanographic phenomena. WINSAR's extreme waveform flexibility allows it to fly the missions of tomorrow's military radars today. Its high-capacity data storage provides hard data for offline processing to optimize target detectability and false alarm rate. GPS and Interferometric height measurements provide a low-cost source of cartographic-quality maps. WINSAR combines five innovations in SAR technology: (1) interleaving pulses at different frequencies (0.2-18 GHz), polarizations, and antennas to allow immediate, direct comparison of the effects of changing parameters; (2) two types of Interferometry to measure terrain height on ground-mapping missions and wave height and current over water; (3) polarization agility (HH, HV, VH, and VV) to enhance automated recognition of ground cover and target discrimination; (4) high-performance, low cost digitizer/ storage system capable of up to 50 MB per second; (5) a high duty, low average power linear FM waveform that enhances sensitivity and expands dynamic range.

Applications

WINSAR produces high-quality airborne remote sensing data for:

- Military target discrimination and oceanographic research programs
- Wave-height and current measurements for assessing landing zone viability, flood detection, and oil spill assessment
- Precise all-weather mapping with height contours and ground cover annotation
- Low cost ocean backscatter, current, and wave height measurements
- Dynamic radar cross section measurements of ships and aircraft
- Unique measurements due to extreme waveform flexibility

■ WINSAR aircraft over WINSAR image of pier and shoreline at Duck, NC.

About the company

METRATEK, Inc. has been building high-performance imaging radars and performing measurements with these radars since 1984. Products include Diagnostic Imaging Radars for measuring radar cross section, WINSAR, and the 3-30 MHz HiFAR high-frequency array radar. The slogan "We Innovate for You" accurately portrays the company's mission to develop system solutions that meet exact customer needs. METRATEK's core competence areas are high-resolution imaging radar, sonar, and real-time and off-line software for signal and data processing.

Contact

METRATEK, Inc.
9858 Main Street
Fairfax, VA 22031-3908

Raymond L. Harris
E-mail info@metratek.net
Telephone (703) 293-9040
WWW http://www.metratek.net

fyi *METRATEK was awarded a $5M ID/IQ contract from ONR in March of 2000 that provides expedited contracting for WINSAR measurements by government customers.*

■ **SBIR Investment: $660K**
■ **Project Revenue: $3.0M**

NVE Corporation
Opposites Attract

About the technology

Giant magnetoresistive (GMR) technology is powering an array of advanced products such as totally nonvolatile computer memory, ultra-sensitive devices that count cars and validate money, and high-speed magnetic isolators. NVE Corporation (formerly Nonvolatile Electronics, Inc.) designed and demonstrated the first prototype GMR computer memory "cells" (components of integrated circuits, or chips) and produced useful spin-off technologies that promise significant benefits. GMR devices are built from alternating ultra-thin layers of magnetic and conductive non-magnetic materials. GMR sensors are compact and inexpensive, and operate on low power, which also makes them attractive for geophysical applications. Under this SBIR, NVE also developed a magnetic sensor that incorporates a Spin Dependent Tunneling (SDT) magnetic sensor bridge, integrated coils, and integrated circuits. These sensors outperform competing devices in terms of size, power consumption, temperature stability, sensitivity, and range of operation.

Military and commercial significance

GMR sensors reduce the size and power needs of traffic-monitoring systems. Their use in enhancing the accuracy of weapons-detection systems may help save lives and could also produce significant savings in the cost of such systems. The promise of Magnetoresistive Random Access Memory (MRAM) chips has attracted the interest of computer industry giants. Emerging uses include counterfeit-detection systems for automobile parts, industrial control systems, factory production lines, antilock braking systems for cars, and electric locks for safes.

Applications

- DARPA R&D Program – refining electronics and device processes
- NWSC "Standoff Detection & Classification of Surface & Buried UXO Using Multi-Dimensional EM Sensors" (NVE subcontract to Blackhawk-Geometrics)
- Army Night Vision Lab
- Army Research Lab – Battlefield Sensors (SfOF)
- Cylinder position sensing for industrial control applications
- GMR computer memory chips that hold data even when the power is off
- Vehicle monitoring and intrusion systems for traffic monitoring and control
- Geophysical applications, e.g., magnetic field anomaly detection in the Earth's crust
- World's fastest electronic isolators
- Medical: measurement of neurological and muscular activity
- MRAM licenses to semiconductor manufacturers including Motorola and USTC

■ NVE's custom magnetic sensor array designed for Blackhawk-Geometrics consisting of 54 spin-dependent tunneling magnetic sensors, nine sensors on each of the six faces of a cube. The sensor will provide both absolute and gradient magnetic field data to facilitate the location and classification of buried materials.

About the company

An electronics component manufacturer specializing in the combination of magnetically sensitive materials with integrated circuits, NVE introduced the world's first products using GMR material in 1994. This product line is used for position, magnetic media, wheel speed, and current sensing applications. NVE has applied the GMR technologies to magnetic sensors, switches, isolators, and MRAM. GMR components often outperform existing devices, providing both cost-effective and performance-enhanced solutions to sensing and data transmission applications. NVE introduced its ISOLOOP™ product line of high-speed digital isolators for communications, industrial controls, and computer applications in 1999. Today, NVE is in the process of developing a new line of magnetic sensors based on its continuing SDT work.

fyi *NVE's Magnetoresistive Random Access Memory (MRAM) devices could eventually capture a sizable share of the $45 billion market for memory and hard disk drive products.*

Contact

NVE Corporation
11409 Valley View Road
Eden Prairie, MN 55344

James M. Daughton
E-mail daughton@nve.com
Telephone (952) 996-1607
WWW http://www.nve.com

■ **SBIR Investment: $698K**
■ **Project Revenue: $2.2M**

Optiphase, Inc.
High Fiber

About the technology

At the present time, fiber optic sensor arrays are neither a commonly accepted nor cost-effective technology. Optiphase continues to mature the development of its Multi-Channel Interferometric Demodulator (MCID) to hasten the emergence of fiber optic sensor arrays as an affordable and standard technology. For the Navy, this technology must also meet the challenge of providing measurement performance data through rates meeting the stringent criteria for Navy Surveillance Array applications employing all-fiber interferometric sensors. Optiphase's design approach is unique in its utilization of a demodulation process based on time-orthogonal properties of phase swept interference signals. This approach has the ability to produce high-fidelity, high-accuracy, large angle PM demodulation measurements while utilizing a highly efficient processing technique. This efficiency leads to a reduction in required hardware, enabling high throughput at a low processing cost. Additional benefits are realized through reduced power consumption and a smaller physical hardware footprint.

■ Optiphase MCID technology is being applied to fiber optic sensor arrays for multiphase-flow and down hole seismic measurements.

Military and commercial significance

Optiphase, Inc. developed the MCID for the Navy's fiber optic surveillance and towed array programs. The applications within these programs call for extremely demanding sensor/demodulator performance relative to high dynamic range, low self-noise, and high linearity. The MCID's capabilities generally exceed those required of other military or commercial sensing applications so applicability to other sensing markets is high. As development matures, Optiphase expects many future applications to emerge in the industrial, municipal, and commercial arenas.

Applications

- Navy surveillance: broad area intrusion detection or monitoring
- "Smart" structures
- "Smart" highways
- Geophysical sensing: oil exploration
- Seismic systems: earthquake warning
- Remote sensing: acoustic, vibration, electromagnetic field
- Secure communications networks

■ Optiphase MCID technology will support US Navy fiber optic sensor arrays used for surveillance applications.

About the company

Optiphase, Inc. is a California corporation formed in 1990 with a charter to "develop and produce precision interferometric fiber optic sensor systems." Being focused on the "standard" function of interferometric demodulation allows Optiphase to utilize common resources to address diverse applications and their associated markets. This business approach aims to reduce the development time and cost of new products which incorporate fiber array sensing. Optiphase's technology focus is concentrated in two key areas: Sensor Interrogation Techniques and Cost Effective Interferometric Fiber Sensor Products. Optiphase has licensed MCID technology for Navy surveillance applications and for general sensing applications in the oil and gas industry. In addition, the company is involved in externally funded Phase III development activities primarily in the oil and gas sector.

fyi *Commercialization of MCID for oil and gas sensing applications has led to Optiphase revenues of almost $2M to date. Optiphase has also been awarded two US patents and a third patent is pending.*

Contact

Optiphase, Inc.
7652 Haskell Avenue
Van Nuys, CA 91406-2005

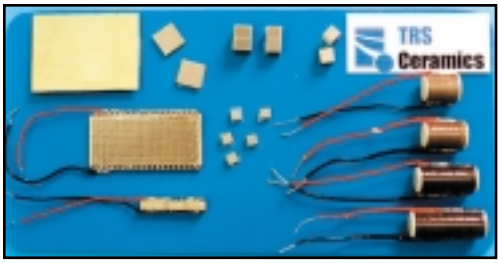
Jeff Bush
E-mail jbush@optiphase.com
Telephone (818) 782-0997 x110
WWW http://www.optiphase.com

■ **SBIR Investment: $623K**
■ **Project Revenue: $2M**

TRS Ceramics, Inc.
The Finest Grain

About the technology

Reducing grain size is a well-known method for increasing the mechanical strength and toughness of ceramic materials. Ceramic materials are presently used in many products that the Navy wants to improve. TRS Ceramics, Inc. developed a family of innovative fine grain piezoceramics that offer two main advantages: 30% higher mechanical strength and improved dielectric strength. These fine grain piezoceramics allow thinner layers and reduced sintering while preserving all the other desirable properties of conventional ceramics – qualities important to the Navy.



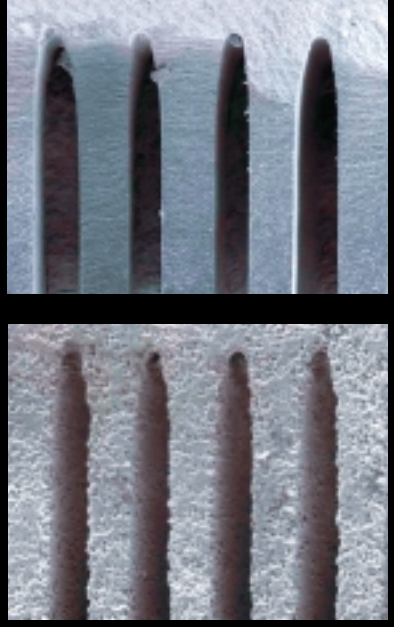
■ Piezoelectric actuator components produced from fine grain ceramic.

Military and commercial significance

The use of fine grain piezoceramics improves reliability and performance of Navy sonar transducers. High reliability, high energy density actuators produced using fine grain piezoceramics were investigated for active noise reduction on the MD-90 helicopter. TRS has refined its material properties to the exact specifications required for biomedical and ink jet manufacturing and has established a pilot line for fine grain ceramic production. Fine grain ceramics can be co-fired with low cost metal electrodes allowing high volume, low cost manufacturing for the automotive market. These ceramics also have potential in the manufacture of scientific instruments and optical systems.

Applications

- High energy density actuators for aircraft noise and vibration control applications
- Very high frequency transducers for medical ultrasound imaging
- Improved ceramic machinability for the production of ink jet printers
- Low cost, co-fired actuators for automobile applications
- Aerospace smart structures applications



■ Top: SEM Micrographs showing diced fine grain (grain size < 1 mm) ceramic ultrasound transducer array compared to (bottom) an array diced from conventional ceramic (grain size > 5 mm). Note the greater resolution of diced features in the fine grain ceramic.

About the company

TRS Ceramics is a ten-year-old company that had 4 employees at the time of its first SBIR award in 1995 and has now grown to 35 employees. TRS teams with its sister company, Stratum Technologies, Inc., for commercialization and transitioning of prototype components and pilot processes to the manufacturing level. The TRS team of scientists and engineers possesses over 40 years of industrial and research experience. TRS owns equipment for powder production, monolithic ceramic fabrication, ceramic finishing, crystal growth, and metallization.

Contact

TRS Ceramics, Inc.
2820 East College Avenue
State College, PA 16801

Wesley Hackenberger
E-mail wsh@trsceramics.com
Telephone (814) 238-7485
WWW http://www.trsceramics.com

fyi *Follow-on funding for fine grain piezoelectric ceramics was provided by DARPA in the Actuator Components and Technology (ACT) Consortium in the amount of $3.4M for 2 years.*

- **SBIR Investment: $647K**
- **Project Revenue: $3.5M**


1001
POBOSKI

SECTION 4 - SPAWAR, MARCOR, NAVFAC, NAVSUP

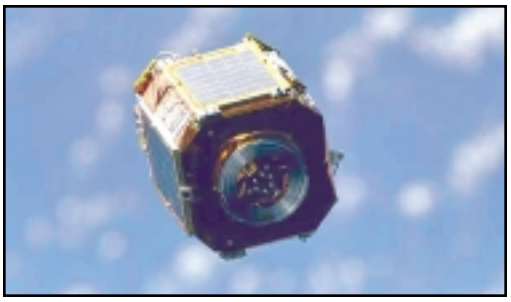
4

Applied Signal & Image Technology, Inc.

What's Your Sign?

About the technology

To support the development of airborne and spaceborne military target detection and identification based on spectral signatures, Applied Signal & Image Technology, Inc. (ASIT) used Navy SBIR dollars to fund its pioneering effort to perfect the application of Orthogonal Subspace Projection (OSP) signal processing technology to hyperspectral data. OSP provides users of hyperspectral remote sensing data the ability to detect, characterize, and identify materials of interest, based on their spectral signatures. Two products have resulted from the Phase II program and are primarily being used in classified operations: Aspect/Sentinel Hyperspectral Analysis Software and the Prospectre Spectral Processing System.



■ Automated Hyperspectral Imaging has migrated to onboard satellite processors.

Military and commercial significance

ASIT's spectral processing technology addresses the requirement for providing tactical and strategic intelligence regarding the remote detection and identification of objects of military significance. In addition to military and intelligence value-added, hyperspectral technology has shown commercial promise for mineral exploration, non-invasive medical testing, and other applications.

Applications

- Airborne Reconnaissance Low – an Army imaging and signal collection platform
- Warfighter 1 – Air Force Research Lab Program
- Military target detection and identification
- Remote sensing
- Mineral exploration
- Chemical analysis
- Process control
- Bio-medicine

About the company

Applied Signal & Image Technology, Inc. (ASIT) is a small business that works primarily with US government agencies to develop signal processing solutions for a variety of applications. ASIT also helps other companies, large and small, reach new markets by advancing their current states of technology. Founded in 1992, ASIT has worked to solve a variety of problems in airborne and ground-based intelligence collection, including radio-signal direction finding and geolocation as well as imagery collection, processing, and analysis. ASIT also produces commercial software for hyperspectral analysis and exploitation that can be tailored to fit specific applications.

Contact

Applied Signal & Image Technology, Inc.
303 Najoles Road
Suite 104
Millersville, MD 21108

John J. Schveibinz
E-mail binz@asitinc.com
Telephone (410) 729-3108
WWW http://www.asitinc.com

■ Hyperspectral analysis software screen capture.

fyi *In 1999, the Department of Defense projected an 800% increase in the use of commercial remote sensing data like hyperspectral imagery for national applications.*

■ **SBIR Investment: $706K**
■ **Project Revenue: $1.09M**

Octa-Flex Environmental Systems
Squeaky Clean

About the technology

To meet the military requirements for washing and decontamination and to prevent the spread of a public health threat, all foreign agricultural pests must be eliminated from military vehicles. The spread of exotic pests from foreign lands can cause irreparable damage to public health, agriculture, or the environment. In order to prevent contamination, washdown operations are required prior to deployment of such vehicles, wheeled or track, from one region of the world to another. Substances normally used in these operations can contaminate local environments, lead to environmental liability, and require large quantities of fresh water – up to 250,000 gallons for 300 vehicles.

■ Two ramps are connected for full drive through capability to create the CAWF.

In response to the need for a cleaner, more environmentally friendly procedure, Octa-Flex designed and developed the Containerized Assembled Wash Facility (CAWF) that utilizes recycled water to remove agricultural pests from vehicles. This closed-loop system delivers 99% efficiency in washdown operations – requiring approximately 2,500 gallons of water to complete the same washdown procedure as previously used.

Military and commercial significance

The Octa-Flex CAWF provides a mobilized, modular system for washdown operations conducted in an environmentally safe manner. The facility protects operators from exposure to undesirable contaminants by separating, containing, and disposing contaminated runoff. It uses any fresh (not salt) water supply (lake, river or well water). It reduces water consumption requirements by 99% and cuts wash time by 66%, thus improving productivity by reducing the number of personnel required to wash rolling stock (track and wheeled vehicles) from 6 to 4. The facility adapts to incorporate Nuclear, Biological and Chemical requirements and integrates with Enhanced Mobile Electrical Power Distribution Systems.

Applications

- Marine Corps and Army land vehicles
- Foreign military use (Norwegian and British Armies)
- United Nations
- Commercial applications: Metropolitan Bus Transit and the Department of Transportation (Vehicle/Truck/Maintenance Equipment Cleaning)

■ Wash facility is used to decontaminate military vehicles that have been in the field.

About the company

Octa-Flex Environmental Systems is located on the Cheyenne River Indian Reservation, a region that has one of the highest unemployment rates in the nation. The area within these boundaries has been designated as a Labor Surplus Area. These areas were set aside after World War II by President Eisenhower for the purpose of producing military contracted equipment. By renovating and re-using vacant buildings, this SBIR project has re-energized the local economy. Since the company was established in 1995, between twenty and twenty-five jobs have been created – a major impact on a town with a population of 500.

Contact

Octa-Flex Environmental Systems
408 South Main Street
P.O. Box 404
Timber Lake, SD 57656

Terry & Barb Gross
E-mail octaflex@sd.cybernex.net
Telephone (605) 865-3400
WWW http://www.octaflex.com

fyi *Octa-Flex was the winner of the SBA's 1996 Project SBIR West Award, the 1997 National Tibbetts Award, and the Small Business High Technology Institute's 1998 Franklin Jefferson Award.*

- **SBIR Investment: $399K**
- **Project Revenue: $685K**

Omnitech Robotics, Inc.
Where's The Driver?

About the technology

The battlefield is a dangerous place and the further away the troops can be, the safer they are. Over the last decade, the Department of Defense has encouraged the use of unmanned vehicles in combat or environmentally hazardous situations.

■ Soldier remotely operating an M1 Panther II Tank with the STS for mine detection.

The Standardized Teleoperation System (STS), the core product of Omnitech Robotics, Inc. (ORI), is a strap-on kit of robotic controls used to convert any vehicle into an unmanned ground vehicle, or robot. The STS was originally developed for the Unmanned Ground Vehicles/Systems Joint Program Office, the US Marine Corps, and the US Army. The STS has been installed on over 70 vehicles, including tanks, tractors, HMMWVs, forklifts, all-terrain vehicles, and trucks, for unmanned operation in hazardous work areas. Unmanned operation eliminates risk to the operator, who still has full control of the vehicle and its payloads via teleoperation. The STS Operator Control Unit emulates the vehicle controls and instruments with audio and video feedback from the vehicle. Most applications of STS have been for minefield proofing and countermine operations. The primary benefits are personal safety, economic operation, and mission documentation.

Military and commercial significance

When installed on an appropriate vehicle, either commercial or military, STS reduces risk to human life during hazardous operations. It has the ability to support a variety of applications, like landmine proofing or clearing to prevent injury to military personnel. Various military vehicles equipped with STS were utilized during military events in Kosovo and Bosnia.

Applications

- Landmine proofing and clearance
- Explosive ordnance disposal
- Smoke obscurant laying
- Reconnaissance, surveillance, and target acquisition
- Security patrols point-man

Vehicles Converted with STS

- High-Mobility Multipurpose Wheeled Vehicle (Humvee)
- Helo-Transportable Tactical Vehicle
- M1 Panther II tank
- M60 Panther tank
- Meerkat special built vehicle
- M9 Armored Combat Earthmover
- Caterpillar D7G and D8N tractor
- John Deere T3 tractor
- Skytrak forklift

■ M1 Panther II tank detonating a mine.

About the company

Omnitech Robotics, Inc. was founded in 1985 for the manufacture of servo motion controller boards for personal computers. Proposals for vehicle robotics solutions to military and government agencies proved successful, enabling rapid development and application of the Standardized Teleoperation System and recently, the fourth-generation Standardized Robotic System technology. As one of the fastest growing companies in Colorado, ORI has earned international recognition for robotic vehicle controls operating in high-risk environments, such as minefield clearing in Bosnia and Kosovo. ORI continues to expand its product portfolio of robotic controls, applying award-winning technical capability for successful applications in commercial and military markets.

Contact

Omnitech Robotics, Inc.
2640 South Raritan Circle
Englewood, CO 80110

David Parish
E-mail dparish@omnitech.com
Telephone (303) 922-7773 x199
WWW http://www.omnitech.com

fyi *A two-hour program entitled "Cyber Warriors" on the Learning Channel features Omnitech Robotics, Inc. clearing landmines in Bosnia-Herzegovina with an M60 Panther tank and the STS kit.*

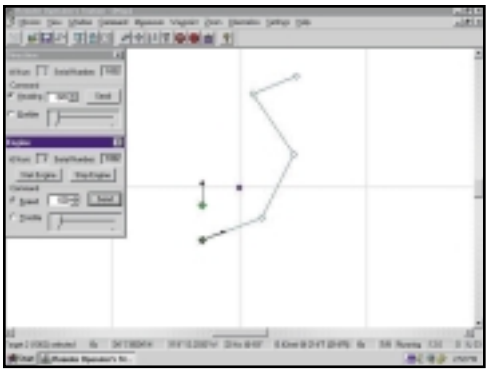
■ **SBIR Investment: $550K**
■ **Project Revenue: $18.75M**

RoboTek Engineering, Inc.

No Riders Allowed

About the technology

Although it bears a striking resemblance to a commercial jet ski, joy riding on the RoboSki is not advisable. RoboTek's Ship Deployable Surface Target ("RoboSki") is an affordable personal watercraft-based, ship-deployable surface target system that provides the Navy with a new way of training against the threat of small surface craft operating in littoral waters. The Navy shift of focus from open ocean to littoral region operations created the need for such a system for main gunnery and close-in weapons systems practice. The system incorporates a two-way digital communications link and uses GPS receivers on both the ship and target vehicle, enabling simple target navigation commands relative to the ship's moving position.



■ Remote Operator's Station (ROS) screen capture.

Extensive use of commercial components, including a three-passenger personal watercraft, makes RoboSki an affordable and realistic target for the Navy. It is outfitted with such high-tech features as GPS receivers, advanced electronics, and optional video camera systems. RoboSki can move at speeds of 30 knots, allowing ship personnel the opportunity to practice on a small, fast moving target during gun weapons exercises.

Military and commercial significance

RoboSki has been proven very effective for the 5" gun system; over 300 rounds were fired at the proof of concept vehicle and it continued to run. The video system also provides the capability to remotely investigate possible hostile craft picked up either visually or on radar. The Norfolk-based AEGIS destroyer USS ROSS (DDG 71) recently used RoboSki to conduct Combat Systems Ship Qualification Trials. RoboSki was described as a very challenging target and one of the best training opportunities aboard ship. RoboSki was also used to demonstrate control from a tactical control station. The Marine Corps has used it as a logistics re-supply vessel for Riverine warfare. It has been used to tow an infrared target for practice firing of Hellfire heat seeking missiles. RoboSki was used by the US Fifth Fleet in Arabian Gauntlet '00, a multi-national training exercise in the Straits of Hormuz that focused on detecting and neutralizing mines that might present danger to commercial shipping or military assets. Equipped with sensors and cameras, RoboSki has the potential to become the next generation system for port/waterfront surveillance, counterdrug operations, fire fighting, and offshore oil platform support.

Applications

- USN Seventh Fleet (two units)
- USN Fifth Fleet (two units)
- CLF N73 Atlantic Fleet (two units)
- Southern California Offshore Range (two units)
- Coastal Systems Station, Panama City (1 unit)
- SPAWAR, Charleston (1 unit)
- Naval Facilities Engineering Command (1 unit)
- Naval Air Warfare Center, Point Magu (1 unit)

■ Ship Deployable Surface Target for Naval Gunnery Training.

About the company

RoboTek Engineering is a very small woman-owned business located in Gainesville, Texas, on 60 acres of land with an airstrip and a 4,000 square foot facility. RoboTek specializes in the design, rapid prototyping, and low rate production of high technology products such as unmanned vehicles and GPS tracking systems. Spin-off products of this technology include a payload interface system for SPAWAR that allows its RoboSki to deploy nets to stop drug-running boats. Other proposals for RoboSki include the Small Weapons Attack Trainer (SWAT) and a derived control system that would be used for clearing landmines for the Army's Remote Combat Support System Program.

Contact

RoboTek Engineering, Inc.
1271 FM 3496
Gainesville, TX 76240

Bruce D. Markle
E-mail robotek@nortexinfo.net
Telephone (940) 612-3030

fyi *Up to 9 Roboski vehicles can be monitored and controlled from a single location either individually or in formation.*

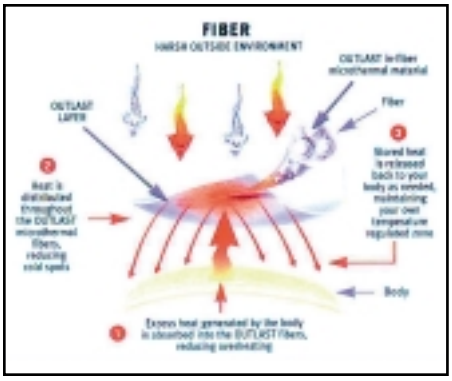
■ **SBIR Investment: $451K**
■ **Project Revenue: $784K**

Triangle Research and Development Corporation

98.6° On The Dot

About the technology

Triangle Research and Development Corporation (TRDC) has pioneered the research of microencapsulated phase change materials (microPCMs) and their incorporation into solution-spun acrylic fibers and melt-spun synthetic fibers such as polypropylene and polyester. MicroPCMs can significantly enhance the thermal energy storage properties (e.g., 10X) of the material or apparel to which they are added, thus enhancing its ability to maintain a more uniform and comfortable thermal environment in extreme hot or cold conditions. These microencapsulated materials help keep heat away from the skin in hot conditions and store body energy and heat in cold conditions for release over time.



Manufacturing and marketing of in-fiber and microPCM-coated products are licensed to Outlast Technologies, Inc. (Boulder, CO). Based on this technology, Outlast is currently developing, licensing, and marketing fibers and fabrics for use in premium quality brands of outerwear, extremitywear, home products, and workwear in North America, Europe, and Asia under the trademark OUTLAST® Temperature Regulation. Dakota Outerwear Co. (Minot, ND), a sub-licensee of Outlast Technologies, manufactures products of significance to the military. TRDC has also patented the use of microPCMs in foamed apparel and licensed that technology to Frisby Technologies, Inc. (Winston-Salem, NC), which markets its apparel products under the trademark COMFORTEMP™. The technology has been extended to macroPCM-based (>1000 microns) products marketed and manufactured through Delta Thermal Systems, a spin-off of TRDC.

Military and commercial significance

MicroPCM technologies have resulted in products that yield fibers, fabrics, and foams with enhanced thermal energy storage capabilities and that have enormous commercial potential for the military, apparel, and industrial insulation markets. Applications include textile fibers, coatings, foams, and coolants where enhanced active or passive thermal control is desired. This technology is currently being extended to agricultural applications by improving the efficacy of mycoherbicides and frost/freeze protection to plants.

Applications

- Insulated flight glove (GS-07F-0027J)
- Military boots suitable for hot or cold climates that meet ANSI Z41/75
- Military, commercial, and recreational skin dive suits
- Fire fighting protection equipment
- Winter apparel
- Home products such as blankets
- USMC macroPCM-based Personal Environmental Cooling System (PECS) garment
- Auto racing garments, bicycle helmets, and many more…

■ Desert forces boot that utilizes OUTLAST® temperature regulation fabric for extreme comfort in desert heat.

About the company

Triangle Research and Development Corporation was founded in 1979 and has won 79 SBIR awards from 7 agencies since 1983. TRDC has moved over half of its SBIR awards to commercialization through licenses and the creation of seven spin-off companies. The company has pioneered the development and application of its encapsulated phase change materials through 25 SBIR programs with DoD, NASA, NSF, HHS, and USDA. Two TRDC licensees have now attracted over $100 million in investment and, through over 100 sub-licensees, have introduced more than 1,000 warm apparel products with the TRDC-patented microencapsulated PCM technologies to the global marketplace.

Contact

Triangle Research and Development Corporation
P.O. Box 12696
Research Triangle Park, NC 27709

Yvonne G. Bryant, Ph.D.
E-mail ygbryant@TRDCorp.com
Telephone (919) 832-5959 x209

fyi *Outlast Technologies and Frisby Technologies, licensees of TRDC, have attracted over $100M in investment and have marketed over 1,000 microPCM-based products.*

■ **SBIR Investment: $163K**
■ **Project Revenue: $45M**

Navy SBIR Program Points of Contact

Navy SBIR Program Managers

Navy SBIR Program Manager
Vincent Schaper
(703) 696-8528
schapev@onr.navy.mil

Deputy, Navy SBIR Program Manager
John Williams
(703) 696-0342
williajr@onr.navy.mil

Marine Corps Systems Command
Rod Manzano
(703) 784-1395
manzanorm@mcsc.usmc.mil

Naval Air Systems Team
Carol Van Wyk
(301) 342-0215
vanwykc@navair.navy.mil

Naval Facilities Engineering Command
Andy Del Collo
(202) 685-9173
delcolloa@navfac.navy.mil

Naval Sea Systems Command
Anthony Nickens
(202) 781-3749
nickensad@navsea.navy.mil

Naval Supply Systems Command
Susan Schneck
(717) 605-1305
susan_d_schneck@navsup.navy.mil

Office of Naval Research
Douglas Harry
(703) 696-4286
harryd@onr.navy.mil

Space and Naval Warfare Systems Command
Linda Whittington
(858) 537-0146
whittinl@spawar.navy.mil

Strategic Systems Program Office
Charles Marino
(202) 764-1553
charles_marino@ssp.navy.mil

Naval Air Systems Team

Deputy Program Manager
Janet McGovern
(301) 342-0168
mcgovernjl@navair.navy.mil

Aircraft Systems
Hank McShane
(301) 342-8079
mcshaneha@navair.navy.mil

Anti-Submarine Warfare
David Bromley
(301) 342-2116
bromleydw@navair.navy.mil

Avionics & Sensors
Mary Eileen Farrell
(301) 342-2114
farrellma@navair.navy.mil

Integrated Systems & Support
Peter O'Donnell
(732) 323-7566
odonnellpm@navair.navy.mil

Total Ownership Costs
Rachel Santos
(301) 757-1529
santosra@navair.navy.mil

Training, Simulation & Modeling
Robert Seltzer
(407) 380-4115
seltzerrm@navair.navy.mil

Weapons Division
Bill Webster
(760) 939-1074
websterwp@navair.navy.mil

Naval Sea Systems Program Offices

NAVSEA - 04 (Maintenance & Logistics)
Kisan Pandit
(202) 781-1783
panditkb@navsea.navy.mil

NAVSEA - 05 (Integrated Warfare Systems)
Gail Williams
(202) 781-3757
williamsge@navsea.navy.mil

PEO-Carriers
Kate Shirley
(703) 588-2432
shirlek@onr.navy.mil

PEO-Surface Strike
Erin Bland
(703) 588-2449
blande@onr.navy.mil

■ **PEO-Expeditionary Warfare & SEA 91**
Cathy Nodgaard
(202) 781-2349
nodgaardcg@navsea.navy.mil

■ **PEO-Mine Warfare**
Bill Kastner
(202) 781-4447
kastnerwj@navsea.navy.mil

■ **PEO-Submarines**
Michelle Willis
(202) 264-7881
willism@egginc.com

■ **PEO-Theater Surface Combatants**
Frank Rucky
(202) 781-2206
ruckyf@navsea.navy.mil

■ **SEA-93**
Chhay Lim
(202) 781-1395
limck@navsea.navy.mil

Naval Warfare Labs and Centers

■ **Naval Facilities Engineering Service**
Nick Olah
(805) 982-1089
olahnj@nfesc.navy.mil

■ **Naval Research Laboratory**
Michelle Nicholl
(202) 767-6263
nicholl@contracts.nrl.navy.mil

■ **Naval Surface Warfare Center/Carderock**
James Wood
(301) 227-2690
woodje@nswccd.navy.mil

■ **Naval Surface Warfare Center/Crane**
Greg Held
(812) 854-1352
held_g@crane.navy.mil

■ **Naval Surface Warfare Center/Dahlgren**
Ronald Vermillion
(540) 653-8906
vermillionrg@nswc.navy.mil

■ **Naval Surface Warfare Center/Indian Head**
Marilyn Houser
(301) 744-6352
houserme@nswcihmd.ih.navy.mil

■ **Naval Undersea Warfare Center/Newport**
Jack Griffin
(401) 832-7283
griffinjf@npt.nuwc.navy.mil

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Technical Writer/Editor	Peggy Walker BRTRC, Inc.
Production Manager/Editor	Lore-Anne Ponirakis BRTRC, Inc.
Design/Layout	Renan Kiper Alpha MicroDesigns, Inc.

Office of Naval Research
ONR 364, SBIR Program
Ballston Tower 2, Room 106
800 North Quincy Street
Arlington, Virginia 22217-5660

For more information on the Navy SBIR program, please visit the website at:

http://www.onr.navy.mil/sbir *or*
http://www.navysbir.com

or visit the ONR homepage at:

http://www.onr.navy.mil

■ Vincent D. Schaper
Navy SBIR Program Manager
(703) 696-8528

■ John Williams
Deputy Navy SBIR Program Manager
(703) 696-0342

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